Preface

Thank you for purchasing the IS500 Series Servodrive!

IS500 Series is an AC servodrive developed by Inovance Technology Co., Ltd. It has the following features:

※ It reaches maximum power of 7.5kW and grades the power into 16 levels.

※ It has five external dimensions and specifications.

※ It supports the MOBUS, CANlink and CANopen communication protocols, adopting RS232/RS485/CAN communication port.

※ It can implement multi-drive networking with a host controller.

This manual is a guideline on selection, installation, parameter setting, on-site commissioning and troubleshooting.

Before using the servodrive, please read this manual carefully so that you fully understand the features of the product. Please hold the manual for safekeeping and forward it to the end user.

Upon Unpacking, Please Check:

Item	Description
Whether the products you receive match your order?	Check the servomotor model and servodrive model on nameplate.
Whether the equipment is damaged during transportation?	If there is any omission or damage, contact Innovance or our agents.
Whether the rotating shaft of servomotor (except motor with power-off brake) runs normally?	It is normal if you can slightly run the shaft with your finger.

First-time Use:

The users who use this product for the first time shall read the manual carefully. For any doubt on some functions and performances, please contact the technical support personnel of our company so that you can use the product properly.

With commitment to constant improvement of the servodrive, our company may change the information without additional notice.

Contents

1

Selection of Servo System

Chapter 1 Selection of Servo System

1.1 Servomotor Model

1.1.1 Servomotor Designation Rules

ISM H1-75B 30C B-U1 3 1 X

Mark	Series No.
ISM	IS Series servomotor

Mark	Features
H	H Series
V	V Series

Mark	Specifications
1	Low inertia, small capacity
2	Low inertia, medium capacity
3	Medium inertia, medium capacity
4	Medium inertia, small capacity

Mark	Power
Consist of 2-digit and a letter	
A	×1
B	×10
C	×100
D	×1000
E	×10000

Mark	Speed
Consist of 2-digit and a letter	
A	×1
B	×10
C	×100
D	×1000
E	×10000

Mark	Voltage
A	100V
B	200V
C	300V
D	400V

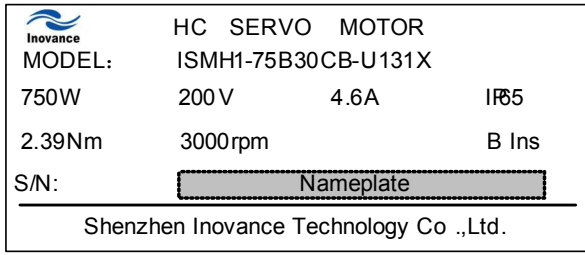
Mark	Encoder Type
Consist of a letter and a digit	
U	Incremental
U1	2500P/R wire-saving incremental encoder
U2	17-bit serial incremental encoder
A	Absolute
A1	17-bit single-ring absolute encoder
A2	17-bit multi-ring absolute encoder
R	Resolver
R1	One-pair-pole resolver
R2	Two-pair-pole resolver
S	Sine-cosine resolver

Mark	Customized Requirement
X	Standard
Y	Aviation plug connection

Mark	Brake, Reducer & Oil Seal
Consist of a letter and a digit	
0	None
1	Oil seal
2	Brake
3	Reducer
4	Oil seal + Brake
5	Oil seal + Reducer
6	Brake +Reducer

Mark	Shaft Connection Mode
Consist of a letter and a digit	
1	Optical Shaft
2	Solid with key
3	Solid, with a key, threaded holes
5	Solid, threaded holes

1.1.2 Servomotor Nameplate



1.2 Servodrive Model

1.2.1 Servodrive Designation Rules

IS500 A S 5R5 I

Mark	Series No.
IS500	Servodrive

Mark	Product Category
A	General
P	Pulse
H	H

Mark	Voltage Level
S	220V
T	380V

Mark	Mounting Mode
I	Substrate installation (standard)

Corresponding Rated Output Current

Corresponding

Mark	3R8	5R5	7R6	8R4	012
Rated Output Current	3.8A	5.5A	7.6A	8.4A	11.6A

1.2.2 Servodrive Nameplate

MODEL：	IS500AS5R5I
POWER：	In=5.5A Imax=16.9A
INPUT：	3PH AC220V 3.7A 50Hz/60Hz
OUTPUT：	3PH AC220V 5.5A 0-400Hz
S/N:	Nameplate
Shenzhen Inovance Technology Co.,Ltd.	

1.3 Servo System Configuration Standard

ISMH: servomotor with maximum rotating speed higher than rated value

IS500*: servodrive with 220V AC power input

Rated Speed	Max. Speed	Capacity	Servomotor Model ISM□□-□□□□□□□-*****		Servodrive model IS500*□□□□I	
					Single-phase AC220V	Three-phase AC220V
3000rpm	6000rpm	200W	H1 (Low inertia, small capacity)	20B30CB	S1R6	
		400W		40B30CB	S2R8	
		750W		75B30CB	S5R5	
		1000W	H2 (Low inertia, medium capacity)	10C30CB		S7R6
	5000rpm	1500W		15C30CB		S012
1500rpm	3000rpm	850W	H3 (Low inertia, medium capacity)	85B15CB		S7R6
		1300W		13C15CB		S012
1000rpm	2000rpm	870W		87B10CB		S7R6
		1200W		12C10CB		S012
3000rpm	6000rpm	400W	H4 (Medium Inertia, small capacity)	40B30CB	S2R8	

ISMH: servomotor with maximum rotating speed higher than rated value

IS500*: servodrive with 380V AC power input

Rated Speed	Max. Speed	Capacity	Servomotor Model ISM□□-□□□□□□□□-*****		Servodrive Model IS500*□□□□I
					Three-phase AC380V
3000rpm	6000rpm	1000W	H2 (Low inertia, medium capacity)	10C30CD	T5R4
	5000rpm	1500W		15C30CD	T5R4
		2000W		20C30CD	T8R4
		2500W		25C30CD	T8R4
		3000W		30C30CD	T012
		4000W		40C30CD	T017
		5000W		50C30CD	T017
1500rpm	3000rpm	850W	H3 (Medium Inertia, small capacity)	85B15CD	T3R5
		1300W		13C15CD	T5R4
		1800W		18C15CD	T8R4
		2900W		29C15CD	T012
		4400W		44C15CD	T017
		5500W		55C15CD	T021
		7500W		75C15CD	T026
1000rpm	2000rpm	870W		87B10CD	T3R5
		1200W		12C10CD	T5R4

ISMV: servomotor with maximum rotating speed equaling rated value

IS500*: servodrive with 380V AC power input

Rated Speed	Max. Speed	Capacity	Servomotor Model ISM□□-□□□□□□□□-*****		Servodrive Model IS500*□□□□I
					Three-phase AC380V
1500rpm	1500rpm	2900W	V3 (Medium Inertia, small capacity)	29C15CD	T8R4
		4400W		44C15CD	T012
		5500W		55C15CD	T017
		7500W		75C15CD	T021

1.4 Cable Selection

Item		ISMH1-*******-U1***	ISMH2-*******-U1*** ISMH3-*******-U1*** (1.8kw or below)	ISMH3-*******-U1*** ISMV3-*******-U1*** (2.9kw or above)	ISMH4-*******-U1***
Motor main circuit cable	L=3.0m	S5-L-M03-3.0	S5-L-M25-3.0	S5-L-M03-3.0	S5-L-M24-3.0
	L=5.0m	S5-L-M03-5.0	S5-L-M25-5.0	S5-L-M03-5.0	S5-L-M24-5.0
	L=10.0m	S5-L-M03-10.0	S5-L-M25-10.0	S5-L-M03-10.0	S5-L-M24-10.0
Motor main encoder cable	L=3.0m	S5-L-P00-3.0	S5-L-P21-3.0	S5-L-P00-3.0	S5-L-P21-3.0
	L=5.0m	S5-L-P00-5.0	S5-L-P21-5.0	S5-L-P00-5.0	S5-L-P21-5.0
	L=10.0m	S5-L-P00-10.0	S5-L-P21-10.0	S5-L-P00-10.0	S5-L-P21-10.0
Connector Set CN1 terminal CN2 terminal 4PIN connector 9PIN connector		S5-C1	S5-C6 (bent) S5-C9 (straight)	S5-C7 (bent) S5-C10 (straight)	S5-C1
		CN1 terminal	CN1 terminal	CN1 terminal	
		CN2 terminal	CN2 terminal	CN2 terminal	
		20-18 aviation plug (bent/ straight)	20-22 aviation plug (bent/straight)	4PIN connector	
		20-29 aviation plug (bent/ straight)	20-29 aviation plug (bent/straight)	9PIN connector	

【Note】
- The Servomotor encoder cable is packed together with CN1 connector.
- The connector set contains CN1 connector, CN2 connector, connector and pin of the main circuit and encoder at the motor side.
- Straight aviation plug is not available temporarily.

1.5 Selection of Peripheral Optional Parts

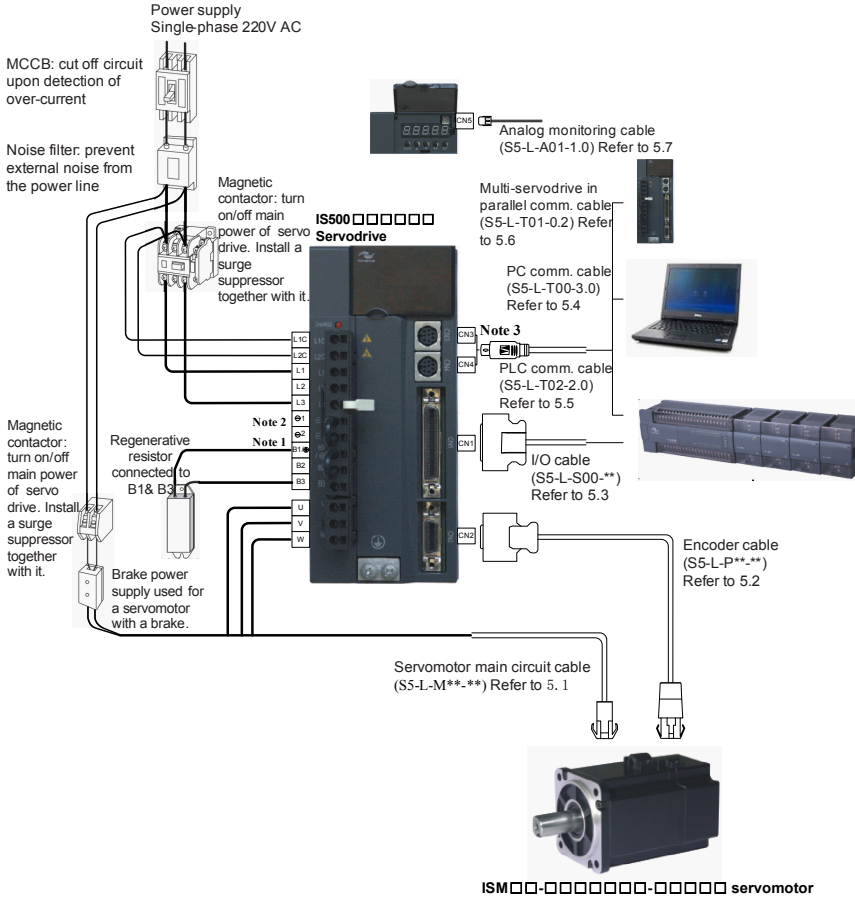
Braking Resistor & Brake Power Supply Units

Servodrive Model		Built-in Regenerative Resistor Specification		Minimum Allowable Resistance (Ω)
		Resistance (Ω)	Capacity (W)	
Single-phase 220V	IS500□S0R7I	-	-	45
	IS500□S0R9I			
	IS500□S1R6I			
	IS500□S2R8I			
Single/3-phsae 220V	IS500□S3R8I	50	40	50
	IS500□S5R5I			40
3-phsae 220V	IS500□S7R6I			35
	IS500□S012I			30
	IS500□S018I	25	100	20
	IS500□S025I	40	100	15
	IS500□S033I			10
3-phsae 380V	IS500□T1R9I	100	40	60
	IS500□T3R5I	100	40	
	IS500□T5R4I	50	40	45
	IS500□T8R4I	100	100	60
	IS500□T012I			
	IS500□T017I	40	100	35
	IS500□T021I			25
	IS500□T026I			

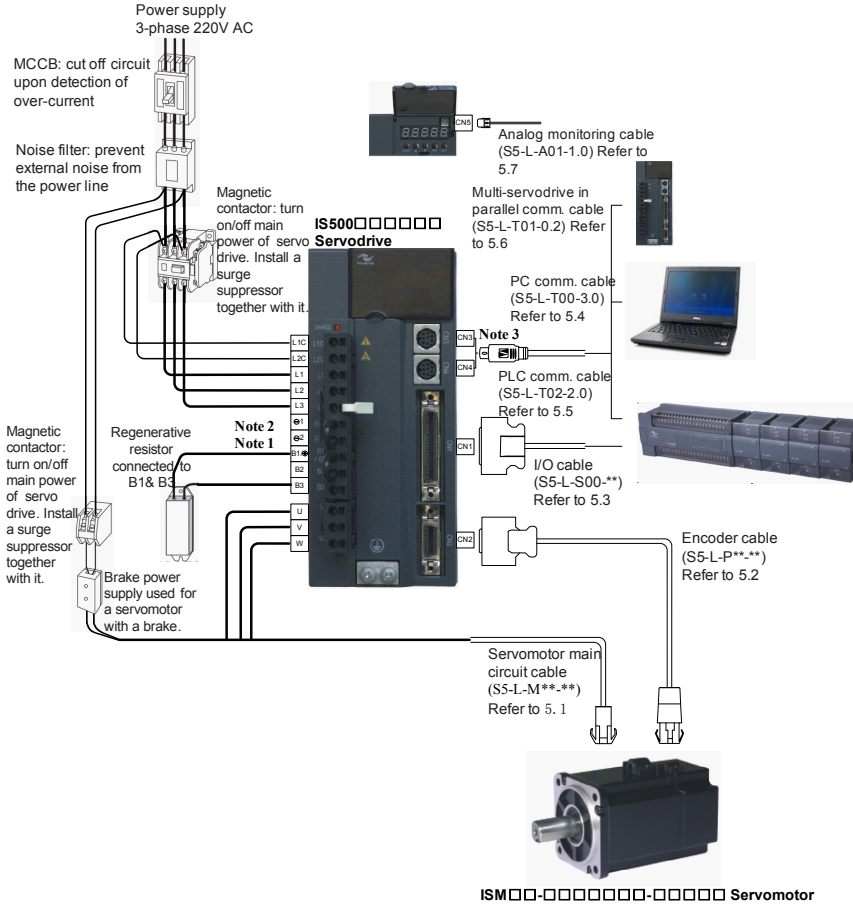
【Note】 Inovance does not prepare the DC24V braking power supply now.

1.6 System Structure

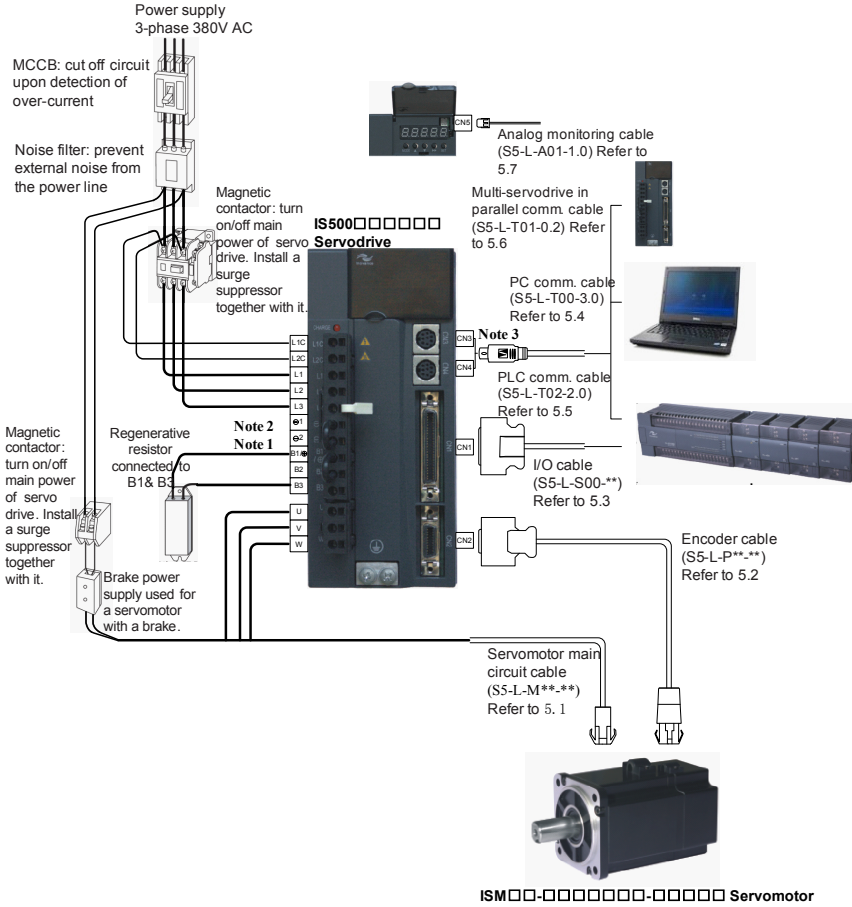
Single-Phase 220V Main Circuit



Three-Phase 220V Main Circuit



Three-Phase 380V Main Circuit



2

Servomotor Specification and External Dimension

Chapter 2 Servomotor Specification and External Dimension

2.1 Servomotor Specification

2.1.1 ISMH/ISMV Series Servomotor Mechanical Specification

Item	Description
Rated time	Continuous
Vibration level	V15
Insulation resistance	DC500V,10MΩ above
Ambient temperature	0-40℃
Magnetization mode	Permanent magnet
Mounting	Flange
Heat resistance level	H1 and H4: B Others: F
Isolation voltage	AC1500V for one minute (200V-level) AC1800V for one minute (400V-level)
Protection mode	H1 and H4: IP65 (except for through shaft section) Others: IP67
Ambient humidity	20%-80% (no condensation)
Connection mode	Direct connection
Rotating direction	Upon a forward instruction, servomotor rotates counterclockwise (CCW) seeing from the load side.

2.1.2 ISMH/ISMV Series Servomotor Rated Value Specification

Servomotor Model	Rated Output	Rated Torque	Instantaneous Max. Torque	Rated Current	Rated Speed	Max. Speed	Torque Parameter	Rotor Moment Inertia
	Kw	N·m	N·m	Arms	min-1	min-1	N·m/Arms	10-4kg·m2
ISMH1-20B30CB-*****	0.2	0.63	1.91	1.6	3000	6000	0.45	0.158 (0.16)
ISMH1-40B30CB-*****	0.4	1.27	3.82	2.8	3000	6000	0.51	0.274 (0.284)
ISMH1-75B30CB-*****	0.75	2.39	7.16	4.6	3000	6000	0.53	1.3 (1.312)
ISMH2-10C30CB-*****	1.0	3.18	9.54	7.5	3000	6000	0.43	1.87 (3.12)
ISMH2-15C30CB-*****	1.5	4.9	14.7	10.8	3000	5000	0.45	2.46 (3.71)
ISMH2-10C30CD-*****	1.0	3.18	9.54	3.65	3000	6000	0.87	1.87 (3.12)
ISMH2-15C30CD-*****	1.5	4.9	14.7	4.48	3000	5000	1.09	2.46 (3.71)

Servomotor Model	Rated Output	Rated Torque	Instantaneous Max. Torque	Rated Current	Rated Speed	Max. Speed	Torque Parameter	Rotor Moment Inertia
	Kw	N·m	N·m	Arms	min-1	min-1	N·m/Arms	10-4kg·m2
ISMH2-20C30CD-*****	2.0	6.36	19.1	5.89	3000	5000	1.08	3.06 (4.31)
ISMH2-25C30CD-*****	2.5	7.96	23.9	7.56	3000	5000	1.05	3.65 (4.9)
ISMH2-30C30CD-*****	3.0	9.8	29.4	10	3000	5000	0.98	7.72 (10.22)
ISMH2-40C30CD-*****	4.0	12.6	37.8	13.6	3000	5000	0.93	12.1 (14.6)
ISMH2-50B30CD-*****	5.0	15.8	47.6	16	3000	5000	1.07	15.4 (17.9)
ISMH3-85B15CB-*****	0.85	5.39	13.5	6.6	1500	3000	0.6	13 (15.5)
ISMH3-13C15CB-*****	1.3	8.34	20.85	10	1500	3000	0.66	19. 3 (21.8)
ISMH3-87B10CB-*****	0.87	8.34	20.85	6.8	1000	2000	1.2	19.3 (21.8)
ISMH3-12C10CB-*****	1.2	11.5	28.75	10.6	1000	2000	1.1	25.5 (28)
ISMH3-87B10CD-*****	0.87	8.34	20.85	3.4	1000	2000	2.5	19.3 (21.8)
ISMH3-12C10CD-*****	1.2	11.5	28.75	4.8	1000	2000	2.4	25.5 (28)
ISMH3-85B15CD-*****	0.85	5.39	13.5	3.3	1500	3000	1.63	13 (15.5)
ISMH3-13C15CD-*****	1.3	8.34	20.85	5	1500	3000	1.67	19. 3 (21.8)
ISMH3-18C15CD-*****	1.8	11.5	28.75	6.6	1500	3000	1.74	25. 5 (28)
ISMH3-29C15CD-*****	2.9	18.6	45.1	11.9	1500	3000	1.7	55 (57.2)
ISMH3-44C15CD-*****	4.4	28.4	71.1	16.5	1500	3000	1.93	88.9 (90.8)
ISMH3-55C15CD-*****	5.5	35	87.6	20.8	1500	3000	1.8	107 (109.5)
ISMH3-75C15CD-*****	7.5	48	119	25.7	1500	3000	1.92	141 (143.1)
ISMH4-40B30CB-*****	0.4	1.27	3.82	2.8	3000	6000	0.51	0.67
ISMV3-29C15CD-*****	2.9	18.6	45.1	8.4	1500	1500	2.21	55 (57.2)
ISMV3-44C15CD-*****	4.4	28.4	71.1	11.63	1500	1500	2.44	88.9 (90.8)
ISMV3-55C15CD-*****	5.5	35	87.6	14.56	1500	1500	2.4	107 (109.5)
ISMV3-75C15CD-*****	7.5	48	119	18.1	1500	1500	2.65	141 (143.1)

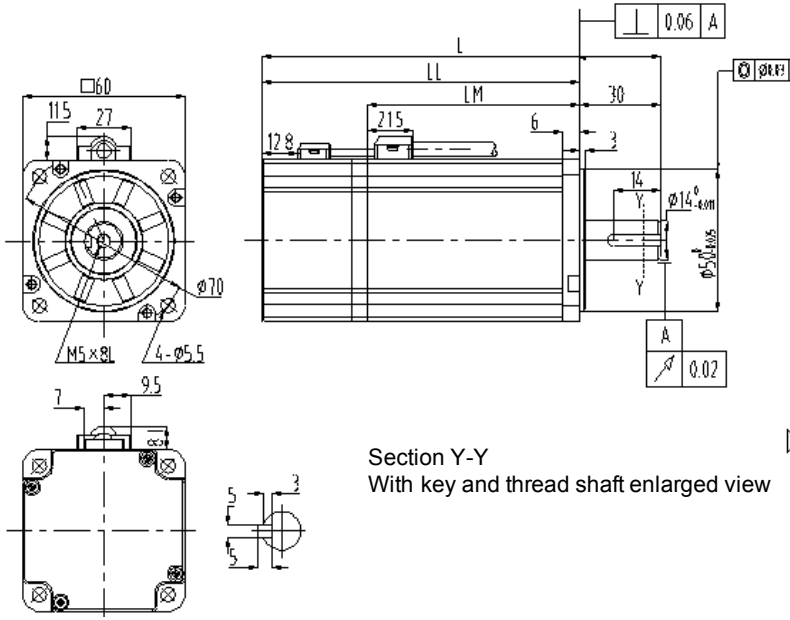
【Note】

- Values of parameters in the table above are obtained when the motor runs in connection with Inovance servodrive and the armature coil works at 20℃.
- The values inside ( ) are values of the motor with a brake.
- The values are obtained with the following heat sink used for cooling:
  ISMH1/ISMH4: 250×250×6mm (aluminum)
  ISMH2-10C-25C: 300×300×12mm (aluminum)
  ISMH2-30C-50C: 400×400×20mm (aluminum)
  ISMH3-85B-18C: 400×400×20mm (iron)
  ISMH3-29C-75C: 360×360×5mm (double-layer aluminum plate)
  ISMV3-29C-75C: 360×360×5mm (double-layer aluminum plate)
- Derate 10% when motor with oil seal is used.

2.2 Servomotor External Dimension

2.2.1 ISMH1 (Vn=3000rpm, Vmax=6000rpm)

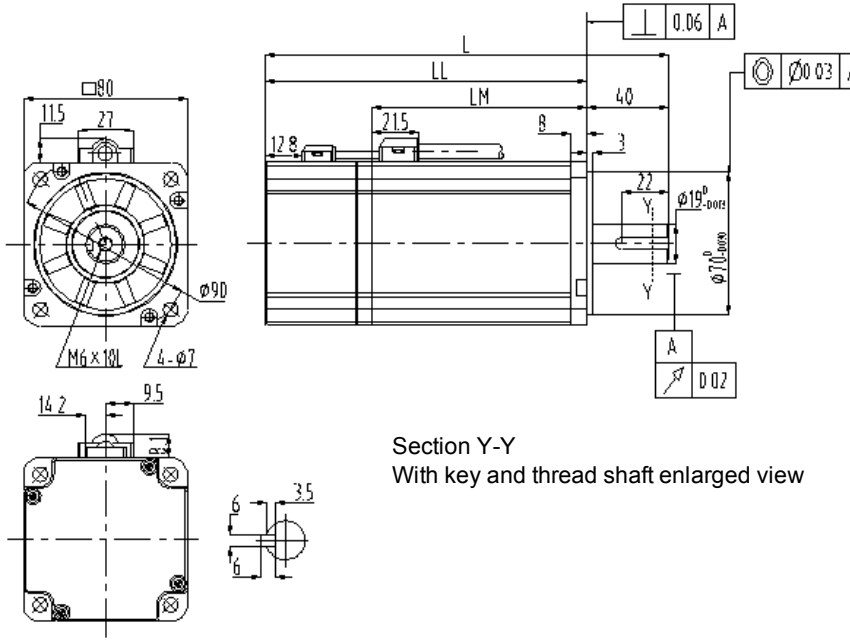
1） 200W, 400W



Section Y-Y
With key and thread shaft enlarged view

Model	ISMH1-20B30CB-*****	ISMH1-40B30CB-*****
L (mm)	144 (183)	169 (208)
LL (mm)	114 (153)	139 (178)
LM (mm)	68	93
Weight (kg)	1.1 (1.4)	1.6 (1.9)

2） 550W, 750W, 1000W



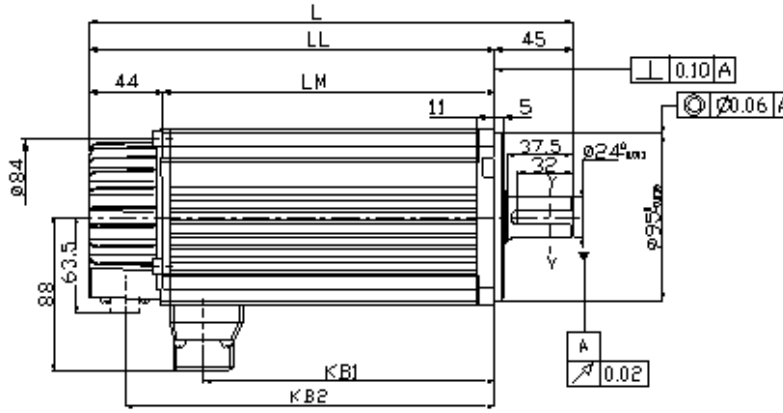
Section Y-Y
With key and thread shaft enlarged view

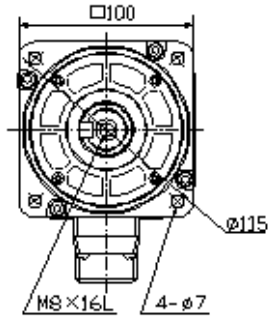
Model	ISMH1-55B30CB-*****	ISMH1-75B30CB-*****	ISMH1-10C30CB-*****
L (mm)	166 (213)	175.5 (222.5)	194
LL (mm)	126 (173)	135.5 (182.5)	153.6
LM (mm)	80.5	90	108
Weight (kg)	2.3 (2.7)	2.7 (3.1)	3.2

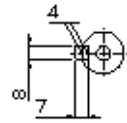
【Note】 The values inside ( ) are values of the motor with a brake.

2.2.2 ISMH2 (Vn=3000rpm, Vmax=6000/5000rpm)

1） 1.0kW, 1.5kW, 2.0kW, 2.5kW



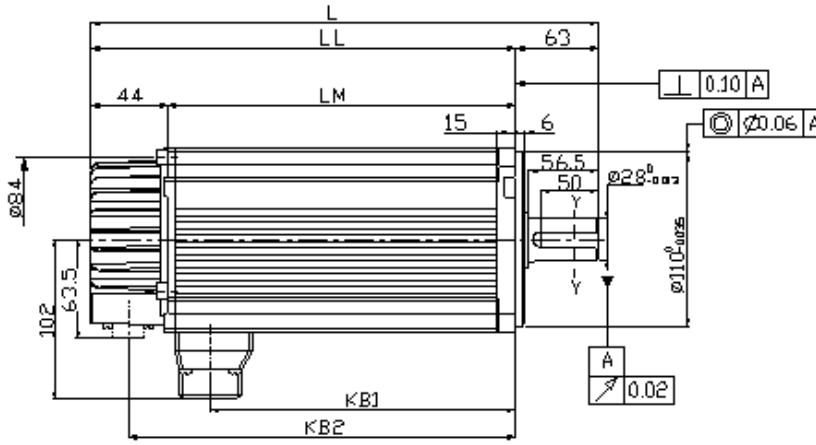


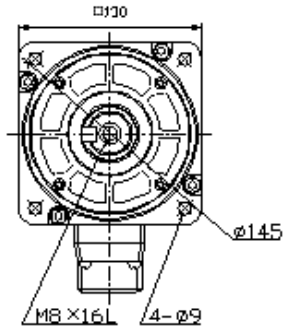


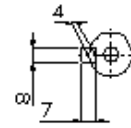
Section Y-Y
With key and thread shaft enlarged view

Model	ISMH2-10C30CB(D)-*****	ISMH2-15C30CB(D)-*****	ISMH2-20C30CB(D)-*****	ISMH2-25C30CB(D)-*****
L (mm)	209 (261)	234 (286)	259 (311)	284 (336)
LL (mm)	164 (216)	189 (241)	214 (266)	239 (291)
LM (mm)	120	145	170	195
KB1 (mm)	94.5 (146.5)	119.5 (171.5)	144.5 (196.5)	169.5 (221.5)
KB2 (mm)	142	167	192	217
Weight (kg)	5.11 (6.41)	6.22 (7.52)	7.39 (8.69)	8.55 (9.83)

2） 3.0kW, 4.0kW, 5.0kW







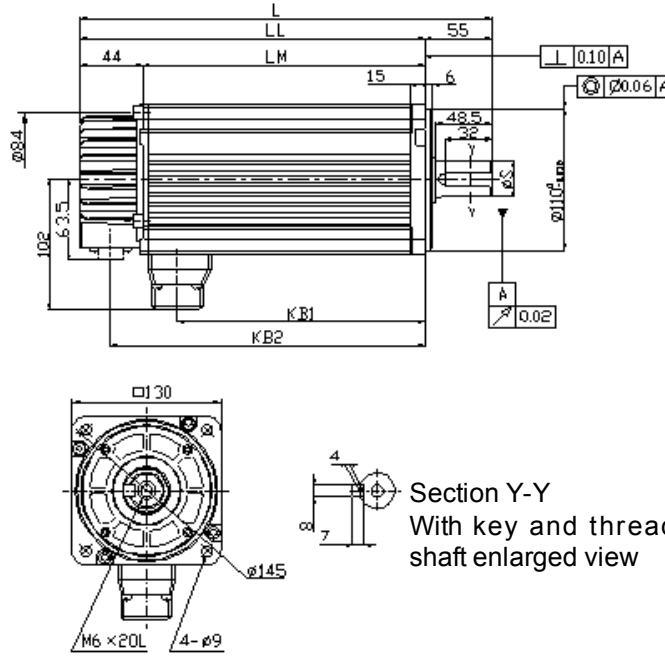
Section Y-Y
With key and thread shaft enlarged view

Model	ISMH2-30C30CD -*****	ISMH2-40C30CD -*****	ISMH2-50C30CD -*****
L (mm)	272.5 (331.5)	315 (374)	357.5 (409.5)
LL (mm)	209.5 (268.5)	252 (311)	294.5 (353.5)
LM (mm)	165	207.5	250
KB1 (mm)	136.5 (195.5)	179 (238)	221.5 (280.5)
KB2 (mm)	186.5	229	271.5
Weight (kg)	10.73 (13.23)	15.43 (17.93)	16.2 (18.7)

【Note】 The values inside ( ) are values of the motor with a brake.

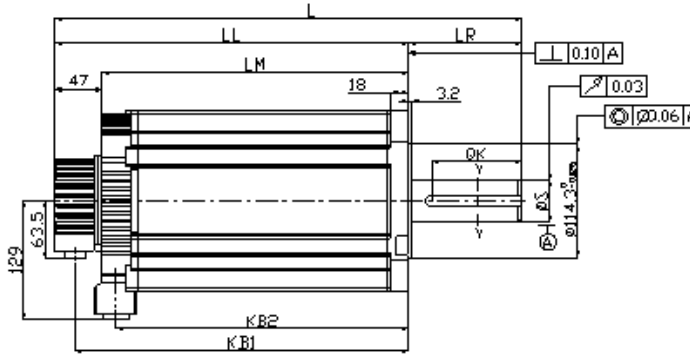
2.2.3 ISMH3 (Vn=1500/1000rpm, Vmax=3000/2000rpm)

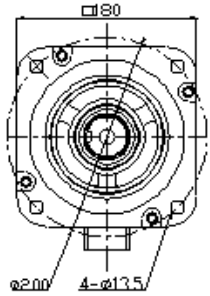
1） 850W, 870W, 1.2KW, 1.3kW, 1.8kW

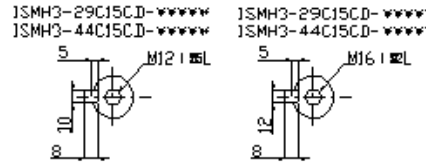


Model	ISMH3-85B15CB(D)-*****	ISMH3-13C15CB(D)-*****	ISMH3-18C15CB(D)-*****	ISMH3-87B15CB(D)-*****	ISMH3-12C15CB(D)-*****
L (mm)	226.5 (285.5)	252.5 (311.5)	278.5 (337.5)	252.5 (311.5)	278.5 (337.5)
LL (mm)	168.5 (227.5)	194.5 (253.5)	220.5 (279.5)	194.5 (253.5)	220.5 (279.5)
LM (mm)	124	150	176	150	176
KB1 (mm)	95.5 (154.5)	121.5 (180.5)	147.5 (206.5)	121 (180.5)	147.5 (206.5)
KB2 (mm)	1475.5	171.5	197.5	171.5	197.5
S (mm)	22 $^{0}_{-0.013}$				
Weight (kg)	8.23 (10.73)	10.57 (13.0)	12.7 (15.2)	10.57 (13.0)	12.7 (15.2)

2） 2.9kW, 4.4kW, 5.5kW, 7.5kW







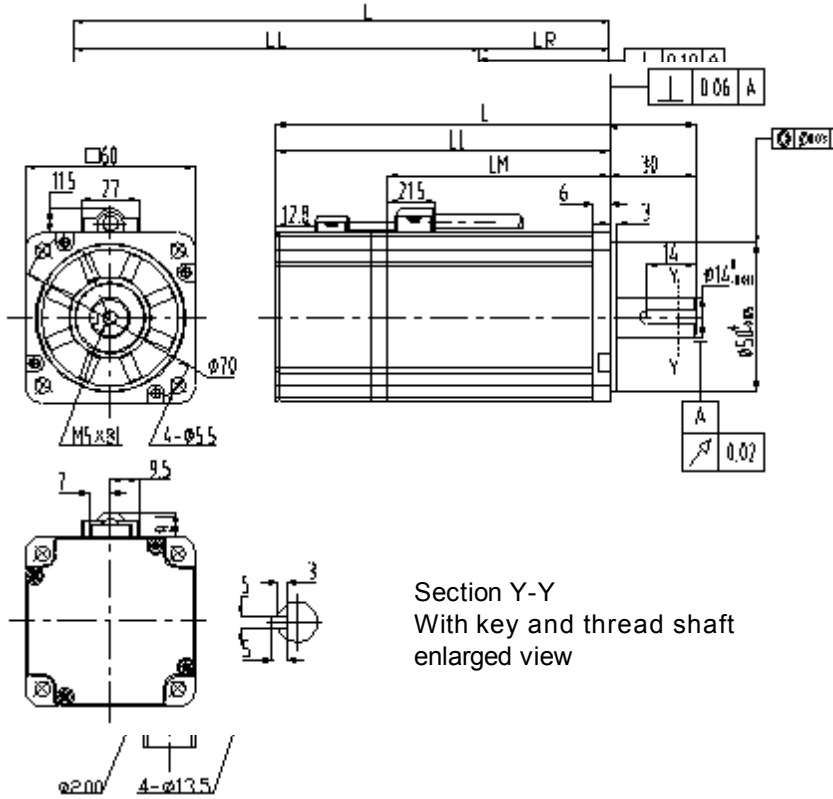
Section Y-Y
With key and thread shaft enlarged view

Model	ISMH3-29C15CD-*****	ISMH3-44C15CD-*****	ISMH3-55C15CD-*****	ISMH3-75C15CD-*****
L (mm)	328 (405)	383 (460)	445 (522)	500 (577)
LL (mm)	249 (323)	304 (381)	332 (409)	387 (464)
LM (mm)	202 (275)	257 (330)	285 (358)	340 (413)
KB1 (mm)	225 (302)	280 (357)	308 (385)	363 (357)
KB2 (mm)	188	243	271	326
LR (mm)	79	79	113	113
S (mm)	$35^{+0.01}_{0}$	$35^{+0.01}_{0}$	$42^{0}_{-0.0016}$	$42^{0}_{-0.0016}$
QK (mm)	60	60	90	90
Weight (kg)	20.9 (32)	29.4 (40)	34.5 (42.5)	43.2 (62.5)

【Note】 The values inside ( ) are values of the motor with a brake.

2.2.4 ISMH4 (Vn=3000rpm, Vmax=6000rpm)

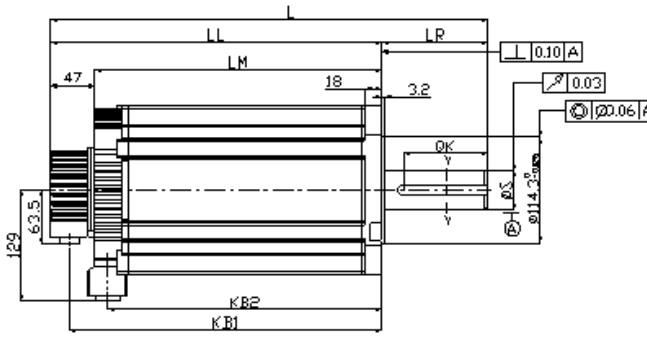
400W

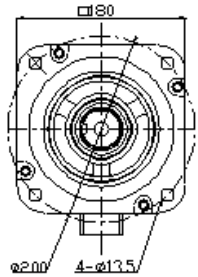


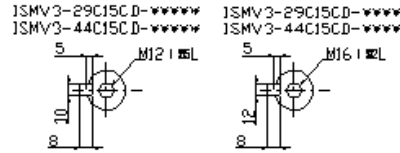
Model	ISMH4-40B30CB-*****
L (mm)	177.5
LL (mm)	147.5
LM (mm)	101.5
Weight (kg)	1.7

2.2.5 ISMV3 (Vn=1500rpm, Vmax=1500rpm)

2.9kW, 4.4kW, 5.5kW, 7.5kW







Section Y-Y
With key and thread shaft
enlarged view

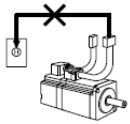
Model	ISMV3-29C15CD -*****	ISMV3-44C15CD -*****	ISMV3-55C15CD -*****	ISMV3-75C15CD -*****
L (mm)	328 (405)	383 (460)	445 (522)	500 (577)
LL (mm)	249 (323)	304 (381)	332 (409)	387 (464)
LM (mm)	202 (275)	257 (330)	285 (358)	340 (413)
KB1 (mm)	225 (302)	280 (357)	308 (385)	363 (357)
KB2 (mm)	188	243	271	326
LR (mm)	79	79	113	113
S (mm)	$35^{+0.01}_{0}$	$35^{+0.01}_{0}$	$42^{0}_{-0.01}$	$42^{0}_{-0.01}$
QK (mm)	60	60	90	90
Weight (kg)	20.9 (32)	29.4 (40)	34.5 (42.5)	43.2 (62.5)

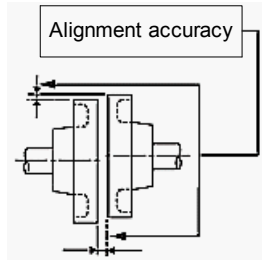
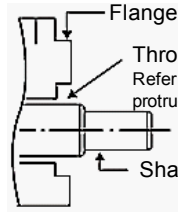
【Note】 The values inside ( ) are values of the motor with a brake.

2.3 Installation of Servomotor

2.3.1 Precautions on Installing Servomotor

Servomotor can be installed either horizontally or vertically. Incorrect/inappropriate installation may shorten service life of servomotor or cause unexpected accident.

CAUTION	
	• Do not connect servomotor directly to a commercial power line. Otherwise, servomotor will be damaged. • Servomotor cannot operate without being connected to specified servodrive.

Item	Description
Alignment	 Measure the distance at four different positions on the circumference . The difference of the maximum and minimum measurements must be 0.03mm or less. Note: Turn together with the coupling. When connecting servomotor with a machine, align the servomotor shaft with the machine shaft and then couple the shafts based on the alignment accuracy described above. If the shafts are not aligned accurately, vibration will occur, which may damage the bearings and encoder.
Mounting Direction	Servomotor can be installed either horizontally or vertically.
Water/Oil Mist	In water mist application, confirm the protection mode of servomotor (except for through shaft section) before using. In application where oil splashes on the through shaft section, use the servomotor with an oil seal. Precautions on using the servomotor with an oil seal: • Keep oil level under the oil seal lip. • Use oil seal in favorably lubricated condition. • Avoid oil accumulation at the oil seal lip when using a servomotor with its shaft upward direction. 

Cable Stress	Make sure there is no bending or tension on power lines. Especially ensure core wires that are only 0.2mm to 0.3mm thin are not subject to stress while wiring.
Connector	Observe the following precautions: • Make sure there are no foreign matters such as dust or metal chips in the connector before connecting. • When connecting a connector to motor, be sure to connect the servomotor main circuit cables first. If the encoder cable is connected first, the encoder may fail because of voltage difference between PEs. • Make sure of the pin arrangement. • Connector is made from the resin. Do not apply shock so as to prevent damage to the connector. • When moving a servomotor with its cables connected, hold the main body of the servomotor. If you hold the cables only, connectors and cables may be damaged. • When using bending cables, remember not to apply excessive stress to the connector section. Otherwise, the connector may be damaged.

【Note】

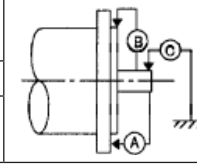
- Before installation, thoroughly remove the anticorrosive paint that coats the end of the motor shaft.

Anticorrosive paint is coated here

- Vibration from improper alignment of shafts may damage the bearings.
- Do not allow direct impact to be applied to the shafts when installing the coupling as the encoder mounted on the opposite end of the shaft may be damaged.

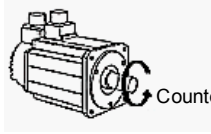
2.3.2 Servomotor Installation Accuracy

The table below shows accuracy for ISMH and ISMV type servomotor’s output shaft and external installation. For the installation accuracy of various servomotors, refer to their dimensions.

Accuracy		Reference Diagram
A	Perpendicularity between the flange face and output shaft: 0.06 mm	
B	Mating concentricity of the flange: 0.04mm	
C	Run-out at the end of the shaft: 0.02mm	

2.3.3 Servomotor Rotating Direction

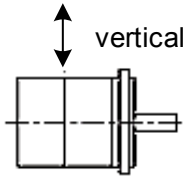
Seen from the load side, positive rotation of the servomotor is counterclockwise (CCW).



2.3.4 Shock Resistance

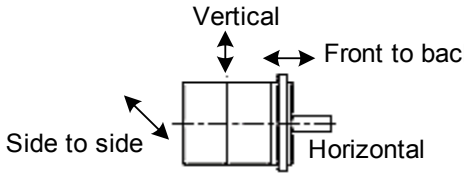
When the servomotor is mounted with its shaft horizontal, it can withstand the following vertical shocks:

- Shock acceleration: 490m/s2
- Shock occurrences: 2



2.3.5 Vibration Resistance

When the servomotor is mounted with its shaft horizontal, it can withstand vibration acceleration of 49m/s2 in three directions: vertical, side to side, and front to back.



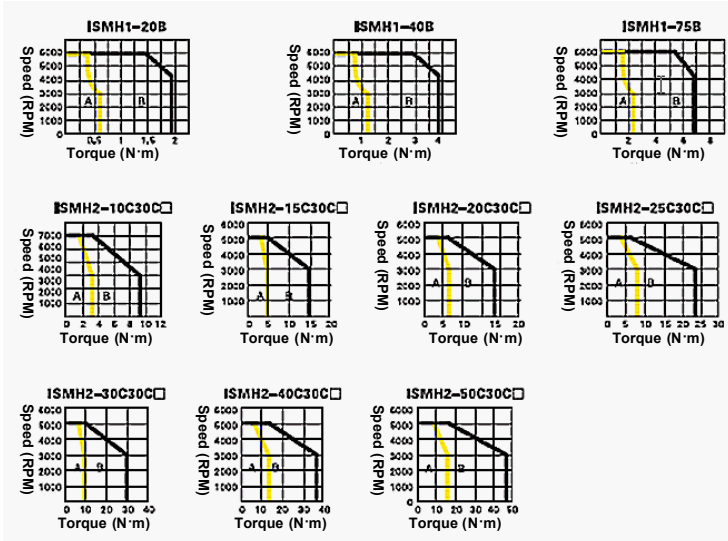
2.3.6 Vibration Level

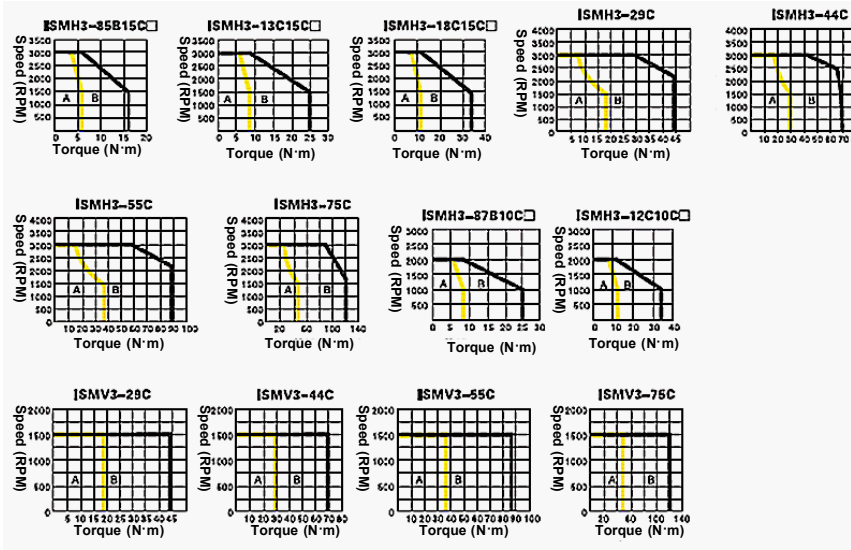
The vibration level for servomotor at rated rotating speed is V15.

【Note】 Vibration level V15 indicates maximum vibration amplitude of 15μm or less when servomotor singly rotates at rated speed.

2.4 Corresponding Relationship between Torque and Speed

In the following figures, "A" indicates continuous working area and "B" indicates short-time working area.





2.5 Overload Feature of Servomotor

Overload detection value is set under the condition of servomotor ambient temperature (40℃) and hot start

Load (Times of Rated Servomotor Current)	Operation Time (s)
120	230
130	80
140	40
150	30
160	20
170	17
180	15
190	12
200	10
210	8.5
220	7
230	6
240	5.5
250	5
300	3

3

Servodrive Specification and External Dimension

Chapter 3 Servodrive Specification and External Dimension

3.1 Servodrive Specification

3.1.1 Single-Phase 220V Servodrive

Size	SIZE-A				SIZE-B	
Drive model IS500*	S0R7	S0R9	S1R6	S2R8	S3R8	S5R5
Continuous Output Current (Arms)	0.66	0.91	1.6	2.8	3.8	5.5
Max. Output Current (Arms)	2.1	2.9	5.8	9.3	11	16.9
Power Supply for Main Circuit	Single-phase AC200V-240V, +10 to -15%, 50/60Hz					
Power Supply for Control Circuit	Single-phase AC200V-240V, +10 to -15%, 50/60Hz					
Brake Processing	External brake resistor				Built-in brake resistor	

3.1.2 Three-Phase 220V Servodrive

Size	SIZE-B		SIZE-C	
Drive model IS500*	S3R8	S5R5	S7R6	S012
Continuous Output Current (Arms)	3.8	5.5	7.6	11.6
Max. Output Current (Arms)	11	16.9	17	28
Power Supply for Main Circuit	Three-phase AC200V-240V, +10 to -15%, 50/60Hz			
Power Supply for Control Circuit	Single-phase AC200V-240V, +10 to -15%, 50/60Hz			
Brake Processing	Built-in brake resistor			

3.1.3 Three-Phase 220V Servodrive

Size	SIZE-C			SIZE-D		SIZE-E		
Drive model IS500*	T1R9	T3R5	T5R4	T8R4	T012	T017	T021	T026
Continuous Output Current (Arms)	1.9	3.5	5.4	8.4	11.9	16.5	20.8	25.7
Max. Output Current (Arms)	5.5	8.5	14	20	28	42	55	65
Power Supply for Main Circuit	Three-phase AC380V-440V, +10 to -15%, 50/60Hz							
Power Supply for Control Circuit	Single-phase AC380V-440V, +10 to -15%, 50/60Hz							
Brake Processing	Built-in brake resistor							

CAUTION
An alarm may be given if servodrive works out of the input power range. If the voltage exceeds the following values, use a step-down transformer so that the voltage will be within the specified range.

3.1.4 Servodrive General Specifications

Item			Description
Basic Specifications	Control Mode IGBT-PWM (sine-wave driven)		220V, 380V: single or three phase full-wave rectification
	Feedback Serial incremental type: 17 bits		Wire-saving incremental type: 2500 P/R
	Conditions	Ambient/Storage Temp. (*1)	0-40℃ (derated when used within 40℃ to 55℃)/-20° C to 85° C
		Ambient/Storage Humidity	90%RH or less (no condensation)
		Vibration/Shock Resistance	4.9m/s2/19.6m/s2
		Protection Level	IP10
		Pollution Level	Level 2
		Altitude	Below 1,000m (derated when used at an altitude of higher than 1,000m)

Item				Description
Speed and Torque Control Modes	Performance	Speed Regulation (*2)	Load Regulation	0-100% load: ±0.01% or less (at rated speed)
			Voltage Regulation	Rated voltage ±10%: 0% (at rated speed)
			Temperature Regulation	Rated voltage ±10%: 0% (at rated speed)
		Speed Control Range		1:5000 (At the lower limit of the speed control range, the servodrive will not stop with a rated torque load.)
		Frequency Features		400Hz (when JL equals JM)
		Torque Control Accuracy (Repeatability)		±2%
		Soft Start Time Setting		0-10s (can be set for Acceleration / Deceleration respectively.)
	Input Signal	Speed Instruction Input	Instruction Voltage (*3)	DC±10V/Rated speed (default factory setting that can be changed by modifying function code)
				Input voltage: 12V at maximum (servodrive rotates forward upon positive instruction)
			Input Impedance	About 14kΩ
			Circuit Time Constant	About 47μs
		Torque Instruction Input	Instruction Voltage	DC±10 V/Rated torque (default setting upon delivery; can change the setting range via function codes)
				Input voltage: 12V at maximum (servodrive rotates forward upon positive instruction)
			Input Impedance	About 14kΩ
			Circuit Time Constant	About 47μs
		MS Speed Instruction	Speed Selection	Select speed of stages 0 to 15 by combing DI1 (CMD1), DI2 (CMD2) DI7 (CMD3) and DI8 (CMD4) signals (This function can be set to other terminals).

Item				Description
Position Control Mode	Performance	Feed Forward Compensation		0 to 100% (preset resolution: 1%)
		Positioning Completed Width Setting		0 to 65535 instruction units (preset resolution: 1 instruction unit)
	Input Signals	Instruction Pulse	Input Pulse Type	Direction + pulse phase A/B orthogonal pulse CCW/CW pulse
			Input Form	Differential driver
				Open collector
			Input Pulse Frequency	Differential driver: 1Mpps max.
				Open collector: 200kpps max.
		Control Signal		Clear signal (input pulse form identical to instruction pulse)
		Built-in Open Collector Power Supply (*4)		+24V (built-in resistor of 2.4kΩ)
		Multi-stage Position Instruction	Position Selection	Select position of stages 0 to 15 by combing DI1 (CMD1), DI2 (CMD2) DI7 (CMD3) and DI8 (CMD4) signals (This function can be set to other terminals).
I/O Signals	Position Output	Output Form		Phase-A, -B, -Z: differential driver output
		Frequency Dividing Ratio		Any frequency division
	Digital Input Signal	Signal allocation can be modified.		10-channel DI
				Servo enabled, alarm reset, proportional motion switch, operation instruction switch, zero-position fixed function enabled, pulse disabled, forward drive disabled, reverse drive disabled, forward external torque limit, reverse external torque limit, forward jog, reverse jog, position step input
	Digital Output Signal	Signal allocation can be modified.		7-channel DO
				Servo ready, motor rotating, zero speed, speed arrival, position arrival, position approach signal, torque limit, brake output, alarm, servo error, 3-digit alarm code

Item			Description
Internal Functions	Over-travel Stop		Deceleration to a stop at P-OT or N-OT
	Electronic Gear Ratio		0.001 ≤ B/A ≤ 4000
	Protection		Over-current, over-voltage, low voltage, overload, main circuit error, radiator overheated, power supply phase-missing, over-speed, encoder error, CPU error, parameter error, others.
	LED Display		Main power Charge, 5-digit LEDs
	Analog Monitoring		Built-in analog connector for monitoring speed, torque and other instruction signals.
	Communications	Connected Devices	RS232, RS485
		1: N Communications	RS485: max. N=247
		Shaft address Setting	Set based on user parameters
		Functions	Status display, parameter setting, monitor display, error trace-back display, JOG and auto-tuning operations, monitoring of speed & torque instruction signals etc.
	Others		Gain adjustment, alarm record, JOG, DC reactor connection terminal for harmonic suppressions.

【Note】

- *1: Install servodrive within the ambient temperature range. When servodrive is stored in a cabinet, temperature inside the cabinet cannot exceed the range.
- *2: Speed regulation is defined as follows:

$$\text{Speed Regulation} = \frac{\text{No-load speed} - \text{Full-load speed}}{\text{Rated speed}} \times 100\%$$

Actually, processing resistance may change due to amplifier drift arising from voltage/temperature variations. This will finally result in a change in rotating speed, which is speed regulation because of voltage/ temperature variations.

- *3: Forward rotating means servomotor rotates clockwise viewed from reverse load side. Servomotor rotates counterclockwise viewed from the load and shaft side.
- *4: The built-in open collector power supply is not electrically insulated from the control circuit in the servodrive.

3.2 Installation of Servodrive

3.2.1 Installation Site

1. Installed in a cabinet

Design the cabinet size, servodrive configuration and cooling method so that the temperature around the servodrive is controlled within 40℃.

2. Installed near a heating unit

   Minimize the heat radiating from the heating unit as well as any temperature rise caused by natural convection so that the temperature around the servodrive is controlled within 40℃.

3. Installed near a source of vibration

   Install a vibration isolator on the servodrive to avoid subjecting it to vibration.

4. Installed at a Site Exposed to Corrosive Gas

   Corrosive gas does not have an immediate effect on the servodrive but will eventually cause the electronic components and contactor-related devices to malfunction. Take appropriate action to avoid corrosive gas.

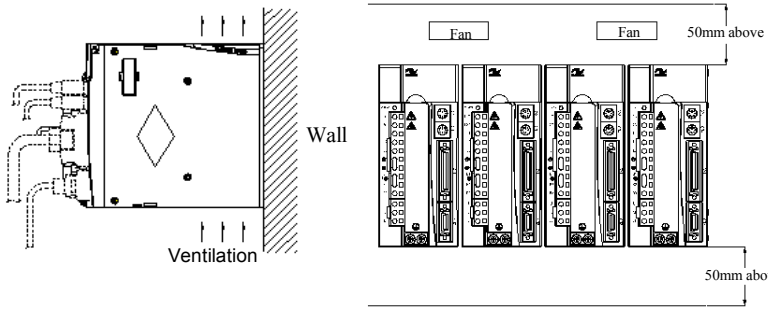
5. Other Situations

   Do not install the servodrive in hot, humid locations or locations subject to excessive dust or iron powder in the air.

3.2.2 Installation Direction

Install the servodrive perpendicular to the wall as shown in the following figure.

The servodrive must be oriented this way because it is designed to be cooled by natural convection or a cooling fan. Secure the servodrive using two to four mounting holes. The number of holes depends on the capacity.



Install the servodrive perpendicular to the wall and make the front panel of the servodrive face outward.

- Cooling

  As shown in the figure above, allow sufficient space around each servodrive for cooling by cooling fans or natural convection.

- Side-by-side Installation

  When installing multiple servodrives side by side, allow at least 10mm between servodrives and at least 50mm above and below each servodrive. Install cooling fans above the servodrives to avoid excessive temperature rise and to maintain even temperature inside the unit.

3.3 Servodrive Power Supply Capacities and Power Loss

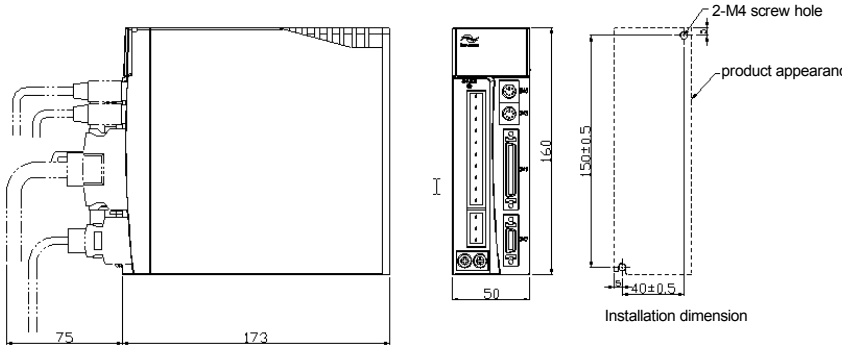
The following table shows servodrive’ s power supply capacities and power losses at the rated output.

Servodrive Model		Output Current (Effective Value) (A)	Main Circuit Power Loss (W)	Regenerative Resistor Power Loss (W)	Control Circuit Power Loss (W)	Total Power Loss (W)
Single-phase 220V	IS500□S0R7I	0.66	5	-	18	23
	IS500□S0R9I	0.91	10			28
	IS500□S1R6I	1.6	15			33
	IS500□S2R8I	2.8	20			38
Single/ Three-phase 220V	IS500□S3R8I	3.8	30	8	20	58
	IS500□S5R5I	5.5	40			68
Three-phase 220V	IS500□S7R6I	7.6	55		21	84
	IS500□S012I	11.6	92			121
	IS500□S018I	18.5	120	20	23	165
	IS500□S025I	24.8	150		28	198
	IS500□S033I	32.9	240			288
Three-phase 380V	IS500□T1R9I	1.9	20	8	21	49
	IS500□T3R5I	3.5	35			64
	IS500□T5R4I	5.4	55			84
	IS500□T8R4I	8.4	83	20	23	126
	IS500□T012I	11.9	120			163
	IS500□T017I	16.5	180		28	228
	IS500□T021I	20.8	220			268
	IS500□T026I	25.7	250			298

3.4 Servodrive Dimension Diagram

3.4.1 Size-A Appearance and Specification

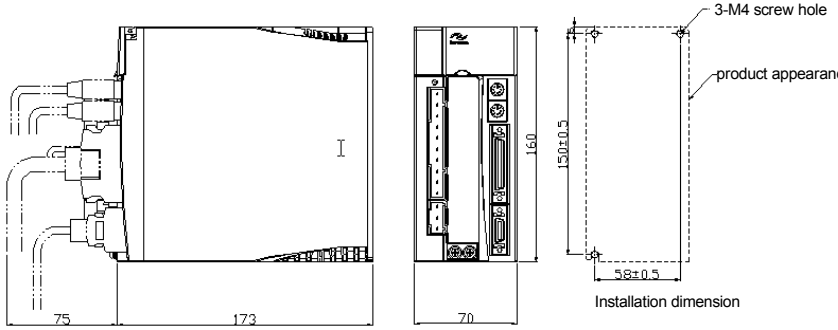
Single-phase 220V: IS500□S0R7I, IS500□S0R9I, IS500□S1R6I and IS500□S2R8I



3.4.2 Size-B Appearance and Specification

Single-phase 220V: IS500□S3R8I, IS500□S5R5I

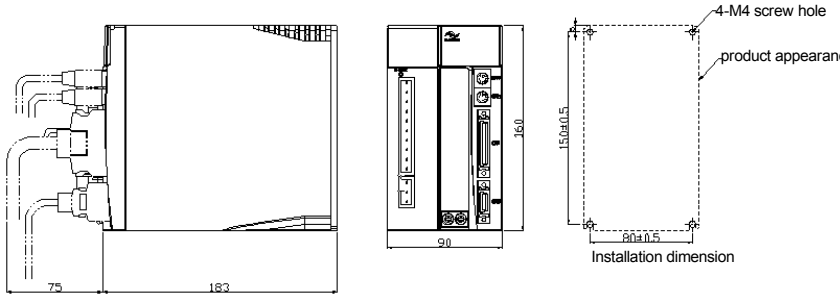
Three-phase 220V: IS500□S3R8I, IS500□S5R5I



3.4.3 Size-C Appearance and Specification

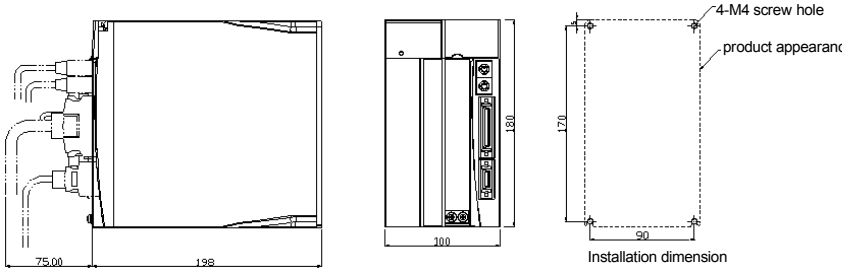
Three-phase 220V: IS500□S7R6I, IS500□S012I

Three-phase 380V: IS500□T1R9I, IS500□T3R5I and IS500□T5R4I



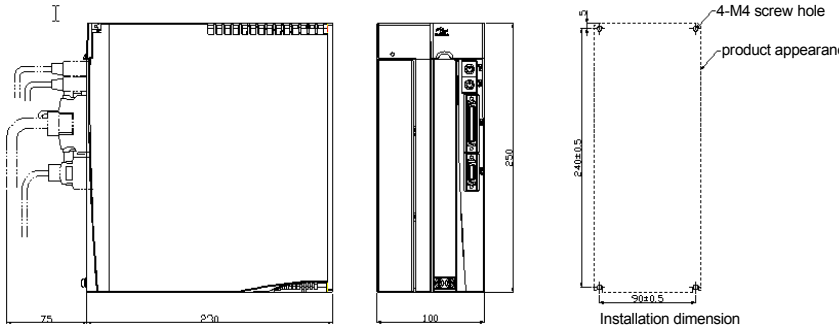
3.3.4 Size-D Appearance and Specification

Three-phase 380V: IS500□T8R4I, IS500□T012I



3.3.5 Size-E Appearance and Specification

Three-phase 380V: IS500□T017I, IS500□T021I, IS500□T026I



4

Cable Specifications and Dimension Diagram

Chapter 4 Cable Specifications and Dimension Diagram

4.1 Servomotor Main Circuit Cable (S5-L-M**-**)

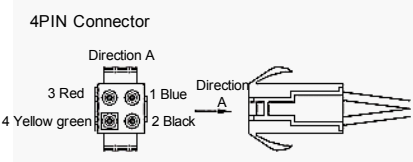
4.1.1 Servomotor Main Circuit Cable Models

Model	Length	Adaptable Servomotor	Connector
S5-L-M03-3.0	3.0m	ISMH1, ISMH4, ISMV1 Series	4 Pin connector
S5-L-M03-5.0	5.0m		
S5-L-M03-10.0	10.0m		
S5-L-M24-3.0	3.0m	ISMH2, ISMV2 Series and ISMH3,ISMV3 Series(1.8kw or below)	20-18 aviation plug
S5-L-M24-5.0	5.0m		
S5-L-M24-10.0	10.0m		
S5-L-M25-3.0	3.0m	ISMH3, ISMV3 Series (2.9kw or above)	20-22 aviation plug
S5-L-M25-5.0	5.0m		
S5-L-M25-10.0	10.0m		

4.1.2 Servomotor Main Circuit Cable Connectors

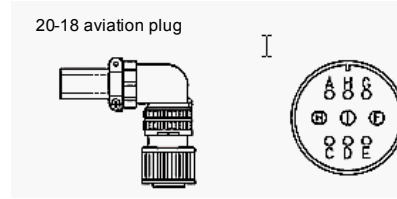
1） S5-L-M03-3.0, S5-L-M03-5.0 and S5-L-M03-10.0 Cable Connector

4 Pin Connector	
Signal Name	Pin No.
U	1
V	2
W	3
PE	4



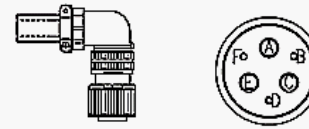
2） S5-L-M24-3.0, S5-L-M24-5.0, S5-L-M24-10.0, S5-L-M25-3.0, S5-L-M25-5.0 and S5-L-M25-10.0 Cable Connector

20-18 Aviation Plug	
Signal Name	Pin
U	B
V	I
W	F
PE	G



20-22 Aviation Plug	
Signal	Pin
U	A
V	C
W	E
PE	F

20-22 aviation plug



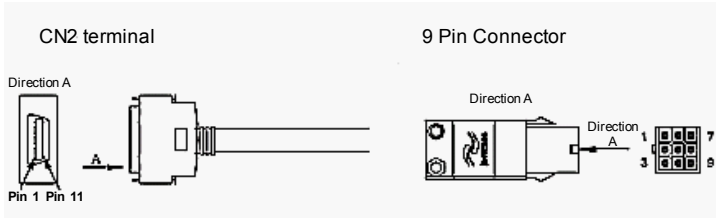
4.2 Servomotor Encoder Cable (S5-L-P**-**)

4.2.1 Servomotor Encoder Cable Models

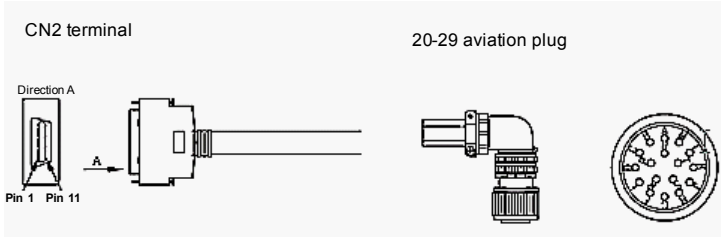
Model	Length	Adaptable Servomotor	Adaptable Encoder	Connector
S5-L-P00-3.0	3.0m	ISMH1, ISMH4, ISMV1 Series	Wire-saving incremental encoder	9 Pin connector
S5-L-P00-5.0	5.0m			
S5-L-P00-10.0	10.0m			
S5-L-P21-3.0	3.0m	ISMH2, ISMV2 Series and ISMH3, ISMV3 Series	Wire-saving incremental encoder	20-29 aviation plug
S5-L-P21-5.0	5.0m			
S5-L-P21-10.0	10.0m			

4.2.2 Servomotor Encoder Cable Connectors

1） S5-L-P00-3.0, S5-L-P00-5.0 and S5-L-P00-10.0 Cable Connector



2） S5-L-P21-3.0 and S5-L-P21-5.0 Cable Connector



4.2.3 Servomotor Encoder Wiring

1） Wiring Specification for S5-L-P00-3.0, S5-L-P00-5.0 and S5-L-P00-10.0

CN2 Terminal		9 Pin Connector	
Signal	Pin	Pin	Signal
A+	1	3	A+
A-	2	6	A-
B+	3	2	B+
B-	4	5	B-
Z+	5	1	Z+
Z-	6	4	Z-
+5V	13	9	+5V
GND	14	8	GND
PE (shielding layer)	Housing	7	PE (shielding layer))

Twisted Pair	
A+	A-
B+	B-
Z+	Z-
+5V	GND

2） Wiring Specification for S5-L-P21-3.0, S5-L-P21-5.0 and S5-L-P21-10.0

CN2 Terminal		20-29 Aviation Plug	
Signal	Pin	Pin	Signal
A+	1	A	A+
A-	2	B	A-
B+	3	C	B+
B-	4	D	B-
Z+	5	E	Z+
Z-	6	F	Z-
+5V	13	G	+5V
GND	14	H	GND
PE (shielding layer)	Housing	J	PE (shielding layer)

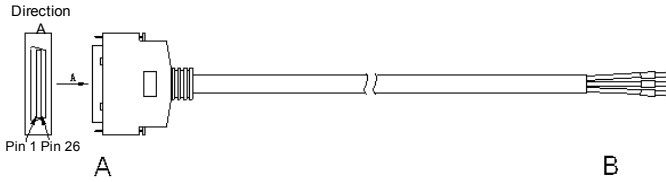
Twisted Pair	
A+	A-
B+	B-
Z+	Z-
+5V	GND

4.3 Servodrive I/O Cable (S5-L-S00-**)

1） Servodrive I/O Cable Model

Model	Length	Remark
S5-L-S00-1.0	1.0 m	It is applicable to all servodrive models.
S5-L-S00-2.0	2.0 m	
S5-L-S00-3.0	3.0 m	

2） Servodrive I/O Cable Appearance



3） Wiring Specification for S5-L-S00-**

A		B		Twisted Pair	
Pin No.	Signal	Wire Color	Relation		
1	SG	White	One pair	1	3
3	PL1	Blue		2	4
2	SG	White	One pair	5	6
4	DI3	Orange		7	8
5	AI1	White	One pair	9	10
6	SG	Green		11	12
7	PULS+	White	One pair	13	39
8	PULS-	Brown		14	15
9	AI2	White	One pair	16	17
10	SG	Gray		18	44
11	SIGN+	White	One pair	19	20
12	SIGN-	Red		21	22
13	PL2	White	One pair	23	24
39	DO8	Yellow		25	26
14	CLR-	White	One pair	27	28
15	CLR+	Purple		29	30
16	+5V	Red	One pair	31	32
17	PZ-OUT	Blue		33	34
18	PL3	Red	One pair	35	36
44	DI4	Orange		37	38
19	PZ0+	Red	One pair	40	41
20	PZ0-	Green		42	43
21	Reserved	Red	One pair	45	46
22	Reserved	Brown		47	50
23	DI9	Red	One pair	48	49
24	DI10	Gray			

A		B	
Pin No.	Signal	Wire Color	Relation
25	DO3+	Red	One pair
26	DO3-	Yellow	
27	DO2+	Red	One pair
28	DO2-	Purple	
29	DO1+	Red	One pair
30	DO1-	Black	
31	DO4+	Black	One pair
32	DO4-	Blue	
33	PAO+	Black	One pair
34	PAO-	Orange	
35	PBO+	Black	One pair
36	PBO-	Green	
37	DO6	Black	One pair
38	DO7	Brown	
40	DI5	Black	One pair
41	DI6	Gray	
42	DI7	Black	One pair
43	DI8	Yellow	
45	DI2	Black	One pair
46	DI1	Purple	
47	+24V	Black	One pair
50	COM	White	
48	AI3+	Brown	One pair
49	AI3-	Orange	
PE (shielding layer)	PE (shielding layer)	Black thermal casing	PE (shielding layer)

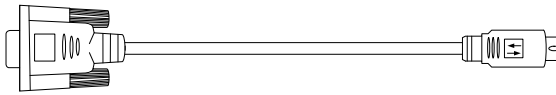
Twisted Pair	
1	3

4.4 Servodrive PC Communication Cable (S5-L-T00-3.0)

1） Servodrive PC Communication Cable Model

Model	Length	Remark
S5-L-T00-3.0	3.0m	It is applicable to all servodrive models.

2） Servodrive PC Communication Cable Appearance



3） Wiring Specification for S5-L-T00-3.0

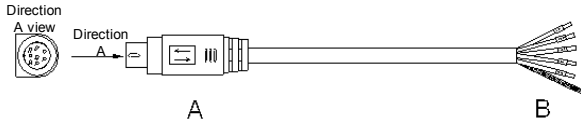
A		B	
Signal	Pin	Pin	Signal
GND	5	1	GND
PC-TXD	3	2	RS232-RXD
PC-RXD	2	3	RS232-TXD
PE (shielding layer)	Housing	Housing	PE (shielding layer)

4.5 Servodrive PLC Communication Cable (S5-L-T02-2.0)

1） Servodrive PLC Communication Cable Model

Model	Length	Remark
S5-L-T02-2.0	2.0 m	It is applicable to all servodrive models.

2） 4.5.2 Servodrive PLC Communication Cable Appearance



3） 4.5.3 Wiring Specification for S5-L-T02-2.0

A		B
Signal	Pin	Pin Signal
GND1	1GND	GND GND
RS485+4	4RS485+	RS485+ RS485+
RS485-5	5RS485-	RS485- RS485-
CANH6	6CANH	CANH CANH
CANL7	7CANL	CANL CANL
PE Housing	PE Housing	PE (Shielding layer)

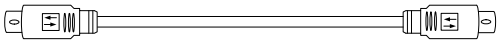
Twisted Pair	
4	5
6	7

4.6 Multi-Servodrive Communication Cable (S5-L-T01-0.2)

1） Multi-Servodrive Communication Cable Model

Model	Length	Remark
S5-L-T01-0.2	0.2 m	It is applicable to all servodrive models.

2） Multi-Servodrive Communication Cable Appearance



A B

3） Wiring Specification for S5-L-T01-0.2

A		B	
Signal	Pin	Pin	Signal
RS485+	4	4	RS485+
RS485-	5	5	RS485-
CANH	6	6	CANH
CANL	7	7	CANL
PE (Shielding layer)	Housing	Housing	PE (Shielding layer)

Twisted Pair	
4	5
6	7

4.7 Servodrive Analog Monitoring Cable (S5-L-A01-1.0)

1） Servodrive Analog Monitoring Cable Model

Model	Length	Remarks
S5-L-A01-1.0	1.0 m	It is applicable to all servodrive models.

2） Servodrive Analog Monitoring Cable Appearance

3） Wiring Specification for S5-L-A01-1.0

A			B
Pin	Signal	Wire Color	Wire Color
1	AO1	Red	Red
2	AO2	White	White
3	GND	Black	Black
4	GND	Black	Black

4.8 Precautions on Using Bending Wires

It is recommended that the bending radius be less than 90 mm. Even if the recommended bending radius is respected in the mechanical design, incorrect wiring may cause early disconnection. Observe the following precautions when wiring.

- Cable Twisting

  Ensure that cables are straightened when wiring. Twisted cables cause early disconnection. Check the indication on the cable surface to make sure that the cable is not twisted.

- Fixing Method

  Do not fix the moving points of the cable. Otherwise, stress on the fixed points may cause early disconnection. Fix the cable at the minimum number of points.

- Cable Length

  If the cable length is too long, it may cause the cable’ s sagging. Besides the cable length is too short, it may cause the excessive tension on the fixed points that will cause the early disconnection. Use a flexible cable with the optimum length.

- Interference between Cables

  Avoid interference between cables. Interference limits the motion of cables, which causes early disconnection. Keep sufficient distance between cables, or provide a partition when wiring.

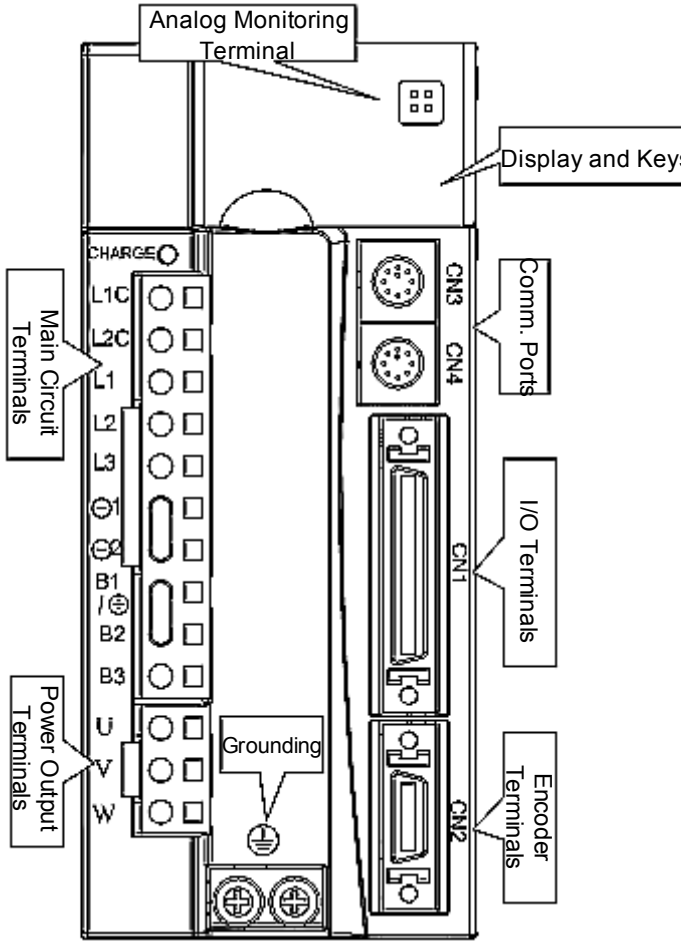
5

Cabling

Chapter 5 Cabling

5.1 Wiring Main Circuit

This section describes typical examples of main circuit wiring, functions of main circuit terminals and the power ON sequence.



5.1.1 Names and Functions of Main Circuit Terminals

Terminal Symbols	Name	Description	
L1, L2, L3	Main circuit power input terminal	IS500□: S0R7, S0R9, S1R6, S2R8	Main circuit power supply input, only L1 and L2. AC220V can be input between L1 and L2.
		IS500□: S3R8, S5R5, S7R6, S012, S018, S025, S033 T1R9, T3R5, T5R4, T8R4, T012, T017, T021, T026	Main circuit power input should refer to rated voltage on nameplate.
L1C, L2C	Control power input terminals	Control circuit power input should refer to rated voltage of the nameplate.	
B1/⊕, B2, B3	External braking resistor terminals	IS500□: S0R7, S0R9, S1R6, S2R8	If the regenerative capacity is insufficient, connect an external regenerative resistor (option) between B1/⊕ and B3.
		IS500□: S3R8, S5R5, S7R6, S012, S018, S025, S033, T1R9, T3R5, T5R4, T8R4, T012, T017, T021, T026	If the internal braking resistor is insufficient, remove the wire between B1 and B2. Connect an external braking resistor (option).
⊖1 ⊖2	DC reactor connection terminals for power supply harmonic suppression	⊖1 and ⊖2 are short circuited by default. If a countermeasure against power supply harmonic waves is required, connect a DC reactor between ⊖1 and ⊖2.	
U, V, W	Servomotor connection terminals	Servo motor connection terminals are connected to motor U, V, W-phase connection.	
⏚ PE	Grounding terminals	Two grounding terminals that are connected to the power supply ground terminal and servomotor ground terminal.	

5.1.2 Wiring Main Circuit Power Supply Connector (Spring Type)

SIZE-A, SIZE-B and SIZE-C servodrives have removable connectors for main circuit power supply and control power supply terminals.

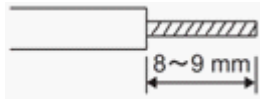
To wire the connector, do as follows:

1. Check the wire size.

   Applicable wire sizes are:

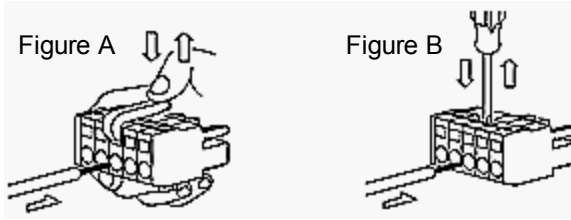
   - Single wire: Φ0.5-Φ1.6mm
   - Twisted-pair wire: AWG28-AWG12

2. Strip back the wire outer coating by 8 to 9mm.



3. Open the connector wiring terminal using provided tool or a standard flat-blade screwdriver.

   - Hang the provided tool in one terminal of the connector and press the connection hook end into the slot as shown in Figure A.
   - Use a standard flat-blade screwdriver (blade width of 3.0 to 3.5 mm). Put the blade into the slot as shown in Figure B, and press it down firmly.



4. Put the wire into the opening terminal.

5.1.3 Main Circuit Connection Cable Specification

For AC 220V

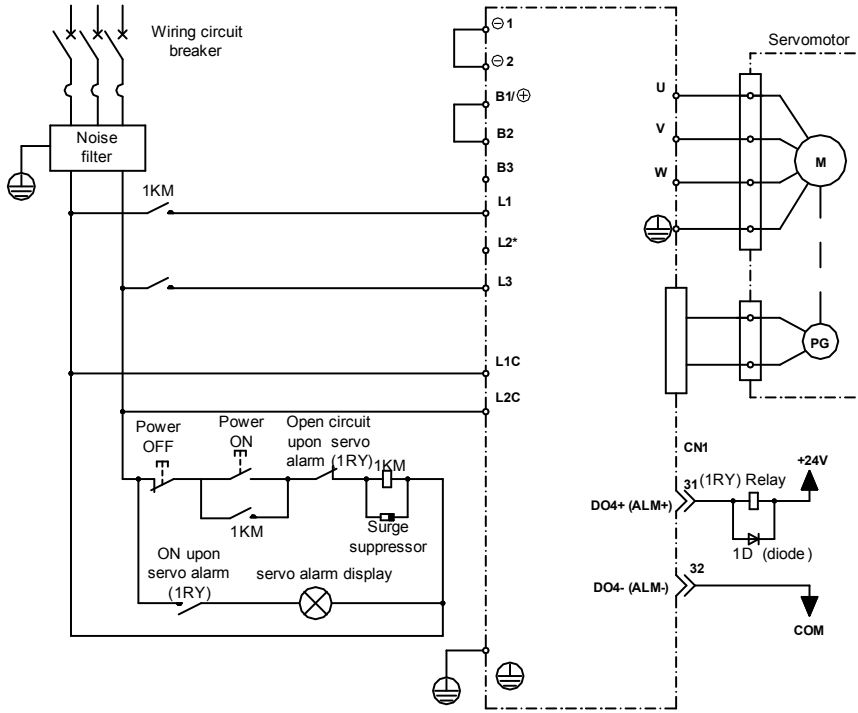
Terminal Symbols	Name	Model: IS500*S□□□*										
		0R7	0R9	1R6	2R8	3R8	5R5	7R6	012	018	025	033
L1, L2, L3	Main circuit power supply input terminal	1.25mm2			2.0mm2					3.5mm2		5.5 mm2
L1C, L2C	Control power input terminals	1.25mm2										
U, V, W	Servomotor connection terminals	1.25mm2				2.0mm2				3.5 mm2	5.5 mm2	8.0 mm2
B1/⊕, B3	External braking resistor terminals	1.25mm2								2.0 mm2	3.5 mm2	5.5 mm2
PE ⏚	Ground terminals	More than 2.0mm2										

For AC 380V

Terminal Symbols	Name	Model IS500*T□□□*							
		1R9	3R5	5R4	8R4	012	017	021	026
L1, L2, L3	Main circuit power supply input terminal	1.25mm2			2.0mm2		3.5mm2		5.5mm2
L1C, L2C	Control power input terminals	1.25mm2							
U, V, W	Servomotor connection terminals	1.25mm2			2.0mm2		3.5mm2		5.5mm2
B1/⊕, B3	External regenerative resistor terminals	1.25mm2					2.0mm2		3.5mm2
PE ⏚	Grounding terminals	More than 2.0mm2							

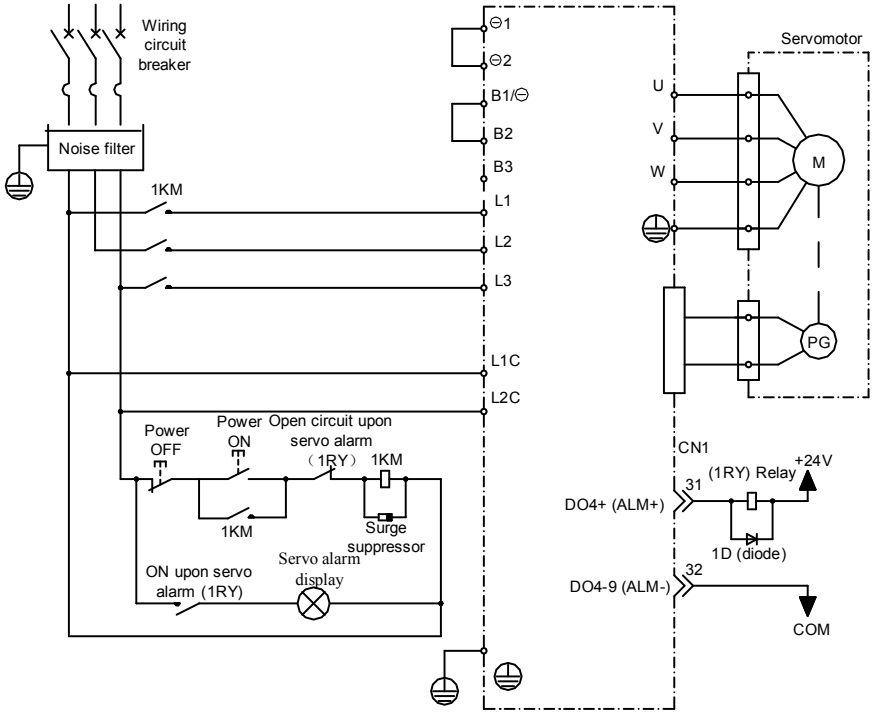
5.1.4 Typical Main Circuit Wiring Examples

■ Single-phase 220V

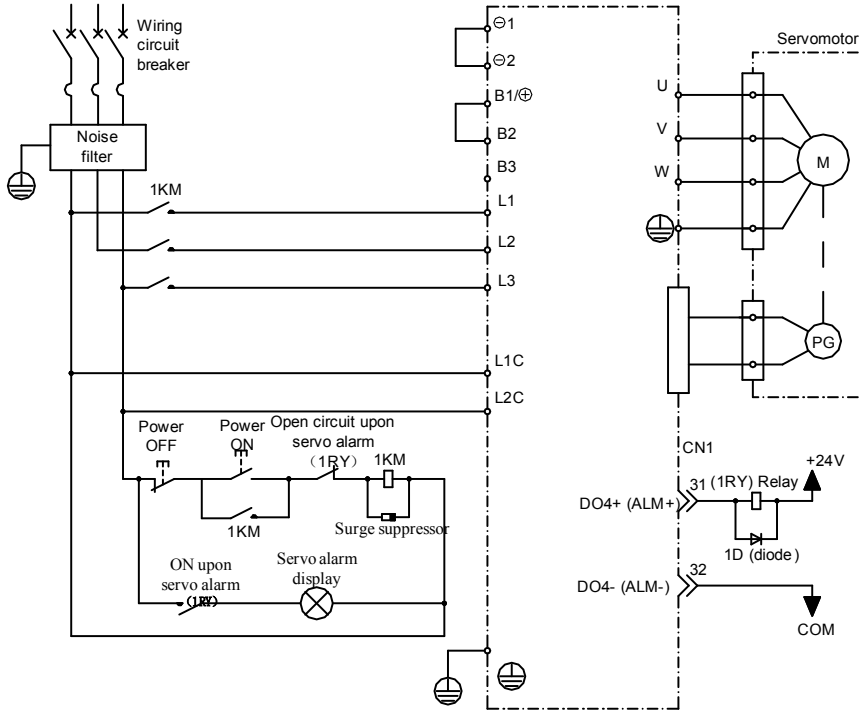


【Note】 In the single-phase 220V wiring, servodrive does not use L2. Thus, wiring L2 is prohibited.

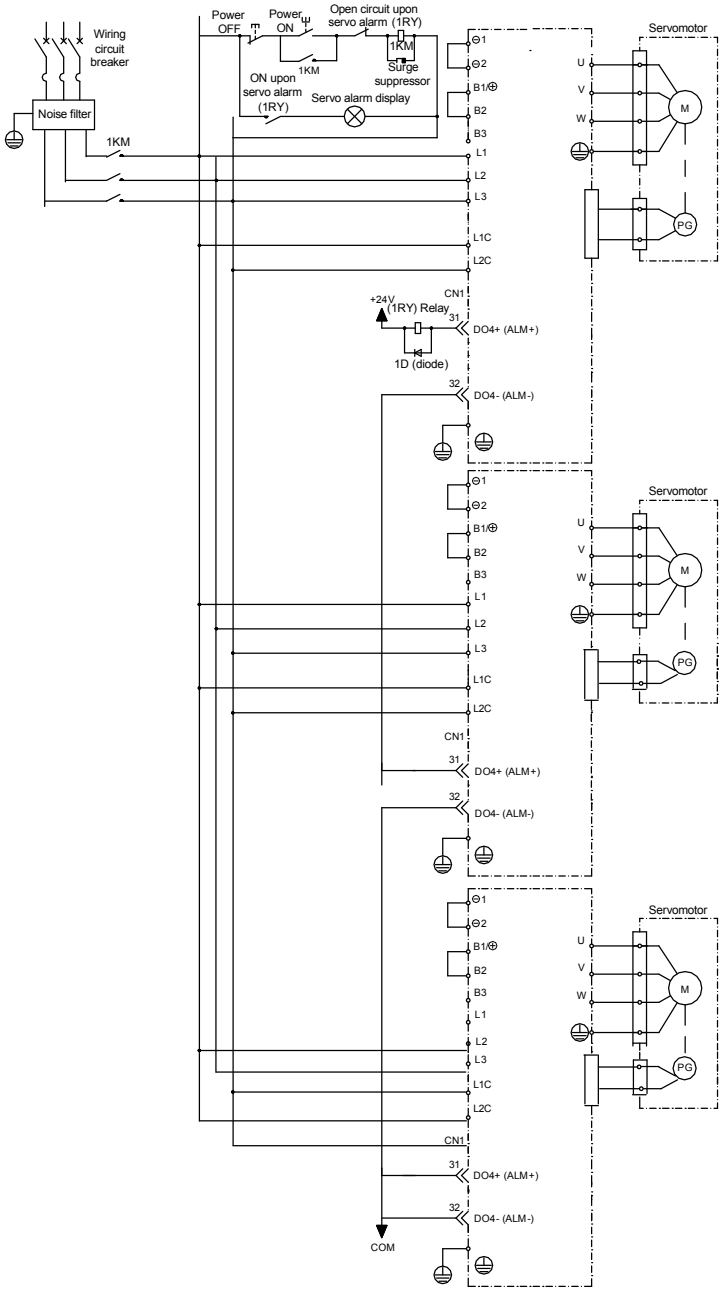
■ Three-phase 220V



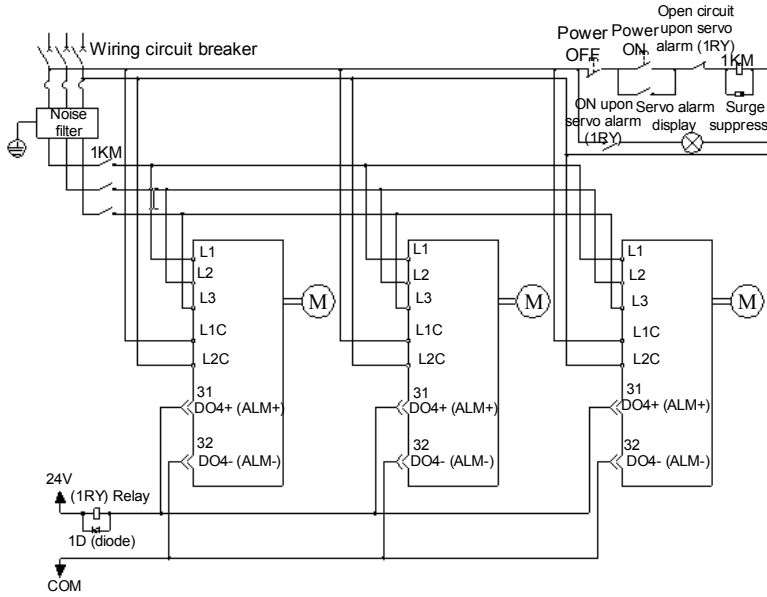
■ Three-phase 380V



■ Multi-drive Wiring (Alarm Output Signal is Normally Closed Terminal)



■ Multi-drive Wiring (Alarm Output Signal is Normally Open Terminal)

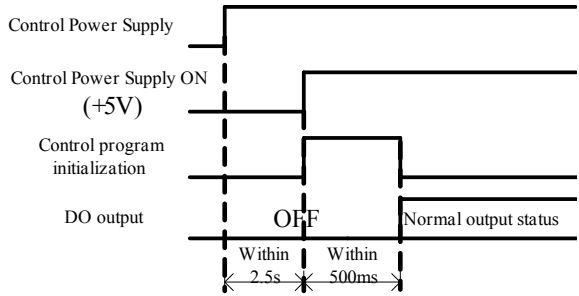


■ Designing a Power ON Sequence

When designing the power ON sequence, please pay attention to the following precautions:

1. Design the power ON sequence so that main circuit power supply is turned OFF when a servo alarm is output. For more details on wiring, see the previous circuit diagram.

2. Upon the servodrive power-on, status changes of the output signal are shown as follows:



- During control power setup and control procedure initialization, DO output is OFF.
- When using the default logical method (ON valid), DO output state is determined to be invalid during power-on initialization. However, the output logic can be flexibly configured. When using the ON and OFF valid logic, DO outputs may be mistaken for output valid. Please pay attention to this.

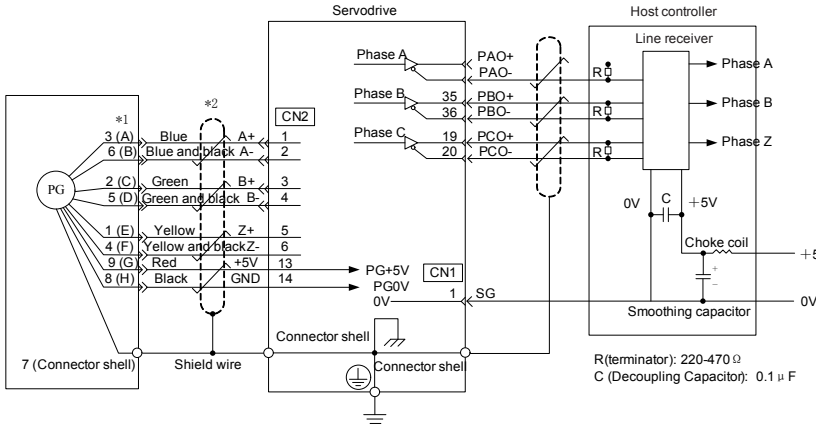
5.1.5 Precautions on Wiring Main Circuit

- Do not connect the input power lines to output terminals U, V, and W. Otherwise, damage to the servodrive may result.
- Braking resistor cannot be directly connected to between (P) and (N) terminals of the DC bus. Otherwise, fire may result.
- Do not bundle or run power and signal lines together in the same duct. Keep power and signal lines separated by at least 30cm. Otherwise, malfunction may result.
- Use twisted-pair shielded wires as signal and encoder (PG) feedback lines. Reference input lines must be no longer than 3m and encoder lines must be no longer than 20m.
- Do not touch power terminals within 5 minutes after power-off because high voltage may still remain in the servodrive. Otherwise, electric shock may result.
- Perform inspection after ensuring the CHARGE indicator LED is OFF.
- Avoid frequently turning power ON and OFF. Do not turn the power ON or OFF more than once per minute.
- Since the servodrive has a capacitor in the power supply, a high charging current flows for 0.2 seconds when the power is turned ON. Frequently turning the power ON and OFF may result deterioration in main power devices.

5.2 Wiring Encoder

5.2.1 Encoder Signal Line Handling

1） Wiring-saving Incremental Encoders

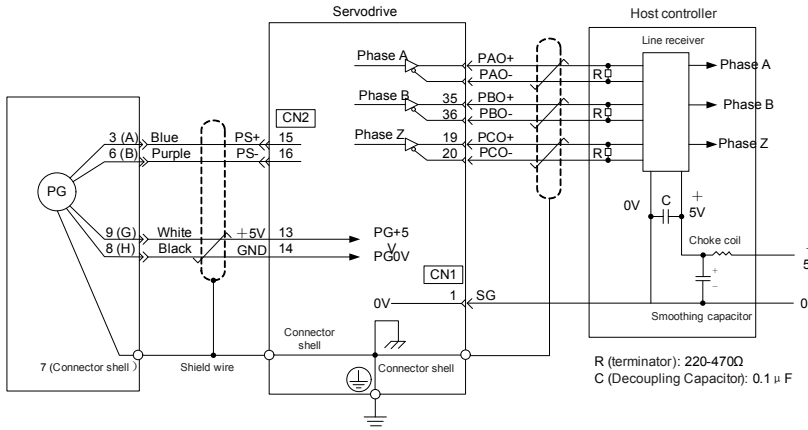


【Note】 *1: The pin number for the connector wiring depends on servomotor model.

- 3, 6, 2, 5, 1, 4, 9, 8, 7: pin number for the ISMH1, ISMH4 and ISMV1 servomotors.
- A, B, C, D, E, F, G, H: Pin number for the ISMH2 and ISMV2 series, ISMH3 and ISMV3 series servomotors.

*2: represents twisted-pair wires.

2） Serial Incremental Encoder



【Note】

*1: The pin number for the connector wiring depends on servomotor model.

- 3, 6, 9, 8, 7: pin number for the ISMH1, ISMH4 and ISMV1 servomotors.
- A, B, G, H: Pin number for the ISMH2 and ISMV2 series, ISMH3 and ISMV3 series servomotors

*2: represents twisted-pair wires.

5.2.2 Encoder Connector (CN2) Terminal Layout

Pin No.	Signal Name	Pin No.	Signal Name
1	A+	2	A-
3	B+	4	B-
5	Z+	6	Z-
7	Reserved	8	Reserved
9	Reserved	10	Reserved
11	Reserved	12	Reserved
13	+5V	14	GND
15	PS+	16	PS-
17	Reserved	18	Reserved
19	Reserved	20	Reserved
Shell	PE (Shield)		

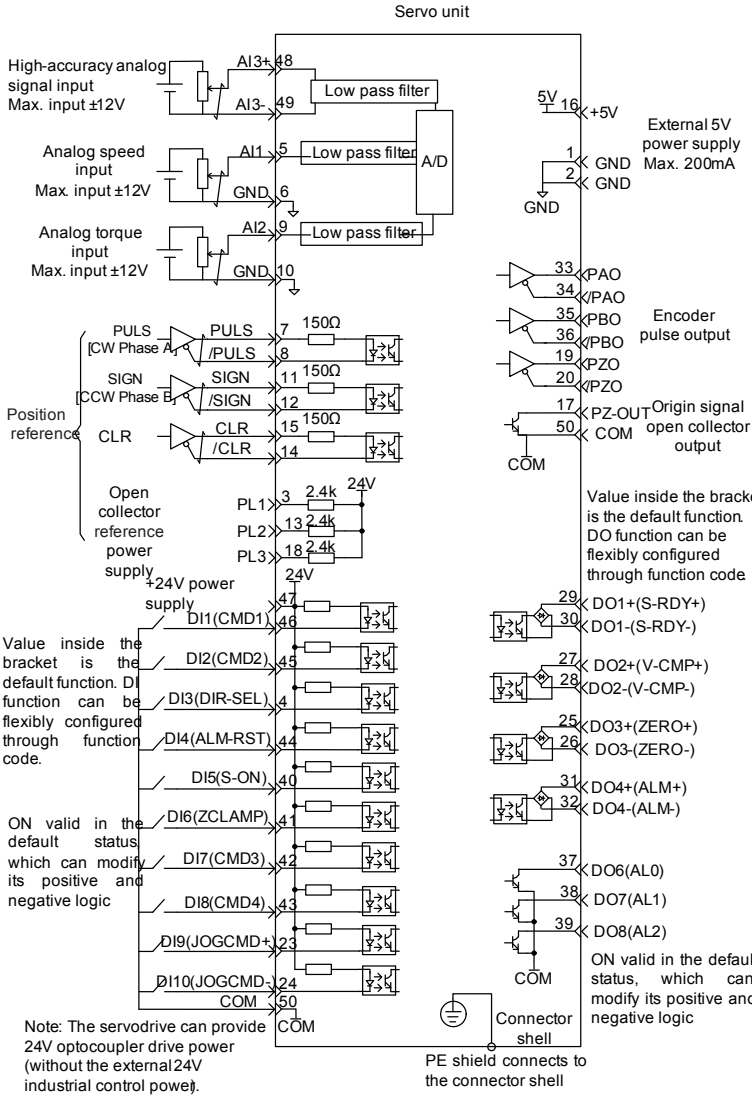
5.2.3 Precautions on Wiring Encoder

- Sequence of wiring encoder and servodrive depends on encoder and servomotor model.
- AWG26-AWG16 twisted-pair shielded cable is recommended with wiring length of no more than 20m.
- Do not wire the reserved terminals.

5.3 Wiring I/O Terminals

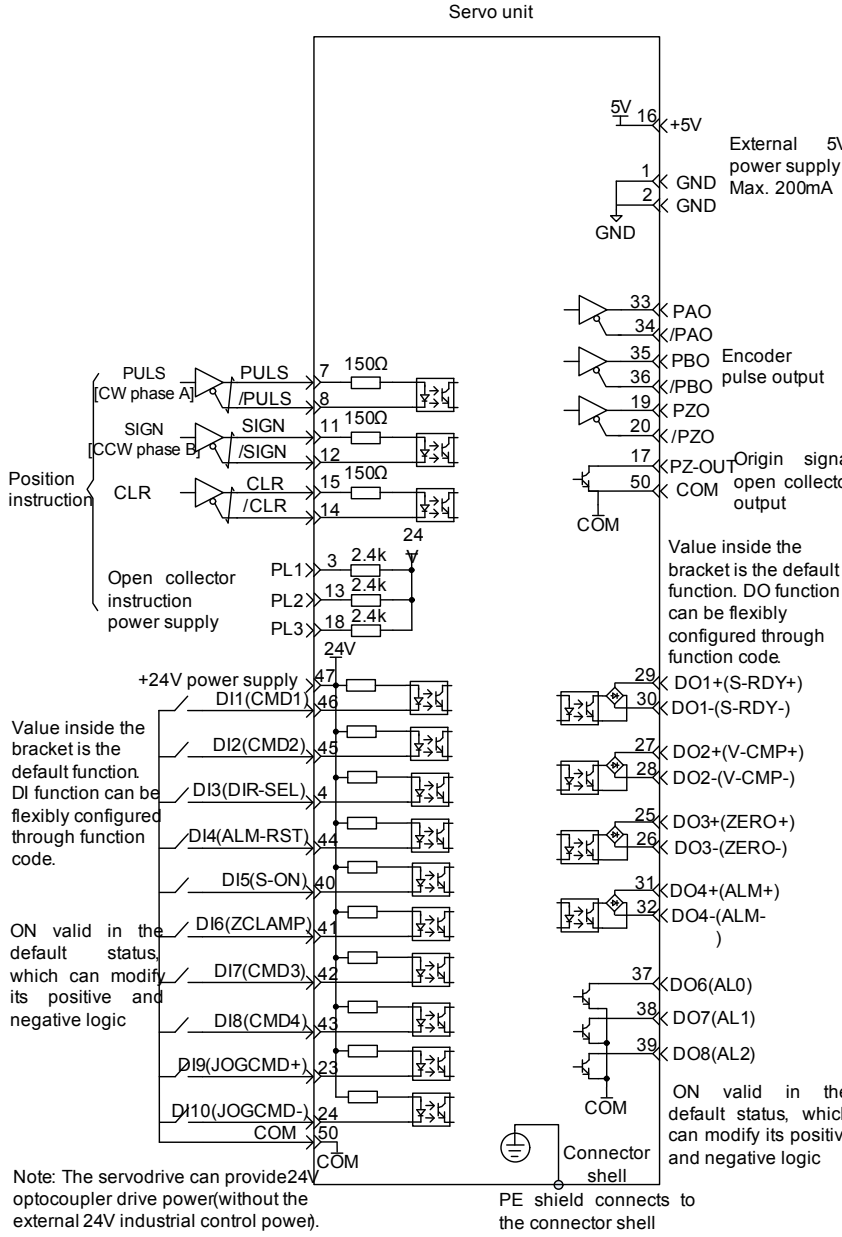
5.3.1 Typical I/O Terminal Wiring Examples

The connection between I/O signals of servodrive and host device is shown as below:



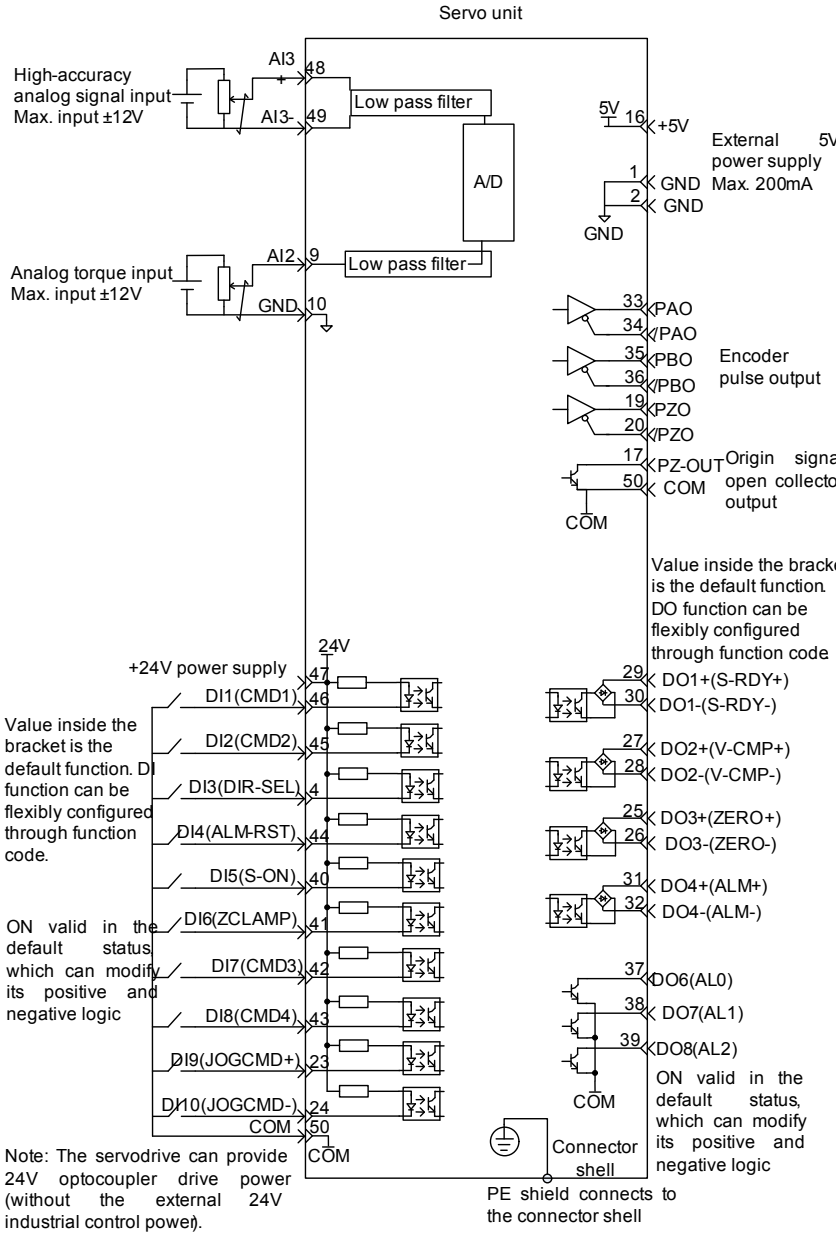
【Note】 ∫ represents twisted-pair wires.

1） Speed Control Mode



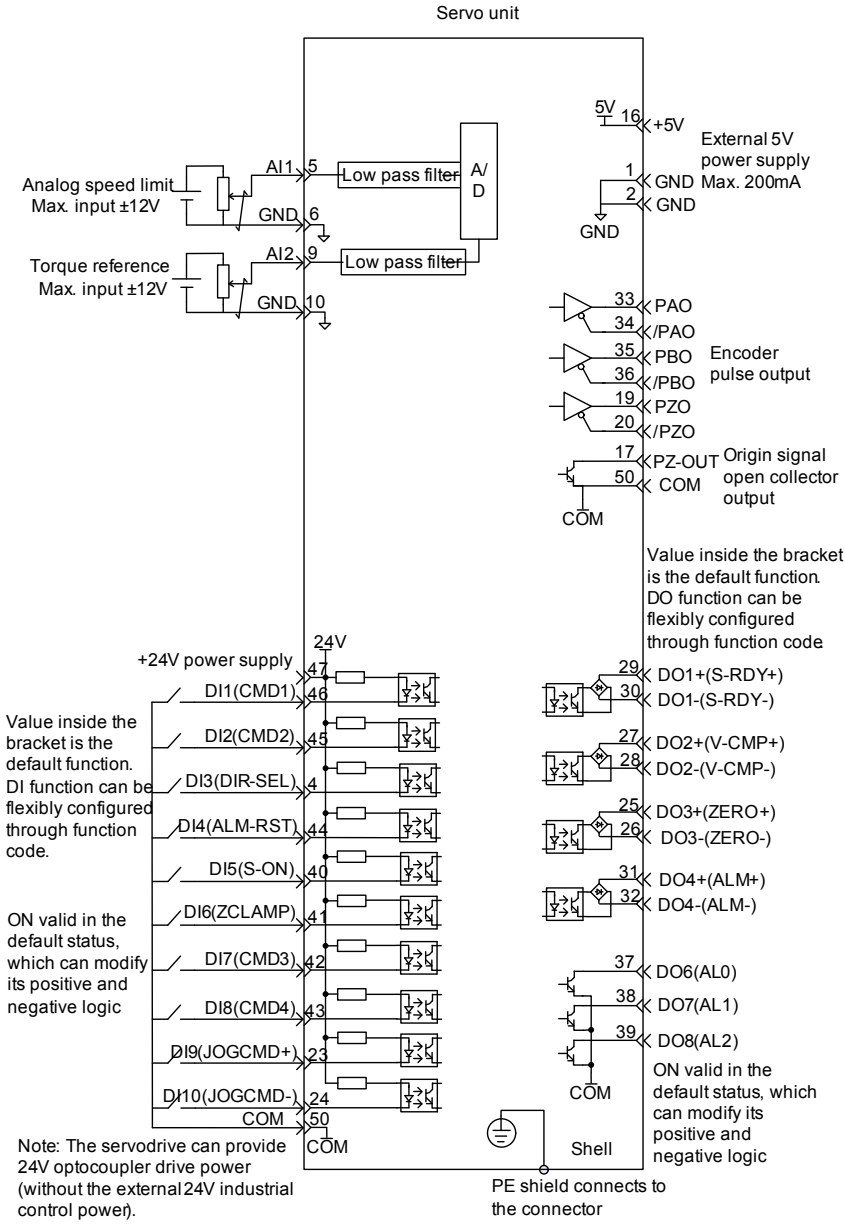
【Note】 ∫ represents twisted-pair wires.

2） Position Control Mode



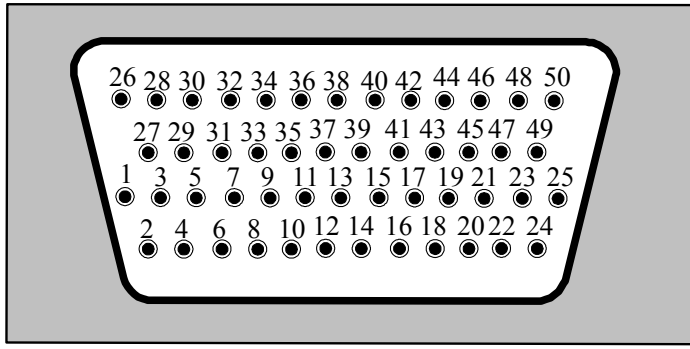
【Note】 ∫ represents twisted-pair wires.

3） Torque Control Mode



【Note】 ∫ represents twisted-pair wires.

5.3.2 I/O Signal Connector (CN1) Terminal Layout



5.3.3 I/O Signal (CN1) Names and Functions

All logical control I/O terminals can be flexibly allocated with other functions via function codes. The following functions are the factory default functions.

1） Input Signals

Signal Name		Default Function	Pin No.	Function	
General	DI1	CMD1	46	MS speed selection 1	
	DI2	CMD2	45	MS speed selection 2	
	DI3	DIR-SEL	4	Direction selection for MS speed operation reference: default direction or reverse direction	
	DI4	ALM-RST	44	Alarm reset: reset servo alarm	
	DI5	S-ON	40	Control servo motor ON/OFF	
	DI6	ZCLAMP	41	Zero-clamp function enabled	
	DI7	CMD3	42	MS speed selection 3	
	DI8	CMD4	43	MS speed selection 4	
	DI9	JOGCMD+	23	Forward jog	
	DI10	JOGCMD-	24	Reverse jog	
Position	PULS+ PULS- SIGN+ SIGN-		7 8 11 12	Pulse input Differential drive Open-collector	Input mode: Direction + pulse Phase A /B orthogonal pulse CCW/CW pulse
	CLR+ CLR-		15 14	Clear error counter during position control	
	PL1 PL2 PL3		3 13 18	+24V working power is supplied when PULS, SIGN, and CLR reference are open-collector output signals. (The internal 24V power supply of servodrive is generated by 2.4k resistor.)	

Signal Name		Default Function	Pin No.	Function
Analog	AI1		5	Analog input signal, input voltage: maximum ±12V
	AI2		9	
	AI3+ AI3-		48 49	
	GND		6 10	Analog input signal ground

2） Output Signals

Signal Name		Default Function	Pin No.	Function	
General	DO1+ DO1-	S-RDY+ S-RDY-	29 30	It turns ON when servo is ready to receive servo ON (S-ON) signals.	
	DO2+ DO2-	V-CMP+ V-CMP-	27 28	It turns ON when servomotor speed within the setting range is in line with speed reference.	
	DO3+ DO3-	ZERO+ ZERO-	25 26	It turns ON when servomotor speed is below speed threshold.	
	DO4+ DO4-	ALM+ ALM-	31 32	It turns ON when an error is detected.	
	PAO+ PAO-		33 34	Phase-A pulse dividing output	Phase A/ B orthogonal frequency dividing pulse output signal
	PBO+ PBO-		35 36	Phase-B pulse dividing output	
	PZO+ PZO-		19 20	Phase-Z pulse dividing output	Zero-point pulse output signal
	PZ-OUT		17	Phase-Z pulse dividing output	Zero-point pulse open-collector output signal
	DO6 DO7 DO8	ALO1 ALO2 ALO3	37 38 39	Alarm code output: output 3-bit alarm code Open-collector output: 30 V and 20 mA at maximum	
	+24V		47	Internal 24V power supply, voltage range: +20-28V Maximum output current: 200mA	
	COM		50		
	+5V		16	Internal 5V power supply Maximum output current: 200mA	
	GND		1 2		
	PE		Shell		

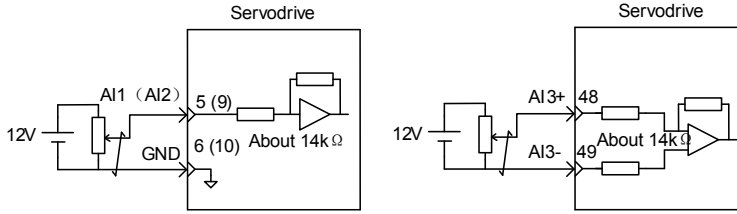
5.3.4 Interface for Reference Input Circuit

1） Analog Input Circuit

CN1 connector terminals, 5-6 (AI1 analog input), 9-10 (AI2 analog input) and 48-49 (AI2 analog input) are described here.

Analog signals are either speed or torque reference signals. The input standard is as follows:

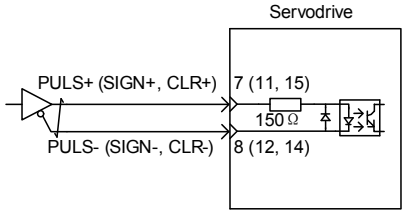
- Maximum allowable voltage: ±12 V
- Input impedance: about 14 kΩ



2） Position Reference Input Circuit

CN1 connector terminals, 7-8 (reference pulse input), 11-12 (reference symbol input) and 15-14 (Clear inputs) are described below. An output circuit for the reference pulse and error counter clearing signals at the host controller can be either differential driver or open-collector output

a） Differential driver output

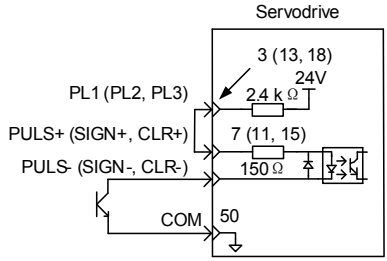


Please ensure that “2.8V ≤ (Hlevel) - (L level) ≤ 3.7V”.

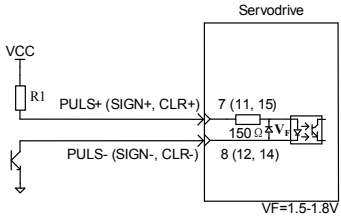
If the formula above is not satisfied, pulse input of servodrive will be instable. This will result pulse loss upon reference pulse input or reverse reference upon reference direction input.

b） Open-collector output:

When servodrive internal 24V power supply is used, the circuit is as follows:



When external power supply is used, the circuit is as follows:



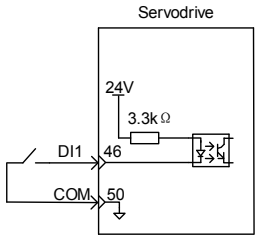
To ensure the current within 6mA-10mA, set R1 resistance as follows:

VCC Voltage	R1 Resistance
24V	2.4k Ω
12V	1.5k Ω
5V	200 Ω

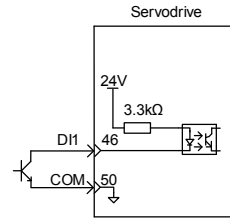
3） Digital Output Circuit

CN1 connector terminal 46 (DI digital input) is described below. The output circuit at host controller can be relay output or open-collector output.

Relay output



Open-collector output

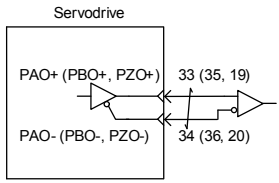


5.3.5 Interface for Output Circuit

1） Encoder Output Circuit

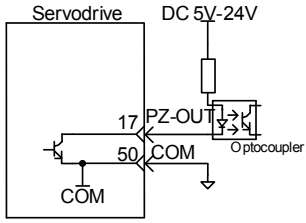
CN1 connector terminals, 33-34 (phase A output), 35-36 (phase B output) and 19-20 (phase Z output), are described below.

Encoder circuit outputs signals through differential driver. It comprises the position control system at the host controller and meanwhile provides feedback. Use the differential receiving circuit at the host controller.



CN1 connector terminals 17-50 (phase Z open-collector output) terminals are described below.

In addition, the encoder phase Z pulse dividing output circuit outputs signals through open collector. It comprises the position control system at the host controller and meanwhile provides feedback. Use the photocoupler circuit, relay circuit or bus receiving circuit at the host controller side.



Maximum allowable voltage/current of the servodrive internal photocoupler output circuit is as follows:

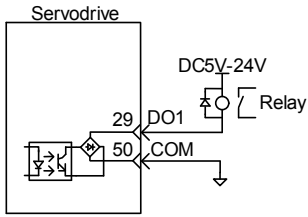
- Voltage: DC30V
- Current: DC50mA

2） Digit Output Circuit

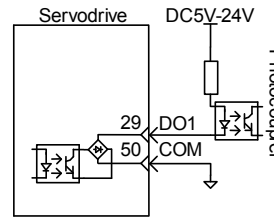
CN1 connector terminal 29 (DO digital output) is described below.

a） DO1-DO4: Photocoupler Output

Relay input



Photocoupler Input:

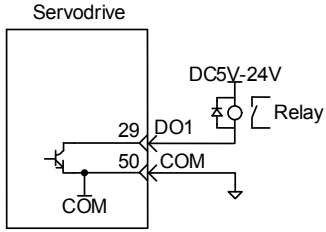


Maximum allowable voltage/current of servodrive internal photocoupler output circuit is as follows:

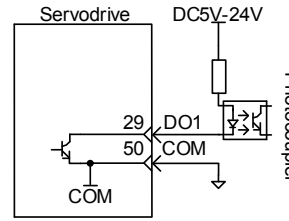
- Voltage: DC30V (Maximum)
- Current: DC50mA (Maximum)

b） DO6-DO8: Open-collector Output

Relay Input:



Photocoupler Input:

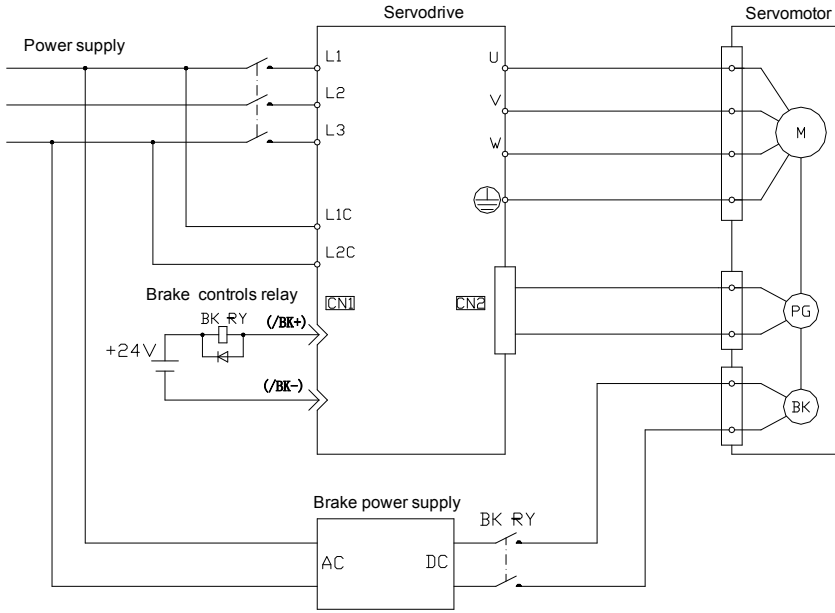


Maximum allowable voltage/current of Servodrive internal photocoupler output circuit is as follows:

- Voltage: DC30V
- Current: DC50mA

5.4 Wiring Holding Brake

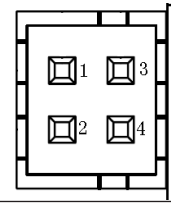
There is no polarity for holding brake input signal. Therefore, 24V power supply should be prepared. The standard connection between brake signal/BK and the brake power supply is shown as below:



5.5 Wiring Analog Monitoring Signals

5.5.1 Analog Monitoring Signal Connector (CN5) Terminal Layout

SN	Definition	SN	Definition
1	GND	3	GND
2	AO1	4	AO2



5.5.2 Monitoring Content

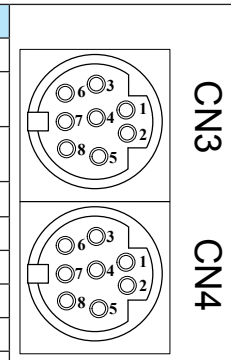
Signal	Monitoring Content
AO1 AO2	00: Motor rotating speed 01: Speed reference 02: Torque reference 03: Position b 04: Position amplifier deviation 05: Position speed reference 06: Positioning completed 07: Speed feedforward (H04-50, H04-53)

【Note】 Upon control power OFF, analog monitor output terminal may output 5V voltage during 50ms. Please take full consideration.

5.6 Wiring Communication Signals

5.6.1 Communication Signal Connector (CN3 and CN4) Terminal Layout

SN	Definition	Description
1	GND	Ground
2	RS232-RXD	RS232 receive terminal can connect to the host computer.
3	RS232-TXD	RS232 receive terminal can connect to the host computer.
4	RS485+	Reserved
5	RS485-	
6	Reserved	
7	Reserved	
8	+5V	+5V power supply
Shell	PE	shell



【Note】
- Both CN3 and CN4 are the internal parallel communication signal connectors.
- Do not wire the reserved terminals.

5.7 Wiring and Anti-interference

5.7.1 Precautions on Wiring

To ensure safe and stable operation, observe the following wiring precautions:

1. For wiring for reference inputs and encoders, select specified cables.
2. For ground wiring, select a cable of 2.0mm2 or thicker).
   - At least D-type ground (100 Ω max.) is recommended.
   - Ground to one point only.
   - Ground the servomotor directly, if servomotor is insulated from the machine
3. Do not bend or apply tension to cables.

   The core wire of a signal cable is 0.2mm or 0.3 mm thin. Thus, handle the cables carefully.
4. Use a noise filter to prevent noise interference.

   If the equipment is to be used near private houses or may receive noise interference, install a noise filter on the input side of the power supply line.
5. To prevent malfunction due to noise, take the following methods:
   - Install the input reference device and noise filter as close to the servodrive as possible.
   - Install a surge suppressor in the relay, solenoid and magnetic contactor coils.
   - Separate a power line and a signal line by at least 30cm. Do not bundle or run them in the same duct.
   - Do not share power supply with an electric welder or electrical discharge machine. Remember to install a noise filter on the input side of the power line, when the servodrive is installed near a high-frequency generator.
6. Use a molded-case circuit breaker (QF) or fuse to protect the power line.

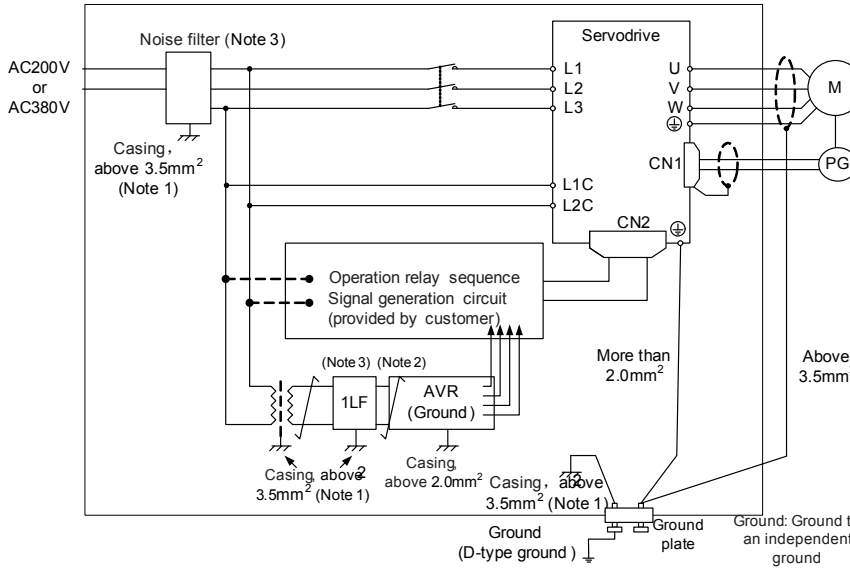
   The servodrive connects directly to a commercial power line without a transformer, so always use a QF or fuse to protect the servodrive from accidental high voltage.
7. Install an earth leakage breaker for protection against overloads and short-circuiting, or install an earth leakage breaker combined with a wiring circuit breaker for ground protection, since the servodrive has no internal ground protection circuits.

5.7.2 Anti-interference Wiring

1） Wiring Example

The servodrive uses high-speed switching components in the main circuit, which may result in switch noise. To prevent this, correctly wire and ground the servodrive.

The servodrive has an internal microprocessor (CPU). Thus, install a noise filter properly to protect it from external noise. An anti-interference wiring is shown as below:



CAUTION

- For ground wires connected to the casing, select a wire of at least 3.5mm2 thick (preferably, plain stitch cooper wire).
- represents twisted-pair wires.
- When installing a noise filter, follow the precautions on using the noise filter described below.

2） Correct Grounding

a） Grounding the servomotor shell

Make sure to connect ground terminal ⏚ of servomotor to ⏚ of servodrive, and tie ⏚ to ground. If the servomotor is grounded via the machine, a switching noise current will flow from the servodrive power unit through servomotor stray capacitance.

b） Interference on the reference input line

If the reference input line receives noise, ground the 0V line (SG) of input line. The servomotor main circuit wire runs through a metal conduit, so ground the conduit and its junction box.

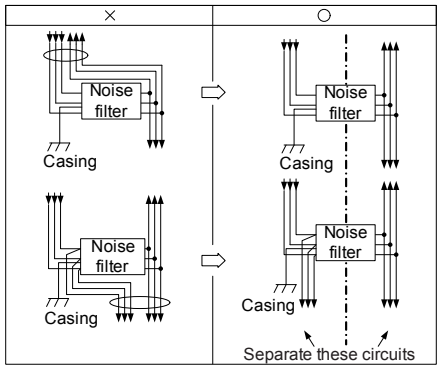
For all grounding, ground at one point only.

3） Precautions on Using the Noise Filter

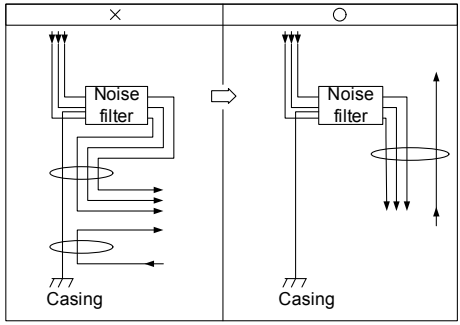
Use an inhibit type noise filter to prevent noise from the power supply line. Install a noise

filter on the power lines for peripheral devices as necessary. When installing and wiring a noise filter, please obey the following precautions. Otherwise, the effect of noise filter will be lowered greatly.

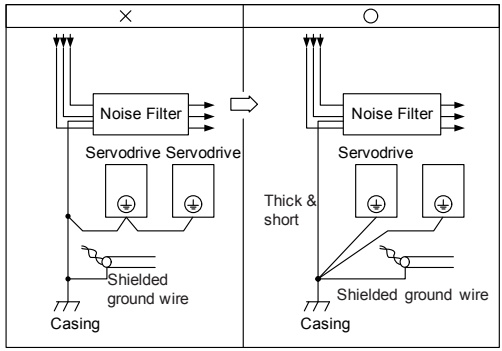
a） Do not put the input and output lines in the same duct or bundle them together.



b） Separate the noise filter ground wire from the output lines.

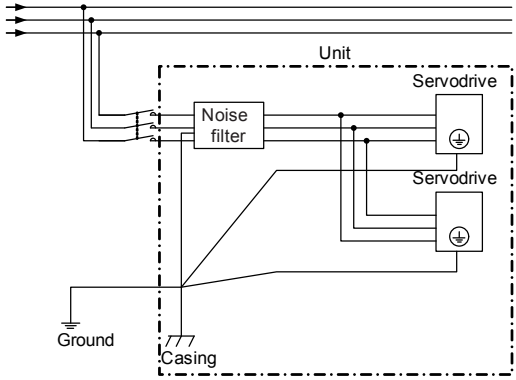


c） Directly connect the noise filter ground wire to the ground. Do not connect the noise filter ground wire to other ground wires.



d） Upon grounding a noise filter inside a unit:

If a noise filter is located inside a unit, connect the noise filter ground wire and the ground wires from other devices inside the unit to the ground plate for the unit first, and then ground these wires.



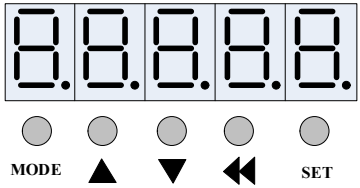
6

Digital Operator

Chapter 6 Digital Operator

6.1 Introduction to Operation Interface

The operation interface of the servodrive consists of five 7-segment LED Nixie tubes and five key, which are used for servodrive's status display and parameter setting. The interface layout is as follows:



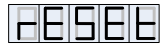
6.1.1 Key Names and Functions

Key	Function
MODE	Press this key to shift between function code groups in turn or return to the upper-level menu.
▲	Press this key to increase the set value of the current flash bit and long press it to rapidly increase the value.
▼	Press this key to decrease the set value of the current flash bit and long press it to rapidly decrease the value.
◀◀	Press this key to shift to the next digit on the left. Long press: Can be used for page turning when contents of more-than-5-digit Nixie tubes are displayed.
SET	Press this key to save the change and enter the next menu.

【Note】 When an alarm is output, please find the reason and clear the fault first before resetting the alarm.

6.1.2 Servodrive Status Display

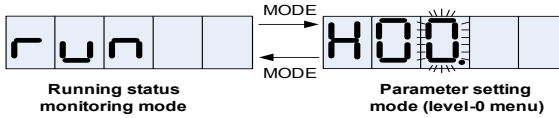
The servodrive status is displayed in a 5-digit Nixie tube.

Code	LED Display	Meaning
"rESEt"		Software is in the start or reset status.
"nrd"		Servo is not ready after start or reset. For example, the main circuit is not powered on.

“run”		Servo is in the normal running status. In this case, you can query the servo’s running status and variables via function codes of Group H0b.
“rdy”		Servo is in the normal state, waiting for the host controller to initiate an enabled signal.
“Er.xxx”		Servo error occurs; “xxx” indicates the error code. For specific error codes, refer to Chapter 11.

6.1.3 Servodrive Parameter Browsing and Modification

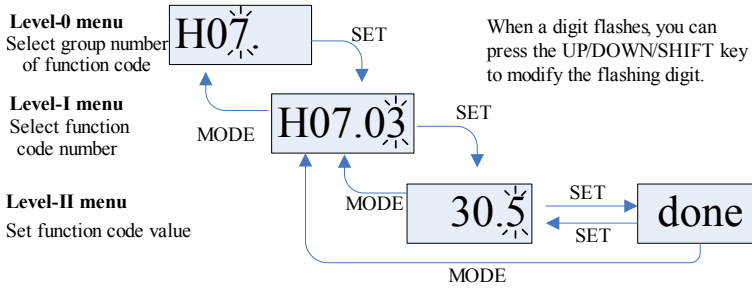
To view the servodrive variable status, press the MODE key to shift to the Group H** and select corresponding function code.



After switching to parameter display mode, the parameter group number is first displayed as “Hxx.”, also called “level-0 menu”. The digit that flashes indicates the status. The flashing digit will increase/decrease 1 if you press the UP/DOWN key. The flashing digit will shift if you press the SHIFT key. Then you can set the group number.

Once you set the group number, press the SET key. Then the function code number is displayed as “Hxx.xx”, also called “level-I menu”.

Once you set the function code as required, press the SET key. Then the function code is displayed, also called “level-II menu”. If the function code can be modified, the rightmost digit flashes. You can perform modification by pressing the SHIFT/UP/DOWN key, shown as below:



After a change is saved by pressing “SET”, “done” is displayed (“done” is not displayed if the modified value remains the same). You can exit from the status monitoring

mode and enter the parameter mode to query and perform modification by pressing "MODE".

6.2 Parameter Setting and Display

6.2.1 Parameter Modification Property and Display Characteristics

For displayable parameters (running parameters) that are displayed without flashing digit after entering level-II menu, the SHIFT/UP/DOWN key becomes invalid. For parameters that are settable after shutdown, they can be changed only after the servo is disabled.

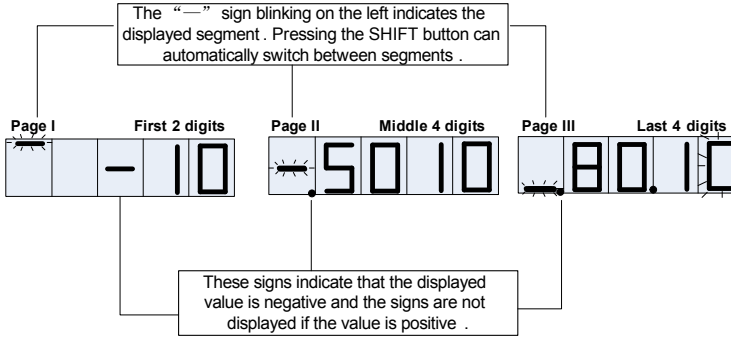
6.2.2 Setting Parameters of 5 Digits or Less

The 5-digit parameters within the range of -9999 to 99999 can be displayed or edited on the Nixie tube display interface.

6.2.3 Setting Parameters of 6 Digits or More

For parameters out of the range of -9999 to 99999, 6 or more digits will be required. The digital operator displays the parameters of 6 digits or more in the 4-digit × 3-page mode. The "—" sign blinking on the leftmost of each page indicates the displayed segment.

The following figure shows a parameter value of -10501080.10, which is displayed in three pages of "-10", "5010" and "80.10". Long pressing the SHIFT button can realize page turning.



The screen will automatically switch to the corresponding segment after you press the SHIFT button. Suppose the screen currently blinks at the kilobit. Once the SHIFT button is pressed, the screen displays the succeeding four digits and blinks at the myriabit (rightmost digit of this segment). In this case, pressing the UP/DOWN button indicates increasing or decreasing 10000. For settable parameters, you can perform modification by pressing SHIFT. But for displayable parameters, long pressing the SHIFT button can realize page turning.

6.3 Monitoring Display Parameter List

Monitoring display is a function of displaying reference values set in the servo drive, status of I/O signals and the internal status of the servo drive. The monitoring display parameters are shown as below:

Function Code	Name	Setting Range	Min. Unit	Type	Related Mode	Description
H0b.00	Actual Motor Speed	-	1rpm	Display	PST	rpm
H0b.01	Speed Reference	-	1rpm	Display	S	rpm
H0b.02	Internal Torque Reference (relative to rated torque)	-	0.1%	Display	PST	%
H0b.03	Input Signal Monitoring DI	-	-	Display	PST	Refer to 8.2.2
H0b.05	Output Signal Monitoring DO	-	-	Display	PST	Refer to 8.2.2
H0b.07	Absolute position counter (32-bit decimal display)	-	1 reference unit	Display	P	Relative to origin displacement. When maximum value of H0b-07, H0b-13 or H0b-17 exceeds 1073741824--1073741824, the counter re-counts from 0.
H0b.09	Mechanical Angle (the number of pulses from the origin)	-	1p	Display	P	Relative to the origin angle and related to the number of encoder lines.
H0b.10	Rotating Angle 2 (Electrical angle)	-	0.1°	Display	PST	
H0b.11	Enter Position Corresponding Speed	-	1rpm	Display	P	Pulse frequency
H0b.12	Deviation Counter (position deviations) (Enabled only when in the position control)	-	1 reference unit	Display	P	Reference unit
H0b.13	Enter Reference Pulse Counter (32-bit decimal display)	-	1 reference unit	Display	P	

Function Code	Name	Setting Range	Min. Unit	Type	Related Mode	Description
H0b.17	Feedback Pulse Counter (Encoder pulse of 4 times frequency data: display 32-bit decimal)	-	1p	Display	P	
H0b.19	Total Power-on Time (32-bit decimal display)	0.0-429496729.6s	0.1s	Display	-	Total time after power on.
H0b.21	AI1 Sampling Voltage	-	0.001V	Display		
H0b.22	AI2 Sampling Voltage	-	0.001V	Display		
H0b.23	AI3 Sampling Voltage	-	0.001V	Display		
H0b.24	Phase-current RMS	-	0.01A	Display		
H0b.26	Bus Voltage	-	0.1V	Display		
H0b.27	Module Temperature	-	° C	Display	-	
H0b.31	Multi-circle Absolute Encoder	-	r	Display	-	Displayed only on H-type drives.
H0b.33	Error Record Display Immediately	0: Current error (factory setting) 1: Last error 2: Last 2 error …… 9: Last 9 error	1	Running Setting		Feature in backward display, showing error code and type.
H0b.34	Error Code	Factory setting: first error code	-			If Er.000 is displayed, it indicates that no error occurs.
H0b.35	Error Time-stamping	-	0.1s	Display		On the scatter point of the total running time shaft.
H0b.37	Rotating speed upon Selected Error	-	1rpm	Display		
H0b.38	Present Current U upon Selected Error	-	0.01A	Display		
H0b.39	Present Current V upon Selected Error		0.01A	Display		

Function Code	Name	Setting Range	Min. Unit	Type	Related Mode	Description
H0b.40	Bus Voltage upon Selected Error	-	0.1V	Display		
H0b.41	Input Terminal Status upon Error	-	-	Display		
H0b.42	Input Terminal Status upon Selected Error	-	-	Display		

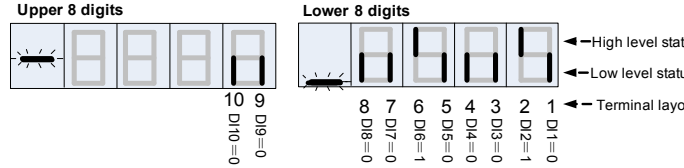
【Note】

- In the speed/torque/position mode, H0b-07, H0b-13 and H0b-17 are able to count. When the mode is switched, they are not reset. Codes H0b-17 and H0b-07 supports power-off memory and H0b-13 counts only when the servo is enabled.
- In three facultative modes (enabled or standby), set H05-30 (origin return) to 6 and H0b-07 and H0b-17 are cleared to zero, providing that H05-36 is zero. You can set H0b-17 to the value as required by setting H05-36.

【Note】

Monitoring of I/O Terminals:

- A Nixie tube displays two DIs/DOs. Upper blinking indicates high electrical level. Lower blinking indicates low electrical level. All displayed contents correspond to physical DI/DO.
- The status of DI/DO uses 16 status digits. In standard configuration, there are 10 DIs and 7 DOs. The following figure shows the status of DI.



7

Setting of Servodrive General Function Codes

Chapter 7 Setting of Servodrive General Function Codes

7.1 Selection of Running Mode

According to command source and running characteristics, the servedrive has the following three running modes:

- Position Control

  Generally, displacement and rotating speed are determined by the number of input pulses and the frequency of input pulses. They can also be directly given by communication. This mode with strict requirements on velocity and position is mostly used in positioning devices. 90% of servodrive's applications adopt the position control mode, such as manipulator, chip mounter, engraving and milling machine and CNC machine.

- Speed Control

  Speed control is realized by analog input, digital given or communication given. This mode is used by the constant-speed feeding control system. Some device, like analog CNC engraving and milling machine, puts position control in host controller and makes servo implement speed control only.

  Torque Control

  Torque control is realized by changing the analog setting in real time or by changing corresponding address value via communication. It is mainly applied in winding/unwinding devices that have strict requirements on stress of the material, such as coiling device or optical device. The torque setting varies with the winding radius so that the stress of the material will not vary with the change of the radius.

You can set the servodrive's running mode via H02-00. Meanwhile, the reference sources in various running modes can be set flexibly.

Function Code	H02-00
Name	Running Mode Selection
Setting Range	0: Speed Mode (default) 1: Position Mode 2: Torque Mode 3: Speed Mode↔ Torque Mode 4: Position Mode↔Speed Mode 5: Position Mode↔ Torque Mode 6: Position↔Speed↔Torque Mixed Mode
Factory Setting	1
Min. Unit	0
When Enabled	Immediately
Type	Stop setting

When H02-00 is set to 0, 1 or 2, it indicates the current control mode is single control mode (speed mode, position mode or torque mode).

When you need to switch the control mode, set H02-00= 3, 4, 5, 6 (speed mode ↔ torque mode, position mode ↔ speed mode, position mode ↔ torque mode speed). The switching is implemented via DI terminals.

Code	FunIN.10	FunIN.11
Signal Name	M1-SEL	M2-SEL
Function Name	Mode switching	Mode switching
Description	Switching among speed, position and torque according to the selected control modes (3, 4, 5)	Switching among speed, position and torque according to the selected modes (6)
Status	Allocation	Allocation
Remarks	Two DIs are required.	Two DIs are required.

When selecting modes 3 to 6, corresponding DI function should be configured. Please refer to the table below.

Mode Selection	M1-SEL	M2-SEL	Operation mode
3: Speed mode ↔ torque mode	1	-	S
	0	-	T
4: Position mode ↔ speed mode	1	-	P
	0	-	S
5: Position mode ↔ torque mode	1	-	P
	0	-	T
6: Position ↔ speed ↔ torque mixed mode	1	1	P
	1	0	P
	0	1	S
	0	0	T

【Note】
- P: Position Control
- S: Speed Control
- T: Torque Control
- 1: Terminal enabled
- 0: Terminal disabled
- -: Unrelated

7.2 Speed Control

7.2.1 Acquiring the Speed Reference

■ Related Function Codes

Function Code	H06	H06	H06	H06
	00	01	03	04
Name	Master Speed Reference A Source	Auxiliary Speed Reference B Source	Speed Reference Keypad Setting Value	Jog Speed Setting Value
Setting Range	0: Digital given (H06-03) 1: AI1 2: AI2; 3: AI3; 4: Jog speed reference	0: Digital given (H06-03) 1: AI1 2: AI2 3: AI3 4: Jog speed reference 5: MS speed reference	-9000rpm to 9000rpm	0rpm to 9000rpm
Min. Unit	1	1	1rpm	1rpm
Factory Setting	0	1	200rpm	300rpm
When Enabled	Immediately	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Running Setting	Running Setting
Related Mode	S	S	S	S

【Note】

- Digital given can be realized by setting H06-03. This function code is running setting.
- DI can be used to control direction switch of speed reference. The corresponding function code is FunIN.26, which is applied in applications where direction switch is required.

■ Related Signal

Code	FunIN.26
Signal Name	SPDDirSel
Function Name	Speed Reference Direction Setting
Description	Disabled: Forward Enabled: Reverse
Status	Allocation
Remark	Set the logic of the corresponding terminal to 0 or 1.

In the speed control mode, there are two speed reference sources: source A and source B. The speed reference can be acquired in the following five ways:

- Source A
- Source B
- Source A + source B
- Source A/B switching through an external DI
- Communication given

The five ways can be set via function code H06-02.

Function Code	H06
	2
Name	Speed Reference Selection
Setting Range	0: Master speed reference A source 1: Auxiliary speed reference B source 2: A+B 3: A/B switch 4: Communication given
Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	S

If H06-02 is set to 3, you need to allocate the DI terminal with the function independently. Then the DI can work normally and it can be figured out whether the current reference input is A or B through this DI terminal.

Code	FunIN.4
Signal Name	/CMD-SEL
Function Name	Operation Reference Switch
Description	Enabled: Current operation reference is B; Disabled: Current operation reference is A
Status	Allocation

Both sources A and B can be generated in the following ways:

1. Digital setting (also called keypad setting): A preset speed is saved in H06-03, which is used to generate the speed reference.
2. Analog speed reference: It is a speed reference generating mode that transforms externally input analog voltage signals into speed reference signals that control the motor.

   The IS500 servodrive has three analog speed signal input channels. AI1 and AI2 are common input sources. AI3 is a high-precision input source, which is generated by an external high-precision AD (AI3 of P model does not have a high-precision AD).
3. Jog speed reference: A preset speed reference is saved in H06-04. You can select the speed direction by configuring two external DIs or through the debugger. The Jog speed reference direction changes with external DI input.
4. MS speed reference: The internal register stores 16 groups of speed references and related control parameters. You can select MS speed reference (from 1 segment to maximum 16 segments) through an external DI or in an internal designated mode.

7.2.2 Ramp Function Control

In the speed control mode, jumping speed reference may make the motor jump or vibrate fiercely, which may damage machine parts. In this case, the ramp function control converts stepwise speed reference into to a consistent rate of Acceleration / Deceleration so that the motor starts smoothly.

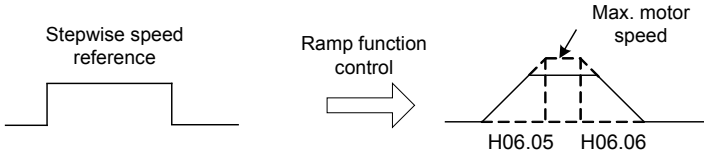
The following table lists related function codes.

Function Code	H06	H06
	5	6
Name	Speed Reference Acceleration Slope Time	Speed Reference Deceleration Slope Time
Setting Range	0ms-0000ms	0ms-10000ms
Min. Unit	1ms	1ms
Factory Setting	0ms	0ms
When Enabled	Immediately	Immediately
Data Type	Stop Setting	Stop Setting
Related Mode	PS	PS

【Note】 Set acceleration/deceleration time to 0 (factory setting) in normal speed control mode.

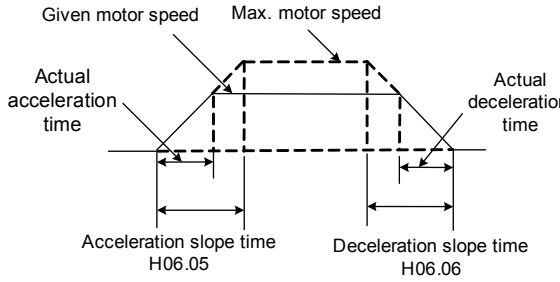
- H06-05 indicates the time the motor takes from start to max. speed.
- H06-06: Indicates the time the motor takes from max. speed to stop.

The ramp function control converts a stepwise speed reference to speed reference with a consistent rate of Acceleration / Deceleration.



The acceleration/deceleration slope time is determined by the time the motor takes from 0 to maximum speed (or from maximum speed to 0). The actual acceleration/deceleration slope time is calculated as below:

Actual acceleration/deceleration time = (Speed reference ÷ Max. motor speed) × Speed reference acceleration/deceleration slop time (H06-05/H06-06).



7.2.3 Speed Reference Limit

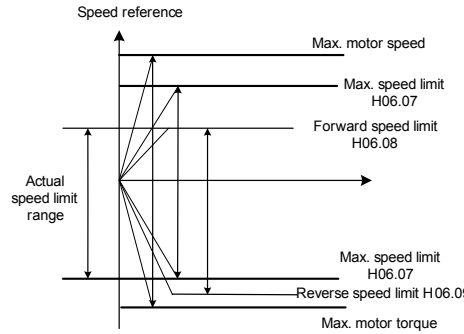
The following table lists related function codes.

Function Code	H06 07	H06 08	H06 09
Name	Maximum Speed Limit	Forward Speed Limit	Reverse Speed Limit
Setting Range	0rpm-9,000rpm	0rpm-9,000rpm	0rpm-9,000rpm
Min. Unit	1rpm	1rpm	1rpm
Factory Setting	9,000rpm	9,000rpm	9,000rpm
When Enabled	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting
Related Mode	S	S	S

In the speed control mode, the servodrive can realize speed reference limit. Speed reference limit involves the following four aspects:

1. Maximum speed limit is set through H06-07. Forward/reverse speed reference cannot exceed it. If exceeding, the reference will be output at this limit.
2. Forward speed limit is set through H06-08. Any forward speed reference exceeding the limit will be output at this limit.
3. Reverse speed limit is set through H06-09. Any reverse speed reference exceeding the limit will be output at this limit.
4. The maximum motor speed is considered as the upper limit by default. It varies with the motor parameter.

【Note】 When speed limits are set through H06-07, H06-08 and H06-09, the minimum limit shall prevail. As shown in the following figure, the actual forward speed limit is the value set in H06-08 and reverse speed limit is the value set in H06-07 since the value set in H06-09 is larger than that set in H06-07)



The actual speed limit range should satisfy the following formulas:

- Forward speed reference ≤ Min. value amongst maximum motor speed, H06-07 and H06-08}
- |Reverse speed reference| ≤ Min. value amongst maximum motor speed, H06-07 and H06-09

7.2.4 Speed Feedback Filtering

The servodrive is designed with a low pass filter that removes high frequency from the feedback speed, making the speed reference much smoother.

You can enable/disable the function through H08-22. When enabling it, do not set the speed-loop gain to an overlarge value. Otherwise, vibration may result.

Function Code	H08
	22
Name	Speed Feedback Filtering
Setting Range	0: Disable speed feedback filter 1: Enable speed feedback filter
Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	PS

7.2.5 Zero Clamp Function

If signal zero clamp (/ZCLAMP) is ON and the speed reference input through AI1/AI2 /AI13 is lower than the zero clamp value set in H06-15, the servodrive enters the servolock state.

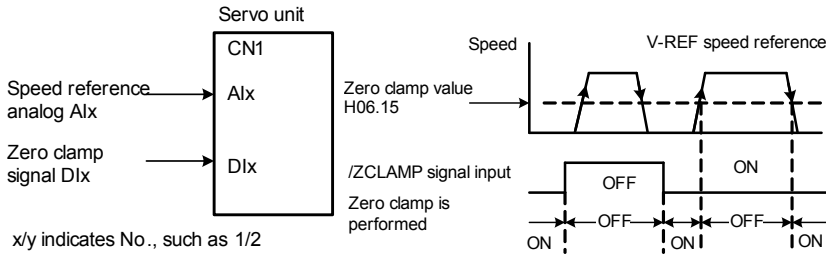
In the servolock state, the servomotor is locked within zero clamp effective unit ± one pulse. That is, the servomotor will return to the zero clamp position even if it rotates due to

an external force.

The zero clamp function is enabled in the speed control mode, when the host controller does not form a position loop control.

Terminology

Servolock: It indicates that servomotor is locked through the zero-position reference in the position control mode.



If vibration occurs when zero-position fixed function is enabled, you can set the position-loop gain through H08-02. If the 2nd gain switching function is enabled, 2nd Position-loop Gain (H08-05) also needs to be adjusted.

The input signal is as follows:

Code	FunIN.12
Signal Name	/ZCLAMP
Function Name	Zero Clamp Function Enabled Signal
Description	Enabled: Zero Clamp Function enabled Disabled: Zero Clamp Function prohibited
Status	Allocation
Remark	ZCLAM function takes effect when the motor is in the speed control mode and the reference source is analog.

Related function code is as follows:

Function Code	H06
	15
Name	Zero Clamp Rotation Limit Value
Setting Range	0rpm-1000rpm
Min. Unit	1rpm
Factory Setting	10rpm
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	S

【Note】 The zero clamp function works only when speed reference source A or B is selected in the speed control mode.

This function can be enabled only in the following control modes:

Function Code	H02-00
Setting Range	0: Speed Mode (default) 3 : Speed Mode↔ Torque Mode 4 : Position Mode↔Speed Mode 6 : Position↔Speed↔Torque Mixed Mode
Speed Reference Function Code Setting	H06-00 = 1, 2, 3 H06-01 = 1, 2, 3 H06-02 = 0, 1
Used Input Signal	/ZCLAMP
When Enabled	Immediately

In the speed control mode, the servomotor is under control by the zero clamp function if the following conditions are satisfied:

- ZCLAMP is enabled.
- The input analog speed reference works as the speed control reference.
- The analog speed reference equals or is lower than the value set in H06-15.

Once the analog speed reference exceeds the value set in H06-15, the servomotor is not controlled by the zero clamp function.

7.2.6 Servo Pulse Output and Setting

The servo pulse output source is set through H05-38.

Function Code	H05
	38
Name	Servo Pulse Output Source
Setting Range	0: Encoder output 1: Pulse Reference synchronous output
Min. Unit	1
Factory Setting	0
When Enabled	After Restart
Data Type	Stop Setting
Related Mode	PST

■ Encoder Output

After H05-17 is set, the servo divides the pulses from the encoder and outputs them through the dividing output terminal.

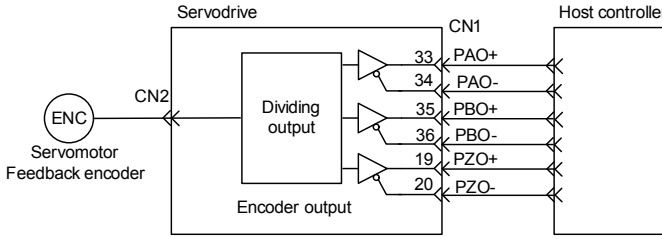
The value of this function code corresponds to the pulse (before ×4 multiplier) of PAO/PBO per rotation.

Function Code	H05 17
Name	Encoder Pulse Count
Setting Range	16P/Rev to 1,073,741,824P/Rev
Min. Unit	1P/Rev
Factory Setting	2500P/Rev
When Enabled	After Restart
Data Type	Stop Setting

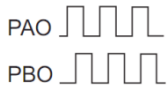
The following table lists corresponding signals and output phases.

Type	Output					
Signal Name	PAO+	PAO-	PBO+	PBO-	PZO+	PZO-
Connector Pin No.	CN1-33	CN1-34	CN1-35	CN1-36	CN1-19	CN1-20
Name	Encoder pulse output: phase A	Encoder pulse output: phase /A	Encoder pulse output: phase B	Encoder pulse output: phase B	Encoder pulse output: phase Z	Encoder pulse output: phase /Z
Remark	When an absolute encoder is used, the dividing coefficient decides the output pulse squares to the phase per motor rotation.				One pulse is output per motor rotation.	

【Note】 Phase Z is an origin pulse, which is a signal indicating that one pulse is output per motor rotation.



Output Phase Form

Forward Rotation (phase A leads by 90°)	Reverse Rotation (phase B leads by 90°)
	

If the encoder feedback pulse output signal is not in the same direction as the host controller reference, you can adjust rotation direction (H02-02) or output feedback direction (H02-03).

CAUTION

- The encoder pulse shall not exceed the resolution ratio of the encoder (Incremental: not exceeding the encoder wire count, Absolute: not exceeding 1/4 of the resolution ratio per rotation). Otherwise, Er.110 (Encoder Output Pulse Setting Error) is reported.

  Take the "2500-wire encoder" as an example. If H05-17 is set to 2501, the servodrive will misjudge and report Er.110.

- The upper limit of the encoder output is 1.6M (A/B). Make sure that the servo's maximum frequency does not exceed the upper limit when the servo works within the operation speed range. Otherwise, Er.510 (Overspeed of Encoder Output Pulse) is reported.

  The motor speed range is +/-2000 rpm. Then, the maximum value of H05-17 is calculated as below:

  Max. value of H05-17 = 1.6 x 10^6 / (2000/60) = 48000

  Multiplied by 4, the resolution ratio amounts to 192000 P/Rev, providing that the encoder pulse count does not exceed the resolution ratio of the encoder.

■ Position Pulse Reference Synchronous Output

Connect the pulse output terminal of a servo to that of another servo or multiple servos, which helps to realize synchronous control of several servos. Differential outputs of signals PAO and PBO correspond to PULS and SIGN. Then, the host controller can output pulse references to other servos through one servo.

CAUTION

- In synchronous control applications, all servos must be of the same parameters and similar loading condition.
- Do not power off the host controller when the controller is outputting pulses. Otherwise, synchronization fails because of pulse attenuation due to instant power disconnection. If it happens, adjust the position of the slave servos again.

7.2.7 Setting the MS Speed Function

The multi-segment (MS) speed function indicates that the servo automatically realizes a control of up to 16 motor speeds through 16 groups of speed parameters. No external speed and pulse generators are required. The MS operation reference direction selection enlarges the speed choices to 32.

The following table lists the input signals for switching the operation speed.

Code	FunIN.5	FunIN.6	FunIN.7	FunIN.8	FunIN.9
Signal Name	/DIR-SEL	CMD1	CMD2	CMD3	CMD4

Function Name	MS Running Reference Direction Selection	MS Running Reference Switch (CMD1)	MS Running Reference Switch (CMD2)	MS Running Reference Switch (CMD3)	MS Running Reference Switch (CMD4)
Description	Enabled: Reference in the reverse direction; Disabled-Default reference direction	16-segment reference selection	16-segment reference selection	16-segment reference selection	16-segment reference selection
Status	Allocation	Allocation	Allocation	Allocation	Allocation
Remark	By default, 0000 indicates segment 1 which is of zero velocity.				

■ Speed Reference Source Selection

The MS speed reference can be generated only by source B. There are four modes for generating speed reference: source A, source B, source A+B, A/B switch. Then, the modes related to MS speed reference are source B, source A+B and A/B switch.

- If you want to select source B as the MS speed reference, set H06-01 to 5 to select the MS speed reference; then set H06-02 to 1.
- If you want to select source A+B as the MS speed reference, set H06-01 to 5 to select the MS speed reference; then set H06-00 to select the speed reference from source A; finally set H06-02 to 2.
- If you want to select A/B switch as the MS speed reference, set H06-01 to 5 to select the MS speed reference; then set H06-00 to select the speed reference from source A; finally set H06-02 to 3.

There are 5 options for the acceleration/deceleration time between segments of the MS speed reference. By default, "Zero Acceleration/Deceleration Time" is selected, that is, the corresponding parameter is set to 0. Take "1st-segment Acceleration/Deceleration Time" as an example, H12-22 is set to 0. The values for the other four options are set through function codes from H12-03 to H12-10.

【Note】 When MS speed reference is selected, the acceleration/deceleration time is determined by each segment. Providing that "A+B" or "A/B Switch" is selected, if source B (H06-01) is set to 5 (MS Speed Reference), the acceleration/deceleration time from "A+B" or "A/B Switch" to source B is determined by that of the current segment. Besides, the speed reference acceleration/deceleration time in the speed control mode is determined by the values set in H06-05 and H06-06.

■ Related Function Codes

Function codes related to MS speed reference belong to group H12.

Function Code	H12	H12	H12
	00	01	02
Name	MS Speed Reference Running Mode	Speed Reference End-segment Selection	Running Time Unit Selection

Setting Range	0: End of single run (Perform H1201 segment selection); 1: Cycle run (Perform H1201 segment selection); 2: Switch via external DI	1-16	0: sec 1: min
Min. Unit	1	1	1
Factory Setting	1	16	0
When Enabled	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting

When H12-02 is set to 0, the unit of the Reference Running Time of a certain segment (such as H12-21) is s (Min. resolution ratio: 0.1 s). When H12-02 is set to 1, the unit of the Reference Running Time of a certain segment (such as H12-21) is min (Min. resolution ratio: 0.1 min).

There are three MS speed reference running modes which are set in H12-00.

- H12-00 = 0 (Single run): After H12-01 and H12-02 are set, the motor runs from segment 1 to the end segment (set in H12-01) based on the selected time unit (H12-01) and then stops.
- H12-00 = 1 (Cycle run): After H12-01 and H12-02 are set, the motor runs from segment 1 to the end segment (set in H12-01) based on the selected time unit (H12-01) and then re-starts from segment 1.
- H12-00 = 2 (Switch via external DI): The system selects the position reference through the 16-bit number that corresponds to four external signals (CMD1/CMD2/CMD3/CMD4). If CMD1/CMD2/CMD3/CMD4 corresponds to the 16-bit number 1, the 2nd speed reference is selected. If CMD1/CMD2/CMD3/CMD4 corresponds to the 16-bit number 15, the 16th speed reference is selected, and the like.

Input Signal					Motor Rotation Direction	Running Speed
/DIR-SEL	CMD1	CMD2	CMD3	CMD4		

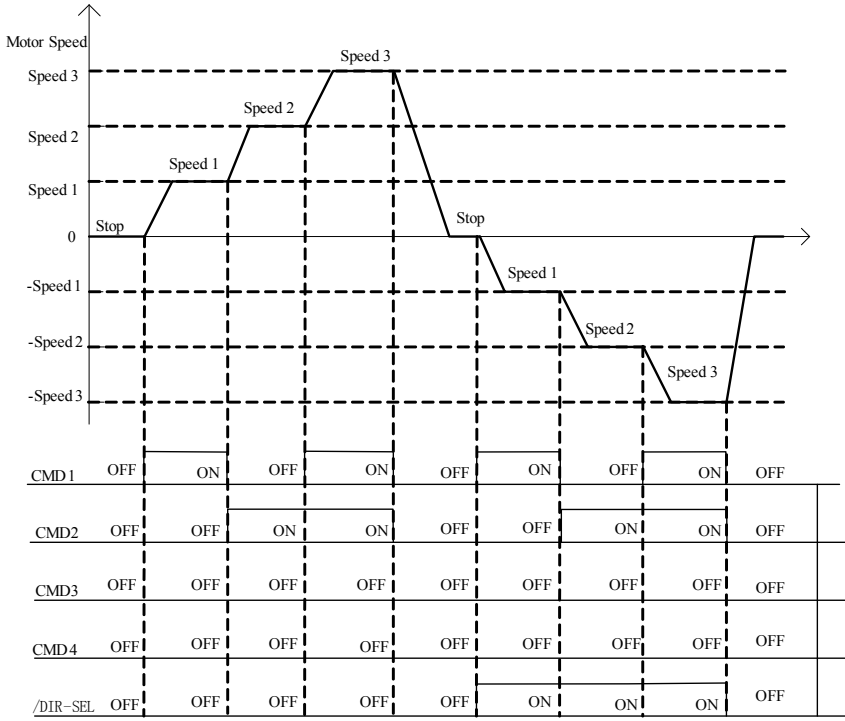
Input Signal					Motor Rotation Direction	Running Speed
OFF	OFF	OFF	OFF	OFF	Speed reference is the same as the set direction.	Set the 1st segment speed through H12-20.
	ON	OFF	OFF	OFF		Set the 2nd segment speed through H12-23.
	OFF	ON	OFF	OFF		Set the 3rd segment speed through H12-26.
	ON	ON	OFF	OFF		Set the 4th segment speed through H12-29.
	OFF	OFF	ON	OFF		Set the 5th segment speed through H12-32.
	ON	OFF	ON	OFF		Set the 6th segment speed through H12-35.
	OFF	ON	ON	OFF		Set the 7th segment speed through H12-38.
	ON	ON	ON	OFF		Set the 8th segment speed through H12-41.
	OFF	OFF	OFF	ON		Set the 9th segment speed through H12-44.
	ON	OFF	OFF	ON		Set the 10th segment speed through H12-47.
	OFF	ON	OFF	ON		Set the 11th segment speed through H12-50.
	ON	ON	OFF	ON		Set the 12th segment speed through H12-53.
	OFF	OFF	ON	ON		Set the 13th segment speed through H12-56.
	ON	OFF	ON	ON		Set the 14th segment speed through H12-59.
	OFF	ON	ON	ON		Set the 15th segment speed through H12-62.
	ON	ON	ON	ON		Set the 16th segment speed through H12-65.

Input Signal					Motor Rotation Direction	Running Speed
ON	OFF	OFF	OFF	OFF	Speed reference is opposite to the set direction.	Set the 1st segment speed through H12-20.
	ON	OFF	OFF	OFF		Set the 2nd segment speed through H12-23.
	OFF	ON	OFF	OFF		Set the 3rd segment speed through H12-26.
	ON	ON	OFF	OFF		Set the 4th segment speed through H12-29.
	OFF	OFF	ON	OFF		Set the 5th segment speed through H12-32.
	ON	OFF	ON	OFF		Set the 6th segment speed through H12-35.
	OFF	ON	ON	OFF		Set the 7th segment speed through H12-38.
	ON	ON	ON	OFF		Set the 8th segment speed through H12-41.
	OFF	OFF	OFF	ON		Set the 9th segment speed through H12-44.
	ON	OFF	OFF	ON		Set the 10th segment speed through H12-47.
	OFF	ON	OFF	ON		Set the 11th segment speed through H12-50.
	ON	ON	OFF	ON		Set the 12th segment speed through H12-53.
	OFF	OFF	ON	ON		Set the 13th segment speed through H12-56.
	ON	OFF	ON	ON		Set the 14th segment speed through H12-59.
	OFF	ON	ON	ON		Set the 15th segment speed through H12-62.
	ON	ON	ON	ON		Set the 16th segment speed through H12-65.

Complement: If the control mode is set to a switching mode (that is, H02-00=3, 4, 5, 6), switching of control modes may be performed.

■ MS Speed Running Example

The following figure shows an MS speed running example, illustrating the running effect when during acceleration/down time. The reference acceleration/deceleration function can effectively lighten shocks to the machine during speed reference switching.



7.3 Position Control

7.3.1 Acquiring the Position Reference

The position reference is acquired through H05-00. Its values are described as follows:

- 0: The servodrive selects external pulse reference as the position reference source.
- 1: The servodrive selects the stepping given as the position reference source.
- 2: Multi-segment position reference
- 3: Communication given

Function Code	H05
	0
Name	Master Position Reference A Source
Setting Range	0: Pulse Reference (default) 1: Stepping Given 2: MS Position Reference 3: Communication Given

Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	P

You can set the direction of position reference (FunIN.27) by an external DI.

Code	FunIN.27
Signal Name	POSDirSel
Function Name	Position Reference Direction Setting
Description	Disabled: Positive direction Enabled: Reverse direction
Status	Allocation
Remark	It’s necessary to set the logic of corresponding DI to 0 or 1.

To select stepping given as the position reference source, set H05-00 to 1, and then set the position reference units for stepping in H05-03. The motor speed during execution of the stepping is determined by the electronic gear and a default parameter, as below:

Steady-state motor speed = 24 (rpm) × Electronic gear

【Note】

- The speed reference range is determined by the above formula, while the speed reference direction is determined by the set position direction.
- Signal /POSSTEP must be enabled when stepping given is selected as the position reference source. Only in this case can the servodrive start acquiring the stepping position reference. After signal /POSSTEP is enabled, servodrive starts to execute the position reference set in H05-03 and then accepts signal /POSSTEP. If signal /POSSTEP is always disabled, the position reference output is zero.
- Signal /POSSTEP will not be accepted during servodrive operation.

Function Code	H05
	03
Name	Stepping
Setting Range	-9999 to 9999 reference units
Min. Unit	1 reference unit
Factory Setting	50
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	P

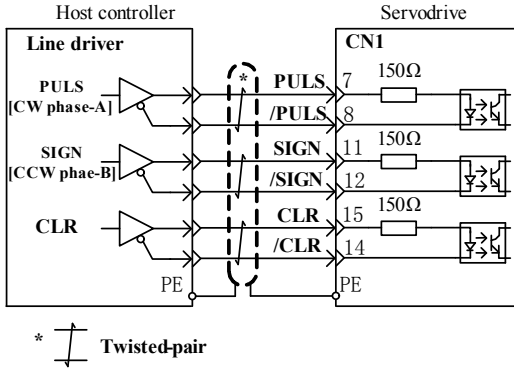
7.3.2 Acquiring the Pulse Reference

■ Setting Pulse Reference Input Signals

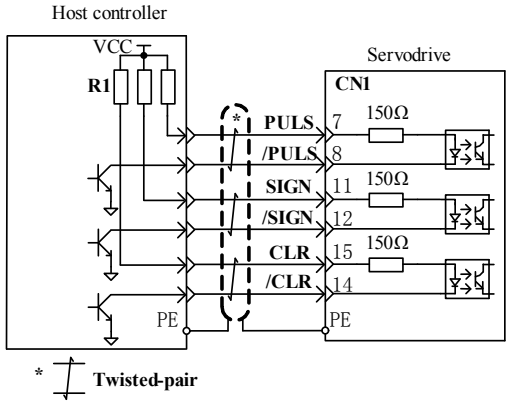
Type	Signal Name	Pin No.	Name
Input	PULS+	CN1-7	Pulse reference input +
	PULS-	CN1-8	Pulse reference input -
	SIGN+	CN1-11	Pulse direction input +
	SIGN-	CN1-12	Pulse direction input -

■ Wiring Pulse Reference Input Signals

1. Wiring differential drive output:



2. Wiring open collector output:



Set the current-limiting resistance R1 and make sure the input current is within the range of 6-10mA.

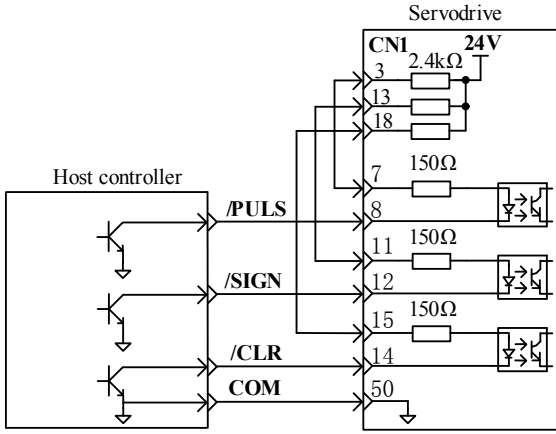
For example:

If Vcc=+24 V, then, R1=2.4 kΩ;

If Vcc=+12 V, then, R1=1.5 kΩ;

If Vcc=+5 V, then, R1=200 Ω.

Wiring open collector through PL1/PL2/PL3 for pull-up helps to utilize the 24V power supply in the servodrive.



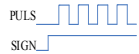
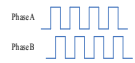
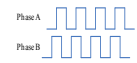
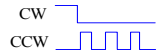
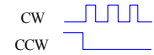
【Note】 Terminals 3, 13 and 18 indicate PL1, PL2 and PL3 respectively.

■ Setting the pulse reference input form

There are four pulse reference input forms, set in H05-15.

Function Code	H05
	15
Name	Reference Pulse Form
Setting Range	0: Direction + pulse, positive logic (default value) 1: Direction + pulse, negative logic 2: Phase A + Phase B Orthogonal pulses, 4 multiple frequency 3: CW+CCW
Min. Unit	1
Factory Setting	0
When Enabled	After Restart
Data Type	Stop Setting
Related Mode	P

■ Principle of pulse reference forms is as below:

Pulse Reference Form	Positive Logic		Negative Logic	
	Forward	Reverse	Forward	Reverse
Direction + pulse				
Orthogonal pulses (Phase A + Phase B)			—	
CW+CCW				

7.3.3 Clearing Pulse Offset

The setting of pulse offset clearing signal is as follows:

Type	Signal Name	Connector Pin No.	Name
Input	CLR	CN1-15	Pulse offset clearing input +
	/CLR	CN1-14	Pulse offset clearing input -

【Note】 If it is not necessary to input an external clearing reference, do not wire the connector but just set H05-16 to 1 (clear position offset pulse upon error).

The clearing mode of pulse offset clearing signals is set in H05-16 as below:

Function Code	Setting Value	Description
H05-16	0	Servo OFF and clear position offset pulse upon error (default)
	1	Clear position offset pulse upon error
	2	Clear with signal CLR connected
	3	Clear with signal CLR disconnected
	4	Clear with signal CLR rising
	5	Clear with signal CLR falling

【Note】 “Signal CLR connected” indicates a current of 6-10mA flows into signal CLR+. For the wiring, refer to.5.3.1.

7.3.4 Setting the Electronic Gear

The electronic gear is set through function codes from H05-07 to H05-13. There are two electronic gear ratios and the selection of an electronic gear ratio is set through signal FunIN.24. If it is disabled, ratio 1 is selected by default. If it is enabled, ratio 2 is selected.

【Note】 The two gear ratios can be switched only when the time of non-position reference input exceeds 10ms.

Function Code	H05	H05	H05	H05	H05
	7	9	11	13	39
Name	Electronic Gear Ratio 1 (Numerator)	Electronic Gear Ratio 1 (Denominator)	Electronic Gear Ratio 2 (Numerator)	Electronic Gear Ratio 2 (Denominator)	Gear Ratio Real-time Modification and DI Switching Enabled
Setting Range	1 to 1073741824	1 to 1073741824	1 to 1073741824	1 to 1073741824	0: No real-time switching 1: Real-time switching
Min. Unit	1	1	1	1	1
Factory Setting	4	1	4	1	0
When Enabled	Immediately	Immediately	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting	Stop Setting	Stop Setting
Related Mode	P	P	P	P	P

Note that 0.001 ≤ Gear Ratio ≤ 4000

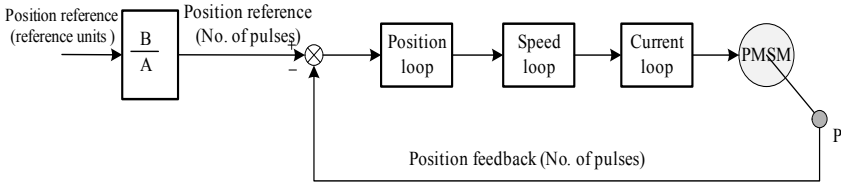
If the deceleration ratio of the servomotor and the load shaft is given as n/m where m is the rotation of the servomotor and n is the rotation of the load shaft, the electronic gear ratio is calculated as below:

$$\text{Electronic gear ratio}: \frac{B}{A} = \frac{H05.07}{H05.09} = \frac{\text{Encoder resolution ratio}}{\text{Displacement per load shaft revolution (reference units)}} \times \frac{m}{n}$$

Encoder resolution ratio indicates the count of pulses output by the encoder during one motor rotation.

Orthogonal incremental encoder resolution ratio = Number of wires x 4

The working principle of the electronic gear is as follows:



7.3.5 Position Reference Smoothing

Position reference smoothing function indicates that the position references are filtered.

This function provides smooth motor rotation in the following cases:

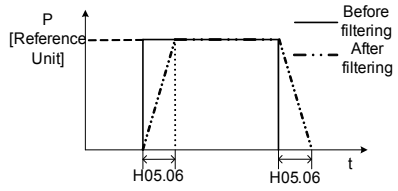
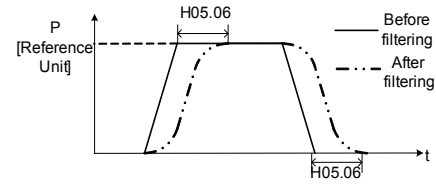
- Host controller cannot output acceleration/deceleration reference.
- The reference pulse frequency is too low.
- The reference electronic gear ratio is 10 times or more.

【Note】 The function does not affect the displacement (total position references).

Functional codes related to position reference smoothing

Function Code	H05 6
Name	Position Reference Moving Average Time
Setting Range	0.0ms-28.0ms
Min. Unit	0.1ms
Factory Setting	0.0ms
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	P

【Note】 If H05-06 is set to 0, the filter is disabled.

Filtering Effect Comparison between Two Different Position References	
Rectangle Position Reference	Trapezoid Position Reference
	

7.3.6 Output of Positioning Completion Signals

In the position control mode, the servodrive outputs the positioning completion signal when the difference (position error pulse) between the number of given position references and the displacement distance of the servomotor equals or is less than the value set in H05-21.

The output signal is as follows:

Code	FunOUT.5
Signal Name	/COIN+-
Function Name	Position Arrival
Description	In the position control mode, it is enabled when “position deviation” arrives “position complete amplitude H05-21”.
Status	Allocation

The related function code is as follows:

Function Code	H05	H05
	20	21
Name	Positioning completion Signal (COIN) Output Condition	Positioning Completion Amplitude
Setting Range	0: Position deviation absolute value is less than position completion amplitude output; 1: Position deviation absolute value is less than position completion amplitude output ,and the reference is zero after position reference filtering; 2: Position deviation absolute value is less than position completion amplitude	1-32767 reference units
Min. Unit	1	1 reference unit
Factory Setting	0	7 reference units
When Enabled	Immediately	Immediately
Data Type	Stop Setting	Stop Setting
Related Mode	P	P

【Note】

- The setting unit of Positioning Completion Amplitude (H05-21) is reference unit which is determined by the set electronic gear ratio.
- The value of Positioning Completion Amplitude (H05-21) only reflects the thresholds of output positioning completion signals and is irrelevant to the positioning precision.
- If the value of Positioning Completion Amplitude (H05-21) is set overlarge, the position offset decreases during operation at low speed and thus positioning completion signals may be continuously output. In this case, decrease the value of H05-21 until positioning completion signals are sensitively output.
- In the conditions of small positioning completion amplitude and position offset, you can change the output condition of signal COIN through H05-20.

The position offset is relatively small in the following cases:

- The servodrive always runs at a low speed.
- The servodrive is of a relatively large speed feed-forward gain.

7.3.7 Output of Positioning Approach Signals

In the position control mode, the servodrive outputs the positioning approach signal when the difference between the number of given position references and the displacement

distance of the servomotor equals or is less than the value set in H05-22. Normally, the host controller receives positioning approach signals before confirming positioning completion signals.

The output signal is as follows:

Code	FunOUT.6
Signal Name	/NEAR+-
Function Name	Positioning Approach Signal
Description	In the position control mode, this signal is enabled when the value of position deviation pulse arrives at the set value of Positioning Completion Approach Signal Amplitude (H05-22).
Status	Allocation

The related function code is as follows:

Function Code	H05
	22
Name	Positioning Completion Approach Signal Amplitude
Setting Range	1-32767 reference units
Min. Unit	1 reference unit
Factory Setting	32767 reference units
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	P

【Note】
- The setting unit of Positioning Completion Approach Signal Amplitude (H05-22) is reference unit which is determined by the set electronic gear ratio.
- Signal /NEAR is output when the absolute value of position offset is smaller than the value set in H05-22.
- Normally, the value set in H05-22 is larger than the value set in H05-21.

7.3.8 Setting the Position Reference Inhibit Function

In the position control mode, this function inhibits reference pulse input via signal /INHIBIT. When it is enabled, the position reference input is zero and the servodrive remains locked.

The input signal is as follows:

Code	FunIN.13
Signal Name	/INHIBIT
Function Name	Pulse Disabled
Description	Enabled: Reference pulse input prohibited; Disabled: Reference pulse input allowed
Status	Allocation
Remark	Enabled only when the position-loop is with pulse control.

The input terminal that corresponds to signal /INHIBIT is allocated by function code group H03. Signal /INHIBIT is always disabled if it is not allocated to a DI. In this case, pulse input is allowed. Once it is allocated, whether this function is enabled depends on the enabled mode of signal /INHIBIT and the corresponding DI's electrical level.

7.3.9 Setting the Handwheel Function

The handwheel function provides source for position references, which is enabled only in the position control mode and in applications with control mode switching. In the position control mode, do as follows to enable the handwheel function.

Step	Operation
1	Check and make sure that the allocation status of DI9 and DI10 is 0. That is, DI9 and DI10 signals are orthogonal handwheel pulse input signals by default.
2	Allocate signal HX_EN (FunIN.23) to the DI terminal.
3	Set HX1 and HX2 if DI terminal selection is required.

After the handwheel function is enabled, switching between position reference and handwheel reference can be performed through signal HX_EN. That is, when signal HX_EN is enabled, the servo position reference is the handwheel pulse. When signal HX_EN is disabled, MF terminals are defined as below.

Code	FunIN.21	FunIN.22	FunIN.23
Signal Name	HX1	HX2	HX_EN
Function Name	Handwheel MF Signal 1	Handwheel MF Signal 2	Handwheel Enable Signal
Description	HX1=1, HX2=0: 10X; HX1=0, HX2=1: 100X HX1=1, HX2=1: 10X;	HX1=0, HX2=0: 10X	OFF: Position control according to H05-00 function code; ON: In the position mode, receive the handwheel pulse signal for position control.
Status	Allocation	Allocation	Allocation
Remark	Check and judge through the debugger.	Check and judge through the debugger.	

【Note】 The handwheel function and Interrupt Length function cannot be enabled at the same time. When the handwheel function is enabled, DI9 and DI10 cannot be allocated as common DI terminals.

7.3.10 Setting the MS Position Function

You can realize the MS position function by setting H05-00 to 2.

The servodrive stores 16 groups of position-related parameters. A maximum of 16 different speeds, running distances and waiting time can be set through these parameters, which can conveniently realize automatic MS fixed-length running or selecting segment through an external terminal input signal and then operating based on the setting. It is not necessary to install an external pulse generator since the operations are performed through servodrive's

internal parameters. Flexible using of this function can realize n-point track planning.

In MS running mode, except the DI switch mode, signal PosInSen (FunIN.28) is used as the triggering signal. When signal PosInSen is disabled, the MS running mode is disabled. When signal PosInSen is enabled, the MS running mode is enabled. The speed is instantly reduced to 0 when the MS running mode is changed from enabled to disabled. If signal PosInSen is disabled and then enabled during n-segment running, the system continues to run from segment n+1 (H1102 = 0) or re-runs from segment 1 (H11-02=1) according to the value set in H11-02 (Margin Processing Method).

The DI switch mode uses an external DI to trigger and change the required segment. One segment is run when the DI triggering signal PosInSen (FunIN.28) changes from disabled to enabled. The specific segment number is selected through CMD1 (FunIN.6), CMD2 (FunIN.7), CMD3 (FunIN.8) and CMD4 (FunIN.9). CMD1-4 corresponds to 4-bit binary number bit0-3. For details, refer to “(3) External Terminal Signals Required for DI Mode” in this section.

In the single run mode, the selected segments are executed only once when signal PosInSen (FunIN.28) is enabled. If you need to re-execute the selected segments, re-enable signal PosInSen (FunIN.28) after the first run is completed. This mode can realize n-point track planning and change information of a certain segment through communication in real time. You can set to re-execute from segment 1 or continue to execute subsequent segments through H11-02 in case of urgent interruption.

The cycle run mode is similar to the single run mode. The system automatically re-executes the selected segments after a single run is executed. The margin processing method in the cycle run mode is the same as that in the single run mode.

The sequence run mode is similar to the single run mode. There is no waiting time between segments in the sequence run mode. Therefore, this mode is of a higher running efficiency. This mode starts the next segment at the maximum speed of the previous segment and the total displacement is the same as the preset value.

【Note】 In the DI switch run mode, the signal for segment selection must be sent before the trigger signal. High/low-level logic is enabled when signal PosInSen works as the enabled signal. Change from Disabled to Enabled takes effect when signal PosInSen works as the trigger signal of the DI switch mode.

The main parameters are as follows:

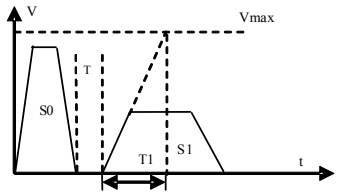
Parameter	Description
Running Mode	0: Single run: Run from segment 1 to segment n (n is set in H1101). Switching between segments requires the set waiting time. 1: Cycle run: Re-run the segments (H1101) from segment 1. Switching between segments requires the set waiting time. 2: DI switch run: Trigger the selected segment through an external DI. The constant running speed, Acceleration / Deceleration time and displacement are determined by the parameters of the selected segment. For details, refer to “(3) External Terminal Signals Required for DI Mode”.
End Segment Selection	Segments after the selected end segment will not be executed. This parameter is disabled when H11-00 is set to 2.

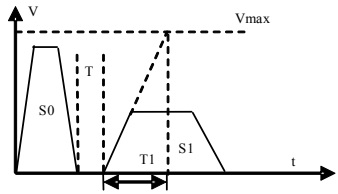
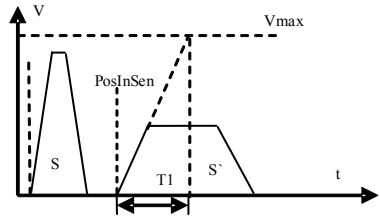
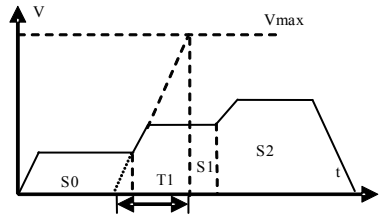
Margin Processing Method		0: Continue to run 1: Run again from segment 1
Waiting Time Unit		0: ms 1: s
Single-segment parameter setting (total 16 segments)	Constant Running Speed	Indicates constant running speed upon trapezoid reference
	Running Displacement	Indicates the fixed length. Positive and negative signs indicate directions. Unit: Reference unit
	Acceleration / Deceleration Time	Corresponds to the rising or falling time upon trapezoid reference. Unit: ms
	Waiting Time	Indicates the time from when a segment is completed (finishing sending reference, not requiring position arrival) to the time when the next segment is started. Value range: 0-10000 s This parameter is disabled when H11-00 is set to 2.

External Terminal Signals Required for DI Mode

Code	FunIN.28	FunIN.6	FunIN.7	FunIN.8	FunIN.9
Signal Name	PosInSen	CMD1	CMD2	CMD3	CMD4
Function Name	MS Running Reference Trigger Signal	Internal Reference Switch CMD1	Internal Reference Switch CMD2	Internal Reference Switch CMD3	Internal Reference Switch CMD4
Description	OFF: Not trigger; ON: Trigger	16-segment reference selection	16-segment reference selection	16-segment reference selection	16-segment reference selection
Status	Allocation	Allocation	Allocation	Allocation	Allocation
Remark		FunIN.Cmd1 to FunIN.Cmd4 corresponds to 4-bit binary number bit3bit2bit1bit0 (“0000” indicates segment 1; “0002” indicates segment 2; ⋯) Cmd1 corresponds to bit0; Cmd2 corresponds to bit1Cmd3 corresponds to bit2; Cmd4 corresponds to bit3.			

Example Charts in Different Running Modes

Mode Chart	Remarks
	Single Run Vmax: Max. motor speed T: Segment-1 waiting time T1: Segment-1 Acceleration / Deceleration time S0/S1: 1st/2nd displacement

Mode Chart	Remarks
	Cycle Run Vmax: Max. motor speed T: Segment-1 waiting time T1: Segment-1 Acceleration / Deceleration time S0/S1: 1st/2nd displacement
	DI Switch Run Vmax: Max. motor speed PosInSen: Triggering terminal enabled S/S`: Displacement selected through Cmd1-4’ T1: Acceleration / Deceleration time of the selected segment
	Sequence Run Vmax: Max. motor speed T1: Segment-1 Acceleration / Deceleration time S0/S1/S2: 1st/2nd/3rd displacement

Function Code	H11	H11	H11	H11	H11
	0	1	2	3	4
Name	MS Position Running Mode	Segment Selection	Margin Processing Method	Waiting Time Unit	Displacement Reference Selection
Setting Range	0: Single run 1: Cycle run 2: DI switch run 3: Sequence run	1-16	In any MS running mode except the DI switch mode: 0: Continue to run 1: Run again from segment 1	0: ms 1: s	0: Relative displacement reference 1: Absolute displacement reference
Min. Unit	1	1	1	1	1
Factory Setting	1	1	0	0	0
When Enabled	Immediately	Immediately	Immediately	Immediately	Immediately

Data Type	Stop Setting	Stop Setting	Stop Setting	Stop Setting	Stop Setting
Related Mode	P	P	P	P	P
For function codes of other 15 segments, refer to the Appendix.					

7.3.11 Setting the Interrupt Length Function

In the condition that a motor is running or stops in the position mode, when H05-23 is enabled, and DI9 is triggered, it will continue to run the preset length towards the previous direction. During execution of interrupt length reference, the motor is locked.

That is, it does not respond to any other position references (the second interrupt trigger included). Once the execution is complete, the allocated DO terminal outputs the interrupt length completed signal (FunOUT.15) enabled. At this time, the host computer should set DI interrupt clearing signal enabled (edge enabled). The motor is unlocked and then responds to other position references.

If the lock state is unnecessary during execution of interrupt length reference, set H05-29 to 0. The lock clear signal is disabled. The motor responds to position reference after completion of interrupt length reference.

■ Related Function Code

To enable the interrupt length function, set H05-23 enabled. To start the function, enable the interrupt length trigger signal DI9. The speed of interrupt length is set via H05-26.

It should be noted that the displacement and speed are set before electronic gear and should be adjusted when electronic gear changes so as to prevent malfunction.

Function Code	H05	H05	H05	H05	H05
	23	24	26	27	29
Name	Interrupt Length Enabled	Interrupt Length Displacement	Length Running Speed	Length Acceleration / Deceleration time	Length lock clear signal enabled
Setting Range	0: Disabled 1: Enabled	0-1073741824	1-9000	0-1000	0: Disabled 1: Enabled
Min. Unit	1	1 Reference Unit	1rpm	1ms	1
Factory Setting	0	10000	200rpm	10ms	1
When Enabled	Enabled upon power-on	Immediately	Immediately	Immediately	Immediately

Data Type	Stop Setting	Stop Setting		Stop Setting	Running Setting
Related Mode	H05	H05	H05	H05	H05

■ DI/DO Terminal Setting

To trigger the Interrupt length function via DI9, set H03-18 to 0 and H03-19 to rising edge or falling edge enabled.

Define a DI as FunIN.29. This DI becomes XintFree, interrupt status clear signal. Set the DI logic level to rising edge or falling edge enabled.

Define a DO as FunOUT.15. This DO becomes Xintcoin, interrupt length completed signal. Set the DO logic level to low or high level enabled.

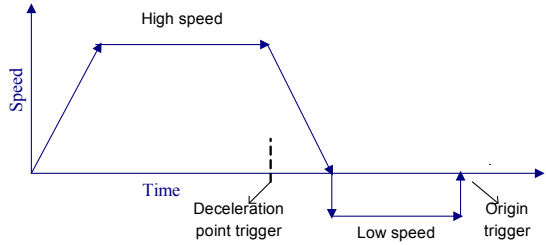
CAUTION
Interrupt length and handwheel cannot be used at the same time. DI9 shall not be allocated with common function when interrupt length function is used.

7.3.12 Setting the Origin Return Function

The origin return function in the position mode indicates that servodrive actively completes origin positioning of the driven machine. The origin return is divided into two phases:

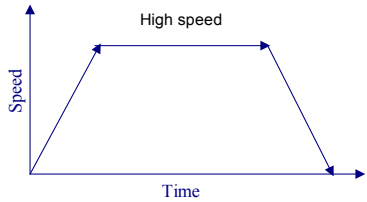
- After the servodrive's origin return function is enabled, the motor searches the deceleration point at specified high speed (H05-32) based on the origin return mode (H05-31). After meeting the rising edge of the deceleration point, it decelerates to 0 at the preset deceleration time.
- The motor searches the location of the origin switch at specified low speed (H05-33) based on the reverse of high-speed origin return direction. After meeting the falling edge of the origin switch, it immediately stops and sets the current absolute position (H0B-07) to H05-36. The origin return is successful and the output is 1. Then origin return ends. If the origin switch location is not found within the origin search time limit, origin return overtime error (ER.601) is output.

The schematic diagram of origin return is shown as below:



【Note】 Electrical zero return indicates that a fixed distance is taken from the current coordinate to the coordinate set in H05-36. The fixed distance is obtained by origin coordinate minus the current coordinate.

The schematic diagram of electrical zero return is shown as below:



The differences between electrical zero return and origin return are described as follows:

1. Electrical zero return does not require the origin switch or signal Z to determine the physical location of the origin.
2. The moving distance of electrical zero return is obtained by origin coordinate minus the current coordinate. But the distance of origin return is the distance when it runs into signal Z or the distance of rising edge of deceleration point.
3. The coordinate after electrical zero return is H0536, while the coordinate after origin return is to re-assign the H05-36 value to the current coordinate.
4. Generally, electric zero return is used when the coordinate is determined after origin return.

■ Input Signals

Code	FunIN.31	P-CON	FunIN.32	P-OT
Signal Name	OrgNear		OrgChuFa	
Function Name	Origin Switch Signal		Origin Return Trigger	
Description	OFF-Not touched the origin switch ON-Touched the origin switch		OFF-Disable origin return ON-Start origin return	
Status	Not allocated		Not allocated	
Remark	Logic level low or high can be selected, rising edge, falling edge and rising/falling trigger cannot be selected, otherwise return to zero may not be precise.		It is valid that the servo enabled in the position mode.	

■ Output Signals

Code	FunOUT.16	FunOUT.17
Signal Name	ORGOK	ELECTOK
Function Name	Origin Return Output	Electrical Return To Zero Output
Description	OFF- upon power-on enable origin reset, or enable origin reset, return to zero failed; ON- Enable origin reset , return to zero	OFF- upon power-on enable origin reset, or enable origin reset, return to zero failed; ON- Enable origin reset, return to zero
Status	Not allocated	Not allocated

■ Related Function Codes

Function Code	H05	H05
	30	31
Name	Origin Return Enable Control	Origin Return Mode
Setting Range	0: Close origin return 1: Input OrgChuFa enable origin return via DI 2: Input OrgChufa enable electric return to origin via DI 3: Start orgin return after power-on 4: Start origin return 5: Start electric return to origin command 6: Start with current position as the origin	0: Forward return to zero, deceleration point/origin represents origin switch 1: Reverse return to zero, deceleration point/origin represents origin switch 2: Forward return to zero, deceleration point/origin represents motor signal Z 3: Reverse return to zero, deceleration point/origin represents motor signal Z 4: Forward return to zero, deceleration point represents origin switch, origin represents motor Z 5: Reverse return to zero, deceleration point represents origin switch, origin represents motor Z
Min. Unit	1	1
Factory Setting	0	0
When Enabled	Immediately	Immediately
Data Type	Running Setting	Stop Setting
Related Mode	P	P

7.4 Torque Control

7.4.1 Acquiring the Torque Reference

In the torque control mode, torque references come from Source A and Source B. You can acquire torque references in the following five modes:

- source A
- Source B
- Source A + source B
- Source A/B switching through an external DI
- Communication given

The five modes are set via H07-02.

Function Code	H07
	2
Name	Torque Reference Selection

Setting Range	0: Master Torque Reference Source A 1: Auxiliary Torque Reference Source B 2: Source A+B 3: A/B Switching 4: Communication given
Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	T

If H07-02 is set to 3, you need to allocate the DI terminal with the function independently. Then the DI can work normally and it can be figured out whether the current reference input is A or B through this DI terminal.

Code	FunIN.4
Signal Name	/CMD-SEL
Function Name	Operation reference switching
Description	Disabled-Current running reference is A Enabled-Current running reference is B
Status	Allocation

Besides, both source A and source can be generated in the following two modes:

- Digital setting (keypad setting): You can set a torque value via function code H07-03 on the keypad. This value is a percentage of rated torque and must be given within the range of the rated torque.
- Analog torque reference source: The externally input analog voltage signal is converted into a torque reference signal, which can freely designate the corresponding relationship between analog and torque reference.

■ Related Function Codes

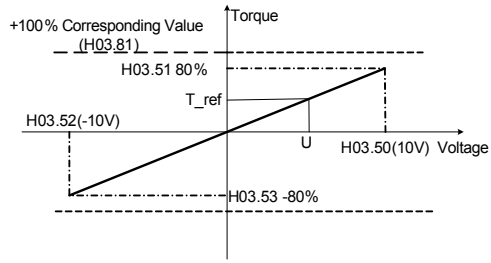
Function Code	H07	H07	H07
	0	1	3
Name	Master Torque Reference A Source	Auxiliary Torque Reference B Source	Torque Reference Keypad Setting Value
Setting Range	0: Digital Given (H07-03) 1: AI1 2: AI2 3: AI3	0: Digital Given (H07-03) 1: AI1 2: AI2 3: AI3	-100.0% to 100.0%
Min. Unit	1	1	0.10%
Factory Setting	0	1	0.00%

When Enabled	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Operation Setting
Related Mode	T	T	T

If analog torque reference source is adopted, perform the following settings (take AI1 as an example):

Step	Operation	Remarks
1	H07-02 = 1, Set reference source as auxiliary torque reference B source	Set reference source in torque control mode.
2	Corresponding relationship of AI1 setting H03-50 = 10V H03-51 = 80% H03-52 = -10V H03-53 = -80%	Corresponding relationship of +-10V input.
3	Set 100% corresponding torque value H03-81 = 3 times rated torque	Designate nominal torque corresponds to 100%

As the figure shown below, set a straight line via H03-50-53 and fix the slope K. For any given U, the reference T_ref = k * U.

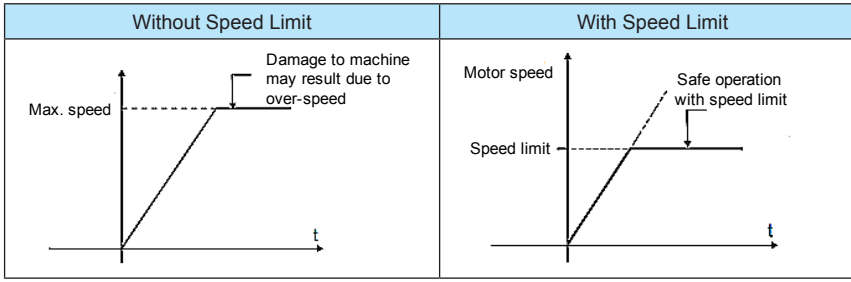


You can view the given torque reference via H0b-02 (Relative to motor maximum torque percentage).

7.4.2 Speed Limit in Torque Control

Speed limit in torque control is required to protect the connected machine. In the torque control mode, servomotor must output torque according to the reference but its speed is not controlled. When an excessive torque reference is set, the output torque will be higher than the load torque at the machine side. Accordingly, the servomotor will greatly speed up and may result in over-speed. In this case, it is necessary to limit the servomotor speed.

【Note】 When motor speed is out of the limit, a torque that is proportional to the difference between the actual speed and the speed limit is used as negative feedback to bring the speed back within limit. The actual motor speed limit varies with the load condition.



Signals output during servomotor speed limit is shown as follows:

Code	FunOUT.8
Signal Name	/V-LT+-
Function Name	Rotating Speed Limit Signal
Description	Speed limit signal in torque control Enabled: motor speed is limited Disabled: motor speed is not limited
Status	Allocation

V-LT needs to allocate signals.

Speed limit is set through the function codes below.

Function Code	H07	H07	H07
	17	18	19
Name	Speed Limit Source	V-LMT Selection	Internal Speed Limit Value in Torque Control
Setting Range	0: Internal speed limit (speed limit in torque control) 1: Take V-LMt as external speed limit input	1: AI1 2: AI2 3: AI3	0rpm-9000rpm
Min. Unit	1	1	1rpm
Factory Setting	0	3	3000rpm
When Enabled	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting
Related Mode	T	T	T

Limit source is divided into internal speed limit and external speed limit. To select internal speed limit, directly set H07-19. To select external speed limit, designate AI first via H07-18 and then set analog corresponding relationship based on needs. But when selecting

external speed limit, the external limit must be less than internal speed limit so as to avoid danger caused by improper setting of external speed limit.

7.4.3 Selection of Torque Limit

We can limit the output torque by setting H07-07 so as to protect the connected machine. You can set torque limit in the following four ways:

Function Code	H07 7
Name	Torque Limit Source
Setting Range	0: positive and negative internal torque limit (default) 1: positive and negative torque limit (by P-CL and N-CL) 2: Take T-LMT as external torque limit input 3: Take positive and negative external torque and minimum T-LMT value as the torque limit
Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	T

■ Related Signals

Digital input (DI): Input positive and negative external torque limit selection signal P-CL/NCL

Code	FunIN.16	FunIN.17
Signal Name	/P-CL	/N-CL
Function Name	Positive External Torque Limit	Negative External Torque Limit
Description	ON: External Torque Limit active OFF: External Torque Limit inactive	ON: External Torque Limit active OFF: External Torque Limit inactive
Status	Allocation	Allocation

Digital output (DO): Output torque limit signal P-CL/NCL

Code	FunOUT.7
Signal Name	/C-LT+-
Function Name	Torque Limit Signal
Description	Enabled: motor torque limited Disabled: motor torque not limited
Status	Allocation

【Note】 DI/DO related function code setting and logic allocation are required.
Analog input AI: Designate the T-LMT variable via HO7-08 and then set the corresponding relationship between rotating speed and analog voltage.

■ Related function codes

Function Code	H07	H07
	7	8
Name	Torque Limit Source	T-LMT selection
Setting Range	0: Positive and Negative Internal Torque Limit (default) 1: Positive and Negative Torque Limit (use P-CL, N-CL selection) 2: Take T-LET as External Torque Limit Input 3: Take Positive and Negative External Torque and minimum T-LMT value as Torque Limit	1: AI1 2: AI2 3: AI3
Min. Unit	1	1
Factory Setting	0	2
When Enabled	Immediately	Immediately
Data Type	Stop Setting	Stop Setting
Related Mode	T	PST

Function Code	H07	H07	H07	H07
	9	10	11	12
Name	Forward Internal Torque Limit	Reverse Internal Torque Limit	Internal Torque Limit at Forward Side	External Torque Limit at Reverse
Setting Range	0.0% to 800.0% (corresponds to one time rated torque)	0.0% to 800.0% (100%corresponds to one time rated torque)	0.0% to 800.0% (100% corresponds to rated torque)	0.0% to 800.0% (100% corresponds to one time rated torque)
Min. Unit	0.10%	0.10%	0.10%	0.10%
Factory Setting	300.00%	300.00%	300.00%	300.00%
When Enabled	Immediately	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting	Stop Setting
Related Mode	PST	PST	PST	PST

■ Operation Description

When H07-07 = 1, forward/reverse external torque limit is set by DI (P-CL/NCL). The torque is limited according to the value set in H07-11/12. Take internal limit if external limit, T_LMT and their combined limit exceed internal limit. That is, take the minimum limit to control torque amongst all limit values. Finally, torque is controlled within the motor's maximum torque range. T_LMT is symmetrical, limit torque according to |T_LMT| value when forward/reverse rotating.

7.5 Setting General Basic Functions

This section describes how to set general basic functions during servo operation.

7.5.1 Setting the Servo ON Signal

■ Signal setting

Code	FunIN.1
Signal Name	/S-ON
Function Name	Servo Enabled
Description	When enabled, the servomotor enters the enabled status. When disabled, the servomotor stops operating.
Status	Allocation
Remark	Set the DI allocation function code corresponding to this signal.

【Note】 FunIN.x indicates that the function code of the DI input signal is x.

■ Setting the servo ON signal to always enabled

If the /S-ON signal is not allocated as input through an external DI, you can set the data bit corresponding to the function code H03-00 to allocate the /S-ON signal as always enabled or disabled.

Function Code	H03	H03
	0	1
Name	FunINL is not allocated (setting the DI to always enabled)	FunINL is not allocated (setting the DI to always enabled)
Setting Range	0-65535 Bit0 corresponds to FunIN.1. Bit1 corresponds to FunIN.2. … Bit15 corresponds to FunIN.16.	0-65535 Bit0 corresponds to FunIN.17. Bit1 corresponds to FunIN.18. … Bit15 corresponds to FunIN.32.
Unit	1	1
Factory Setting	0	0
When Enabled	After Restart	After Restart

Data Type	Running Setting	Running Setting

CAUTION

- If the /S-ON signal is set to always enabled, the servodrive enters the operation enabled state when main circuit of the servodrive is powered on. Once a position/ speed/torque reference is input, the servomotor or machine starts immediately. This may result in accidents. Please remember to take safety measures.
- If the /S-ON signal is set to always enabled, once an error occurs to the servo, the error cannot be reset. Please set the /S-ON signal to disabled through H03-00 and power on the servo again.

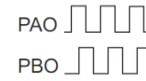
7.5.2 Switching the Servomotor Rotation Direction

This basic function is designed to follow the host controller. The servomotor rotation direction can be set through function codes H02-02 and H02-03.

Set the servomotor rotation direction via H02-02 shown as below:

Function Code	H02	
	02	
Name	Rotation Direction	Selection
Setting Range	0-reference direction is forward.	1-reference direction is reverse.
Min. Unit	1	
Factory Setting	0	
When Enabled	After restart	
Data Type	Stop setting	
Related Mode	PST	

The correlation between the servomotor rotation direction and the reference is as follows:

Reference Direction (Bipolarity)	Motor Rotation Direction	Encoder Feedback Output Direction
Forward reference	 Servomotor rotates CCW viewed from the shaft end.	 A leads B by 90° .

Reference Direction (Bipolarity)	Motor Rotation Direction	Encoder Feedback Output Direction
Reverse reference	 Servomotor rotates CW viewed from the shaft end.	PAO PBO B leads A by 90°.

Set the encoder feedback pulse output via H02-03 shown as below:

Function Code	H02	
	03	
Name	Ouput Pulse Feedback Direction Selection	
Setting Range	0-reference direction is forward.	1-reference direction is reverse.
Min. Unit	1	
Factory Setting	0	
When Enabled	After Restart	
Data Type	Stop Setting	
Related Mode	PST	

Function code H02-03 assists the function code H02-02 and is designed to set the encoder feedback pulse output direction.

Set the encoder feedback pulse output direction as follows:

Motor Rotation Direction	Function Code Setting	Encoder Feedback Pulse Output Direction
 Servomotor rotates CCW viewed from the shaft end.	H02-03 = 0	PAO PBO A leads B by 90°.
	H02-03 = 1	PAO PBO B leads A by 90°.
 Servomotor rotates CW viewed from the shaft end.	H02-03 = 0	PAO PBO B leads A by 90°.
	H02-03 = 1	PAO PBO A leads B by 90°.

7.5.3 Setting the Over-travel Disabled Function

The over-travel disabled function of the servodrive switches ON the limit switch to forcibly stop the servomotor when the movable machine parts exceed the allowable range.

The setting of the over-travel signals is as follows:

Code	FunIN.14	FunIN.15
Signal Name	P-OT	N-OT
Function Name	Forward Drive Disabled	Reverse Drive Disabled
Description	When the machine moves out of the allowable range, the over-travel disabled function takes effect. Enabled: Forward drive prohibited Disabled: Forward drive allowed	When the machine moves out of the allowable range, the over-travel disabled function takes effect. Enabled: Reverse drive prohibited Disabled: Reverse drive allowed
Status	Allocation	Allocation
Remark	Set the DI allocation function code corresponding to the over-travel signal. The over-travel limit switch works when these two signals over-travel simultaneously.	

Drive in opposite direction through reference input is still allowed in the over-travel state.


The servomotor rotates in the original direction when the over-travel signal is removed manually. Ensure safety when removing the over-travel signal.

7.5.4 Selecting the Motor Stop Mode When Servo is OFF

The motor may stop due to over-travel, servo OFF or fault. You can select the motor stop mode and status by setting corresponding function code.

- Select the motor stop mode by setting H02-05 when the servo is OFF.
- Select the motor stop mode and status by setting H02-07 upon over-travel.

Function Code	H02
	07
Name	Stop mode upon over-travel
Setting Range	0: The motor coasts to a stop. 1: Take the emergency stop torque as the maximum torque to make the motor decelerate to a stop. The motor then enters servo-locked state. 2: Take the preset emergency stop torque as the maximum torque to make the motor decelerate to a stop. The motor then enters free operation state.
Min. Unit	1
Factory Setting	0
When Enabled	Immediately

Data Type	Stop Setting
Related Mode	PS

You can set the emergency stop torque upon over-travel via H07-15.

Function Code	H07 15
Name	Emergency Stop Torque
Setting Range	0.0%-800.0% (100% equals one time of the rated torque).
Min. Unit	0.10%
Factory Setting	100.00%
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	PST

Select the motor stop mode and status by setting H02-05 or H02-06 based on the fault type (No.1 fault and No.2 fault).

- When No.1 fault occurs, select the stop mode and status by setting H02-05.
- When No.2 fault occurs, select the stop mode and status by setting H02-06.

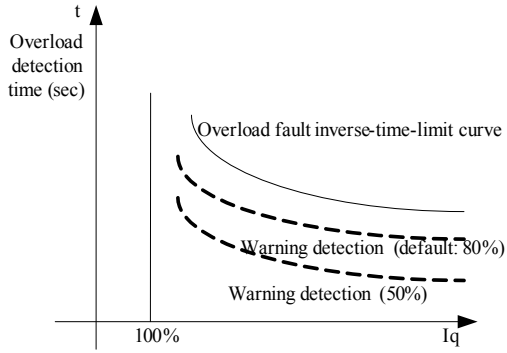
Function Code	H02 06
Name	Stop Mode Upon Fault
Setting Range	0: Coast to a stop; 1: Zero-velocity Stop
Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	PST

7.5.5 Setting the Detection Value of Motor Overload

The servodrive can change the detection time of motor overload warning and overload fault alarm, but cannot change the overload feature.

The overload warning detection time is 80% of the overload fault alarm detection time by default. You can change the warning detection time by changing the value of H0a-05. As shown in the figure below, once the value of H0a-05 is changed from 80% to 50%, the overload warning detection time is 50% of the overload alarm detection time.

In addition, the overload warming signal (/WARN) can also be output at the corresponding time to improve safety.



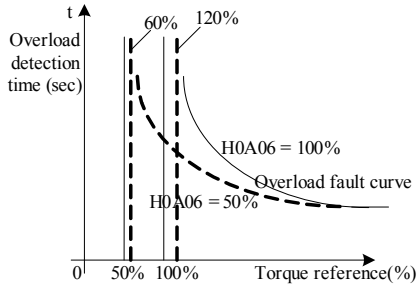
The following table lists the overload feature of the servomotor.

Function Code	H0a
	5
Name	Overload Warning Value
Setting Range	1%-100%
Min. Unit	1%
Factory Setting	80%
When Enabled	Immediately
Data Type	Stop Setting

You can also detect overload fault in advance using the following formula:

Motor rated current × Motor overload current derated (H0a-06) = Motor current after derated

Suppose the motor rated current is 5A. After H0a-06 is set to 50%, the existing motor rated current becomes 2.5A. In this case, motor overload is detected once the rated current gets to 3A because motor overload is indicated upon 120% of the motor rated current. Similarly, if H0a-06 is set to 100%, motor overload is detected once rated current gets to 6A



Function Code	H0a 6
Name	Motor Overload Current Derating
Setting Range	10%-100%
Min. Unit	1%
Factory Setting	100%
When Enabled	Immediately
Data Type	Stop Setting

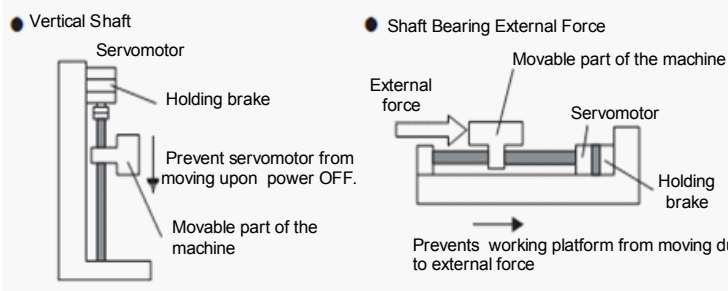
7.5.6 Motor Overload Protection Gain

Changing the value of H0a-04 based on motor heating can advance or delay the time when a motor overload protection fault occurs. If H0a-04 is set to 50%, the time is a half. If H0a-04 is set to 150%, the time is 1.5 multiple.

Function Code	H0a 4
Name	Motor Overload Protection Gain
Setting Range	50%-150%
Min. Unit	1%
Factory Setting	100%
When Enabled	Immediately
Data Type	Stop Setting

7.5.7 Setting the Holding Brake

The brake, built in the servomotor, is used to hold the motor at a specific position when a servodrive is OFF, thus preventing the machine movable part from moving due to gravity or external force.



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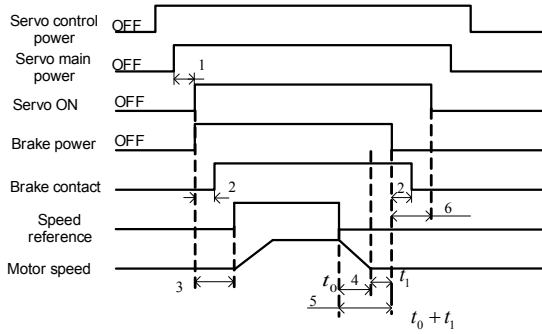
CAUTION

The brake built in the servomotor is a de-energized brake that cannot be used for braking. Use it only to hold a stopped motor.

Turn OFF the servo when the brake is applied.

The holding brake runs with a delay time, as shown in the following figure. If brake interlock signal output is applied, timing for brake ON/OFF is easy to handle.

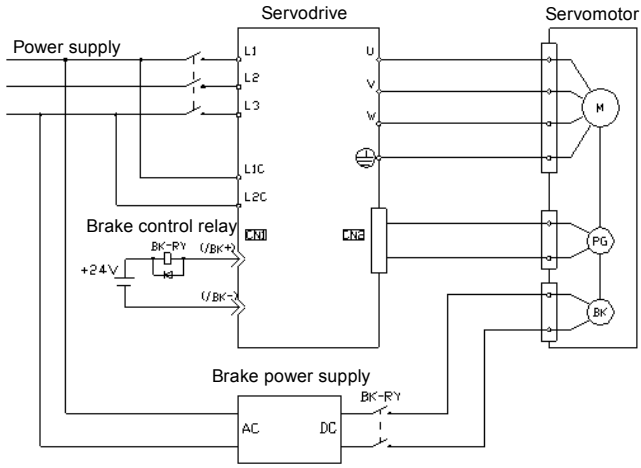


1. The servo and holding brake can be turned ON at the same time.
2. Delay of the holding brake depends on the motor model.
3. Turn ON the brake and then wait for at least 200ms before inputting speed reference.
4. In the following formula, t0 indicates the motor stopping time.
5. Do not turn OFF the brake before the motor stops. Normally, set t0+t1 to 1-2 seconds.
6. Turn OFF the servo 0.2 to 1 second after the brake is turned OFF.

Refer to the following table to calculate the motor stopping time.

Calculation Using SI Units	Traditional Calculation
$t_0 = \frac{(J_M + J_L) \times N_M}{(T_P + T_L)} \times \frac{2\pi}{60}(s)$	$t_0 = \frac{(GD_M^2 + GD_L^2) \times N_M}{375 \times (T_P + T_L)}$
JM: Rotor Moment of Inertia (kg·m2)	GDM2: Motor GD2 (kgf·m2)
JL: Loading Moment of Inertia (kg·m2)	GDL2: Loading GD2(kgf·m2)
NM: Motor Speed (rpm)	NM: Motor Speed (rpm)
TP: Motor Deceleration Torque (N·m)	TP: Motor Deceleration Torque (N·m)
TL: Loading Deceleration Torque (N·m)	TL: Loading Deceleration Torque (N·m)

Standard wiring example for the brake signal (/BK) and brake power is shown as below:



The brake signal output is shown as below:

Code	FunOUT.9
Signal Name	/BK+-
Function Name	Brake Output Signal
Description	Brake Signal Output: Enabled: Closed, remove the brake; Disabled: Start the brake
Status	Allocation

【Note】
- When DO is allocated with the /BLK signal, the DO should be set to the default value (low effective).
- The /BLK signal is not output upon over-travel.

For more details on allocating brake signals, refer to DI/DO allocation description.

When DO is not allocated with the /BK signal (default setting), the brake is not applied. In

this case, the delay setting related to the brake is invalid. The brake works immediately after the /BK signal is allocated. Once DO terminal of the /BK signal is re-allocated with other signals, the brake will become invalid after re-power-on.

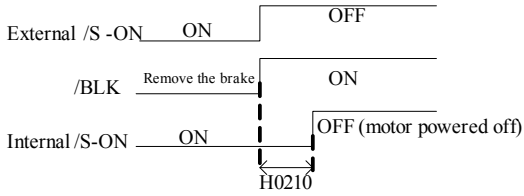
■ Brake Signal Output Time When Servomotor Stops

The /BK signal is output when the /S-ON signal is OFF. You can change the time (servo OFF delay) from external /S-ON signal OFF to motor actually powered off by setting H02.10.

Function Code	H02
	10
Name	Holding Brake Reference - Servo OFF Delay Time
Setting Range	1ms-500ms
Min. Unit	1ms
Factory Setting	100ms
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	PST

On a vertical shaft, the machine movable part may slightly shift due to gravity or external force. By setting H02-10, the motor can enter the power-off state after the brake finishes operation.

This parameter is used to set the stopping time of the servomotor.



【Note】 The servomotor will turn OFF immediately when a fault occurs, regardless of the setting of this parameter. The movable part of the machine may shift due to gravity or external force before the brake operates.

■ Setting Brake Signal Output Time When Servomotor Rotates:

If a fault occurs or the servo is OFF during motor rotation, the servomotor stops and the brake signal (/BK) turns OFF. In this case, you can adjust the brake signal output time by setting H02-11 and H02-12.

【Note】 If a NO.2 fault occurs, select zero-velocity stop mode and follow the operation in “Setting the brake signal (/BK) output time when servomotor stops”.

Function Code	H02	H02
	11	12

Name	Holding Brake Reference Output Speed Limit Value	Servo OFF - Holding Brake Reference Waiting Time
Setting Range	0 rpm to 1000 rpm	100 ms to 1000 ms
Min. Unit	1 rpm	1 ms
Factory Setting	100 rpm	500 ms
When Enabled	Immediately	Immediately
Data Type	Stop Setting	Stop Setting
Related Mode	PST	PST

The brake operates when either of the following conditions is satisfied:

- After the motor enters the power-off state, its rotation speed is below H02-11.
- After the motor enters the power-off state, the rotation time is longer than the preset value of H02-12.

7.5.8 Setting the Power Input Phase Missing Protection

Drive models have different main power input mode. The IS500 servodrive series supports single-phase 220V, three-phase 220V and three-phase 380V. The input voltage depends on the drive model. You can select phase missing protection through H0a-00.

Function Code	H0a
	00
Name	Power Input Phase Missing Protection Selection
Setting Range	0: Enable fault and disable alarm 1: Enable fault and alarm 2: Disable fault and alarm
Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Stop Setting

CAUTION

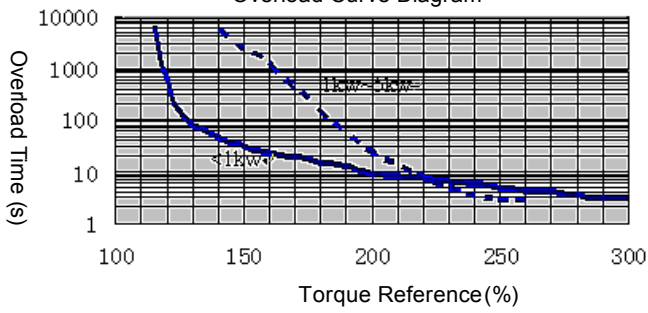
- When H0a-00 is set to 2, the servodrive can be powered on or off independently. That is, the main power can be turned off when the control power is on. This can quickly bleed the electricity in the capacitor, ensuring safety. Currently, the bus voltage of the main circuit cannot be connected in parallel.
- When H0a-00 is set to 2, ensure that three-phase 220V or three-phase 380V input is normal since phase missing fault is disabled. Otherwise, damage to modules may result.

7.5.9 Overload Feature

All Servodrives have a peak current (Imax) that allows operation, but it does not mean that servodrives can operate under this peak current for long. The time when the servodrive works continuously under the peak current is called Continuous Operation Time under Peak Current. The critical current that allows long-time operation is called Threshold Current for Motor Overload Protection (Ic).

Overload curve of the servodrive shows one-one correspondence between a specific current and the continuous operation time under this current. The continuous operation time depends on the heat generated under the specific current. The following figure shows the overload curves of servodrives with different power rates.

Overload Curve Diagram



7.5.10 Setting and Protecting the Brake Resistance

The servodrive can protect the regenerative resistor through corresponding function codes, as follows:

Function Code	H02	H02	H02
	21	22	23
Name	Drive Allowable Minimum Value of Regenerative Resistor	Built-in Regenerative Resistor Power Capacity	Built-in Regenerative Resistor Resistance
Setting Range	1Ω-1000Ω (Readable)	1-65535W (Readable)	1Ω-1000Ω (Readable)
Min. Unit	1Ω	1W	1Ω
Factory Setting	Model dependent	Model dependent	Model dependent
When Enabled	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting
Related Mode	PST	PST	PST

Function Code	H02	H02	H02
	25	26	27

Name	Regenerative Resistor Setting	External Regenerative Resistor Power Capacity	External Regenerative Resistor
Setting Range	0: Built-in regenerative resistor 1: External regenerative resistor and natural cooling 2: External regenerative resistor and forced air cooling 3: No regenerative resistor, dependent on the capacity	1W-60000W	1Ω-1000Ω
Min. Unit	1	1W	1Ω
Factory Setting	0	Different models have different default values	Different models have different default values
When Enabled	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting
Related Mode	PST	PST	PST

【Note】

1. The H02-21 gives the allowable minimum value of regenerative resistor based on rated current and over-voltage point of servodrive’s resistor triode.
2. The H02-22 gives the power capacity of the built-in regenerative resistor (if exists). The debugger determines whether the resistance overloads and whether it alarms through the parameter.
3. The H02-23 gives the value of the built-in regenerative resistor (if exists).
4. You must set H02-25 according to the actual condition. By default, H02-25 is set to 0. If an external resistance is used, H02-25 should be set to 1 or 2. If you want to disable the bleeding function, set H02-25 to 3. Improper setting may cause abnormal regenerative braking.
5. You must set H02-26 based on the power capacity of actually connected regenerative resistor.
   For example, if an external resistance indicates 800w power on its label, you should set H02-26 to 800. Improper setting of H02-26 may cause damage to triode or resistor.
   The servodrive is capable of protecting the regenerative resistor based on the power you set. If the bleeding power during operation exceeds the bleeding capacity, the servodrive will bleed off the electricity at the originally constant power. This may lead to over-voltage.

【Note】 The power capacity should be calculated based on the actual working conditions, such as the rotating inertia and deceleration time. For details, refer to the appendix. Over-small power leads to insufficient regenerative ability, which can easily cause over-voltage.

6. You must set H02-27 correctly according to actually connected regenerative resistor. The external regenerative resistor cannot be smaller than the value of H02-21.
   For example, if actually connected resistance is 33Ω, you should set H02-27 to 33. Improper setting of H02-27 may cause damage to triode or resistor.
   The servodrive can judge whether the input resistance is smaller than the minimum value. If yes, the servodrive reports Er.922. Then you should re-input the resistance until the alarm is reset. If you leave it, the servodrive disables the bleeding function to prevent hardware. This can easily cause over-voltage.
   The resistance should be calculated based on the actual working conditions. For details, refer to the appendix. If the external resistance is smaller than the minimum value or is short-circuited, resistor triode may be burnt out.
7. You can improve the bleeding capacity by increasing resistance wire heating time constant of H01.21, which affects the resistor initial braking continuous time and lowering speed. Setting for long may burn out the resistor.

7.5.11 Motor Startup Angle and Phase Sequence Identification

If servomotor’s UVW three-phase power lines are connected properly, the servodrive does not deed the motor startup angle and phase sequence identification function. If you are not sure whether the phase sequence is correct when connecting UVW power lines, you can make the servomotor operate normally by using the startup angle and phase sequence identification function.

The identification steps are as follows:

1. Ensure that the servomotor encoder signal is connected properly.
2. Ensure that the servomotor is connected to zero or light load.
3. Ensure that the servo is in the disabled state.
4. Set function code H0d03 to 1. The servo enters into the identification status and automatically operates for 20 seconds.

If ER.602 is found, the servo needs to identify again.

Once angle identification completes, if connecting sequence of servomotor’s UVW power lines complies with the specification, function code H00.08 is displayed as 0. Conversely, H00.08 is automatically set to 1, which indicates connecting sequence error. In this case, check UVW phase sequence and re-identify until H00.08 is 0.

After identification completes, H00-33 initialized electric angle and H00.34 phase-U electric angle have been refreshed. Please back up these two function codes if necessary.

【Note】 When the servomotor model is changed, H00-08 will refresh to 0.

Related function codes are shown as follows:

Function Code	H00	H0d
	08	03
Name	Motor U/V/W Phase Sequence	Angle Identification
Range	0-1	0-1
Min. Unit	1	1
Factory Setting	0	0
When Enabled	Immediately	Immediately
Data Type	Stop setting	Stop setting

7.6 Setting General I/O Signals

This section describes DI/DO configuration and other I/O signals in other control modes.

The IS500 Servodrive Series has 10 digital inputs: DI1, DI2, ···, DI10. They are collector inputs. There are 7 digital outputs. DO1, DO2, DO3 and DO4 are ambipolar open collector outputs. DO6, DO7 and DO8 are open collector outputs.

7.6.1 Configuring Digital I/O Signals

■ Allocating DI Signals

You can configure DI terminals freely through the panel or host controller.

For example, to configure DI1 with FunIN.6 (CMD1) signal, set H03-02 to 6.

There are five options for DI terminal logic:

- 0: Low level is enabled
- 1: High level is enabled
- 2: Rising edge enabled
- 3: Falling edge enabled
- 4: Both rising and falling edges are enabled

If you want to set DI1 to low level enabled, set H03-03 to 0. You can set function codes of other DI terminals in the same way.

【Note】
- Do not allocate different DIs with the same function. Otherwise, fault Er.130 occurs.
- If the Interrupt Length function is enabled, DI9 is allocated with external position interrupt signals by default.
- If the Handwheel function is enabled, DI9 and DI10 are considered as input terminals for PHIP and NHIP by default. In other cases, DI9 and DI10 are used as common terminals.

The following table lists the function codes of DI1.

Function Code	H03	H03
	02	03
Name	DI1 Terminal Function Selection	DI1 Terminal Logic Selection
Setting Range	Input Function Code: 0, 1-32. 0: No Definition; 1-32: FunIN.1-32 (Refer to the DI/DO Basic Function Code Table).	Input Polarity: 0-4. 0: Low level is enabled; 1: High level is enabled; 2: Rising edge enabled; 3: Falling edge enabled; 4: Both rising and falling edges are enabled.
Min. Unit	1	1
Factory Setting	6	0
When Enabled	After Restart	After Restart
Data Type	Running Setting	Running Setting

Explanation of I/O terminal logic:

- Low level: switch ON
- High level: switch OFF
- Rising edge: switch from ON to OFF
- Falling edge: switch from OFF to ON

Select the terminal logic based on the selected function.

For unallocated DIs, configure them based on H03-00 (unallocated FunINL signals) and H03-01 (unallocated FunINL signals). Set H03-00 and H03-01 to HEX values.

- Each H03-00 binary bit corresponds to FunIn.1-FunIn.16 from low to high (0: always disabled, 1: always enabled).
- Each H03-01 binary bit corresponds to FunIn.17-FunIn.32 from low to high (0: always disabled, 1: always enabled)

These two function codes are running setting, effective after re-power-on.

The following table lists DI terminal signals.

Function Code	Signal	Definition	Function Code	Signal	Definition
FunIN.1	/S-ON	Servo Enabled	FunIN.17	/N-CL	Reverse External Torque Limit ON
FunIN.2	/ALM-RST	Error Reset Signal	FunIN.18	/JOGCMD+	Forward Jog
FunIN.3	/P-CON	Proportional Motion Switch	FunIN.19	/JOGCMD-	Reverse Jog

Function Code	Signal	Definition	Function Code	Signal	Definition
FunIN.4	/CMD-SEL	Main and Auxiliary Running Reference Switch	FunIN.20	/POSSTEP	Position Step Input DI Variable
FunIN.5	/DIR-SEL	MS Running Reference Direction Selection	FunIN.21	HX1	Handwheel MF Signal 1
FunIN.6	CMD1	CMD1 Internal Reference Switch CMD1	FunIN.22	HX2	Handwheel MF Signal 2
FunIN.7	CMD2	Internal Reference Switch CMD2	FunIN.23	HX_EN	Handwheel Enable Signal
FunIN.8	CMD3	Internal Reference Switch CMD3	FunIN.24	GEAR_SEL	Electronic Gear Selection
FunIN.9	CMD4	CMD1 Internal Reference Switch CMD4	FunIN.25	TOQDirSel	Torque Reference Direction Setting
FunIN.10	M1-SEL	Mode Switch M1-SEL	FunIN.26	SPDDirSel	Speed Reference Direction Setting
FunIN.11	M2-SEL	M-SEL Mode Switch M-SEL	FunIN.27	POSDirSel	Position Reference Direction Setting
FunIN.12	/ZCLAMP	Zero-position Fixed Function Enabled Signal	FunIN.28	PosInSen	Internal MS Position Enabled Signal
FunIN.13	/INHIBIT	Pulse Disabled	FunIN.29	XintFree	Interrupt Length Status Clear Signal
FunIN.14	P-OT	Forward Drive Disabled	FunIN.30	G-SEL	Gain Switch
FunIN.15	N-OT	Reverse Drive Disabled	FunIN.31	OrgNear	Origin Switch
FunIN.16	/P-CL	Forward External Torque Limit ON	FunIN.32	OrgChufa	Origin Return Enabled

For details of DI variables, refer to the appendix Function Code Parameter List.

■ Allocating DO Signals

Dos output 17 effective variables: FunOut.1, FunOut.2, ⋯, FunOut.17. These variables are effective when they are allocated to DOs.

You can configure DO terminals freely through the panel or host controller.

For example, to configure DO1 with signal /S-RDY, set H04-00 to 1.

There are two options for DO terminal logic:

- 0: Low level is enabled (optocoupler ON)
- 1: High level is enabled (Optocoupler OFF)

If you want to set signal /S-RDY to high level enabled, set H04-01 to 1.

【Note】 Do not allocate different DOs with the same function. Otherwise, DO setting fault occurs.

The following table lists DO terminal signals.

Function Code	Signal	Definition	Function Code	Signal	Definition
FunOUT.1	/S-RDY+-	Servo Ready	FunOUT.10	/WARN+-	Warning Output
FunOUT.2	/TGON+-	Motor Rotation Detection Signal	FunOUT.11	/ALM+-	Error Output
FunOUT.3	/ZERO+-	Zero Speed	FunOUT.12	ALMO1	Output 3- Digit Error Code
FunOUT.4	/V-CMP+-	Speed Arrival	FunOUT.13	ALMO2	Output 3- Digit Error Code
FunOUT.5	/COIN+-	Position Arrival	FunOUT.14	ALMO3	Output 3- Digit Error Code
FunOUT.6	/NEAR+-	Position Approach Signal	FunOUT.15	Xintcoin	Interrupt Length Completion signal
FunOUT.7	/C-LT+-	Torque Limit Signal	FunOUT.16	OrgOk	Origin Return Output
FunOUT.8	/V-LT+-	Rotation Speed Limit	FunOUT.17	OrgOkElectric	Electric Return to Origin Output
FunOUT.9	/BK+-	Brake Output Signal			

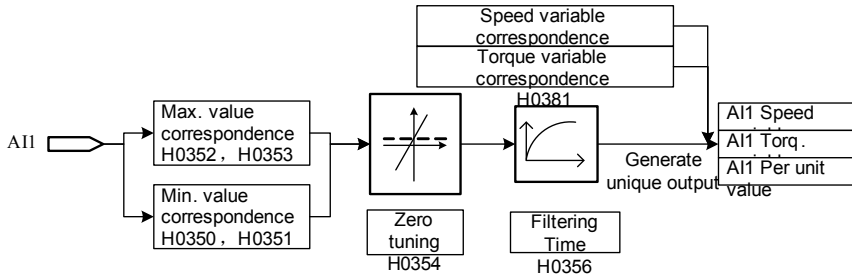
For DO variables, refer to the appendix Function Code Parameter List.

7.6.2 Configuring Analog Input

There are three analog inputs: AI1, AI2 and AI3. You can set the correspondence between analog input and control variable by setting the corresponding function code.

For example, to designate AI1 is as main operation reference input in speed mode and correspond analog ±10 V to ±5000 rpm, set the function codes as below:

- H06-00: 1
- H03-52: 10.00 V
- H03-53: 100.0%
- H03-50: -10.00 V
- H03-51: -100.0%
- H03-80: 5000 rpm

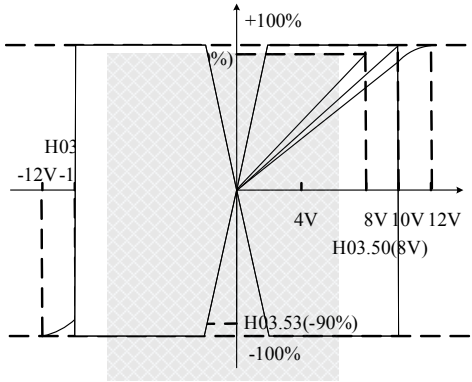


Designate analog using method based on the function codes below .

H0519-Speed Feedforward Control Selection
H0600-Master Speed Reference A Source
H0601-Auxiliary Speed Reference B Source
H0700-Master Torque Reference A Source
H0701-Auxiliary Torque Reference Source B
H0708-T-LMT Selection
H0718-V-LMT Selection
Reserved 1
Reserved 2

Corresponding rule of analog voltage and control variable is:

Analog input range is ±12V and normal inspection range is ±10V. For details, refer to technical specifications.



In the above figure, the shaded areas can realize full scale ±100% at any voltage. In other areas, full scale cannot be realized or the analog voltage precision cannot be fully utilized.

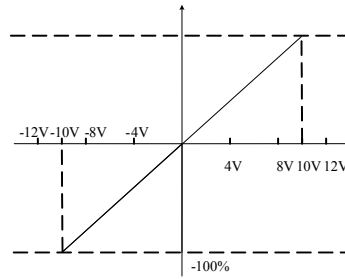
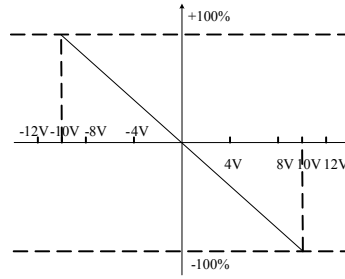
It is suggested that the range between maximum voltage and minimum voltage be not set too small. Otherwise, the analog sampling scale cannot be effectively utilized. Currently, the allowable minimum voltage difference (Max. input voltage – Min. input voltage) is 0.5V. Difference of less than 0.5 V is handled as 0.5V.

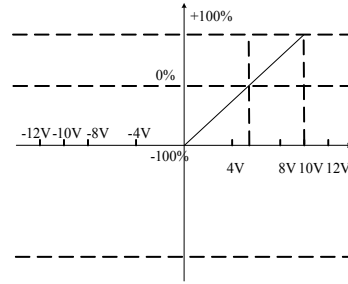
Take AI1 as an example. The correspondence can be set via the following function codes.

Function Code	H03	H03	H03	H03
	50	51	52	53
Name	AI1 Minimum Input	AI1 Minimum Value Corresponds to the Setting Value	AI1 Maximum Input	AI1 Maximum Value Corresponds to the Setting Value
Setting Range	-10.00V to 10.00V	-100.0% to 100.0%	-10.00V to 10.00V	-100.0% to 100.0%
Min. Unit	0.01V	0.1%	0.01V	0.10%
Factory Setting	-10.00V	-100.0%	10.00V	100.00%
When Enabled	Immediately	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting	Stop Setting

【Note】 When setting these function codes, H03-50 and H03-52 are associated. That is, H03-50 is smaller than H03-52. But H03-51 and H03-53 can be designated freely based on actual condition. It is suggested that H03-51 and H03-53 are set to their maximum absolute values.

For example:

Function Code Setting	Setting Result Description
H03-50 = 10V H03-51 = 100% H03-52 = -10V H03-53 = -100%	 Bipolarity signal input indicates the bipolarity variable.
H03-50 = -10V H03-51 = -100% H03-52 = 10V H03-53 = 100%	 Bipolarity signal input indicates the reverse bipolarity variable.

Function Code Setting	Setting Result Description
H03-50 = 10V H03-51 = 100% H03-52 = 0V H03-53 = -100%	 Unipolarity signal input indicates the bipolarity signal.

Determine the control variable range that corresponds to 100% full scale through function codes H03-80 and H03-81.

Function Code	H03	H03
	80	81
Name	Analog100% Corresponding Speed Value	Analog100% Corresponding Torque Value
Setting Range	0rpm to 9000 rpm	One time to eight times of rated torque
Min. Unit	1rpm	One time rated torque
Factory Setting	3000rpm	One time rated torque
When Enabled	Immediately	Immediately
Data Type	Stop Setting	Stop Setting

■ Zero Tuning

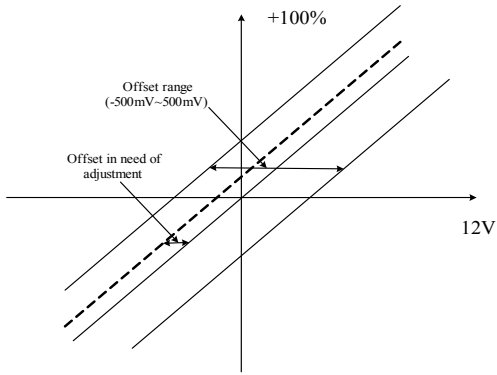
Analog channels also have the zero tuning function. When the reference analog voltage is 0V, a ground voltage difference exists. In this case, you can remove the voltage difference through zero tuning function. Note that the analog scale may be shortened if zero tuning is overlarge.

Zero tuning includes automatic tuning and manual tuning. For automatic tuning, you can set H0d-10 to 1, 2 or 3 to select the corresponding analog channel. Tuning values are saved in H03-54, H03-61 and H03-68 respectively.

Function Code	H0d	H03	H03	H03
	10	54	61	68
Name	Analog channel automatic adjustment	AI1 Zero Offset	AI2 Zero Offset	AI3 Zero Offset
Setting Range	0rpm to 9000 rpm	-500.0mV to 500.0 mV	-500.0mV to 500.0mV	-500.0mV to 500.0mV
Min. Unit	1rpm	0.1mV	0.1mV	0.1mV

Factory Setting	3000 rpm	0 mV	0 mV	0mV
When Enabled	Immediately	Immediately	Immediately	Immediately
Data Type	Stop Setting	Running Setting	Running Setting	Running Setting

Operation steps of manual tuning are as follows:



Step	Operation	Description
1	Designate an analog channel (AI1) as reference source in the speed mode.	Set the function codes of group H06.
2	Set the corresponding speed range.	Set function codes H03-52, H03-53, H03-50 and H03-51.
3	Enable the servo and set the analog reference of the host controller to 0.	
4	Observe whether the motor rotates.	
5	If the motor does not rotate, zero tuning is not necessary.	
6	If the motor rotates, adjust H03-54 in the rotation direction until the motor stops.	If the motor speed reference increases (speed increase) with the increasing of H03-54, decrease the value of H03-54, vice versa.

■ Setting the analog filtering time

The filter is a 1st-order filter that is used for filtering high-frequency noise in analog sampling signals. Set the filtering time as long as possible in the condition that the reference bandwidth is satisfied. The filtering time can be properly decreased based on your requirement on reference response.

No.	Aix Setting Variable	Recommended Filtering Time
1	Speed reference	2ms
2	Torque reference	1ms

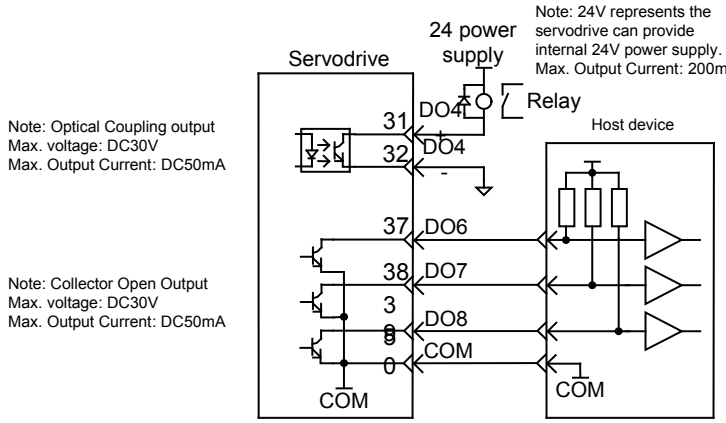
The following table lists the function codes for setting the filtering time of analog channels.

Function Code	H03	H03	H03
	56	63	70
Name	AI1 Input Filtering Time	AI2 Input Filtering Time	AI3 Input Filtering Time
Setting Range	0.00ms to 655.35ms	0.00ms to 655.35ms	0.00ms to 655.35ms
Min. Unit	0.01ms	0.01ms	0.01ms
Factory Setting	2.00ms	2.00ms	2.00ms
When Enabled	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting

7.6.3 Other Output Signals

The servodrive alarm is graded into two levels:

- Level I (Error): The servodrive alarms and has to stop when an error occurs. DO outputs signal /ALM.
- Level II (Warning): The servodrive sends out warning status, which will not damage the machine temporarily. But there will be a higher level of error output if the warning status is not handled timely. DO outputs signal /WARN.



1） Servo Error Output Signal (ALM) with Error Code (ALMO1, ALMO2 and ALMO3)

- Servo Error Output Signal (ALM)

DO outputs signal /ALM when the servodrive detects an error. When designing the control system, use the output of this error signal to implement a sequence control circuit that can break the main circuit of the servodrive.

Code	FunOUT.11
Signal Name	ALM+-
Function Name	Error Output Signal
Description	ON when error is detected
Status	Allocation
Remarks	Refer to Part 6.2.1 for Allocation Methods

- Error Code (ALMO1, ALMO2 and ALMO3)

The type of error detected by servodrive can be displayed via ON/OFF of this group of signals. This group pf signals is used in the applications without on-site bus supporting where host devices expect a display of error contents.

Code	FunOUT.12	FunOUT.13	FunOUT.14
Signal Name	ALMO1	ALMO2	ALMO3
Function Name	Error code 1	Error code 2	Error code 3
Description	Error code	Error code	Error code
Status	Allocation	Allocation	Allocation
Remarks	It is suggested to allocate the three signals to terminals DO6/7/8.		

- How to Set the Alarm

IMPORTANT

Make sure of clearing the fault before resetting the alarm.

When the error signal ALM is output, clear the fault first. Then set the input signal ALM-RST to ON. The alarm is reset.

Code	FunIN.2
Signal Name	ALM-RST
Function Name	Error Reset Signal
Description	According to the error type, the servo can continue to work after some alarms are reset.
Status	Common use

For allocating DO with the output signal, refer to section7.6.1.

Form an external circuit so that the main circuit turns OFF when an error occurs. The alarm can be reset automatically when the control power supply is turned OFF. Alarms can also be reset using a panel.

2） Servo Warning Output Signal (/WARN)

DO outputs warning signal /WARN when overload warning, regenerative warning or any other warning is detected by the servodrive.

Code	FunOUT.12
Signal Name	WARN+-
Function Name	Warning Output Signal
Description	ON when warning is detected
Status	Allocation

When only warning is detected, ALM0, ALM1 and ALM2 output warning code when warning signal (WARN+-) is output.

When both warning and error are detected, AL0, AL1 and AL2 output error code when warning signal (WARN+-) and error signal (ALM+-) are output.

3） Servo Ready Output Signal (/S-RDY)

This signal indicates whether the servodrive completes the power-on initialization work. The signal is disabled when an error occurs.

Code	FunOUT.1
Signal Name	/S-RDY+-
Function Name	Servo Ready
Description	Servo is ready to receive S-ON signal Enabled: Servo ready Disabled- Servo Not ready
Status	Allocation
Remarks	Refer to Part 6.2.1 for allocation method

8

Operation

Chapter 8 Operation

8.1 Pre-trial Checking

To ensure safety and proper trial operation, check the following items before the trial:

1. Status of the servomotor
   - Ensure fixed parts of the servomotor are securely connected.
   - Ensure servomotor shaft rotates fluently (note that oil-sealed motor shaft is normally a bit tight).
   - Ensure the servomotor's encoder connector and power supply's connector are wired properly and securely.
2. Status of the servodrive
   - Ensure terminals of the servodrive are properly wired and securely connected.
   - Check the external power supply of the servodrive and make sure that the voltage is normal.
   - Connect the encoder cable and power lines of the servodrive and servomotor.
3. Connection and status of input signals.

Step	Item	Operation
1	Confirm CN1 terminal	Connect the input signal circuit necessary for trial to control terminal CN1 under the following conditions: • Servo ON input signal (/S-ON) must be input-capable. • Forward drive disabled (P-OT) and reverse drive disabled (N-OT) input signals must be in the OFF state (forward/reverse drive is supported). Resume the standard setting after trial is complete. • When inputting reference, ensure that the reference is 0 V or pulse reference is 0.
2	Confirm power-on status	Power on the servodrive. If the panel displays "rdy", it indicates normal. Otherwise, check whether wiring is proper. If an alarm is given, clear the fault based on Troubleshooting. Otherwise, the servodrive cannot operate.
3	Confirm signals of holding brake	The holding brake is controlled by signal /BK of servodrive. To prevent maloperation caused by gravity or external force, check the operation of the holding brake in the condition that the servomotor and the machine are disconnected. Then connect the servomotor to the machine and proceed with the trial.

CAUTION
Make sure that the parameters of the servomotor's group H00 are consistent or compatible to the actually connected servomotor.

If abnormality is found, please feel free to contact Inovance's service department.

8.2 Examples of Jog Run

8.2.1 Jog Run via Function Codes and DIs

Step	Item	Operation
1	Set the running speed	Set the motor’s running speed via H06-04. Setting range: -9000 to 9000 rpm
2	Set the speed reference source	Set the speed reference source via H06-02. H06-02=0: source A H06-02=1: source B
3	Select the Jog reference	Source A: Select Jog reference via H06-00=4. Source B: Select Jog reference via H06-01=4.
4	Set the Jog input terminals (DI).	Set jog input terminals (DI) through H03. H03-18=18: DI9= forward jog (/JOGCMD+) H03-18=19: DI10= reverse jog (/JOGCMD-)
5	Execute Jog operation	Switch on signal /S-ON to enable the servodrive (factory setting: DI5 is set to /S-ON). Execute Jog operation through DI9 and DI10.

8.2.2 Jog Run via Panel

In this case, it’s unnecessary to connect I/O terminals of CN1. Connect the motor only. After power-on, “rdy” is displayed on the panel. Input H0d-11 on the keypad to enter the Jog mode. You can adjust the Jog running speed by pressing the UP/DOWN button. The Jog running speed is 100 rpm by default. Press the SET button to enter the Jog status. Then, the panel displays “Jog”. You can implement jog forward/reverse rotation by pressing the UP/DOWN button.

8.2.3 Jog Run via Debugger

Step	Item	Operation
1	Connect	Connect the computer.
2	Open the jog interface	Enable the Jog trial operation function on the auxiliary function menu of the back segment control software.
3	Execute jog operation	Set the jog speed and realize forward/reverse Jog operation by pressing the UP/DOWN button.

8.3 Examples of Trial Operation in Speed Mode

8.3.1 Continuous Running

■ Purpose

The servomotor runs stably at any speed in the allowable range.

■ Procedure

Step	Operation
1	Select the control mode via H02-00=0 (speed control).
2	Select speed reference via H06-02=0 (source A).

3	Select speed reference source A via H06-00=0 (digital given).
4	Set the speed via H06-03=2000 (2,000rpm).
5	Set the acceleration time H06-05=1000 (1,000ms).
6	Set the deceleration time H06-05=1000 (1,000ms).
7	Set the maximum speed H06-07=3000 (3,000rpm)
8	Set the maximum speed in forward direction via H06-08=1000 (1,000rpm).
9	Set the maximum speed in reverse direction via H06-08=800 (800rpm).
10	Turn ON the Servo enabled (/S-ON) input signal. The motor is found to rotate at the speed of 1,000rpm from H0b-00.
11	Set H06-08=3000. The speed becomes the preset 2,000rpm from H0b-00.

8.3.2 MS Speed

■ Purpose

The servomotor runs at three speeds (50rpm, 100rpm and 300rpm) in cycle continuously. It runs at each speed for 5 seconds, requiring smoother speed change and smaller shock.

■ Procedure

Step	Operation
1	Select the control mode via H02-00=0 (speed control).
2	Select speed reference via H06-02=1 (source B).
3	Select speed reference source B via H06-01=5 (MS speed).
4	Select MS speed running mode via H12-00=1 (cycle run).
5	Designate segments via H12-01=3 (3 segments).
6	Select running time unit via H12-02=0 (second).
7	Set acceleration time 1 via H12-03=3000 (3,000ms) and deceleration time 1 via H12-04=3000 (3,000ms).
8	Set 1st-segment speed parameters: • Speed: H12-20=50 (50rpm) • Running time: H12-21=5.0 (5s). • Acceleration/Deceleration time: H12-22=1 (acceleration/deceleration time 1)
9	Set 2nd-segment speed parameters (H12-23, H12-24 and H12-25) as you do in step 8.
10	Set 3rd-segment speed parameters (H12-26, H12-27 and H12-28) as you do in step 8.
11	Change segments via H12-01=2 (2 segments). Then the servomotor runs at two speeds in cycle from H0b-00.
12	Change MS speed running mode via H12-00=0 (single run). Then the servomotor stops after running at two speeds.
13	You can change the speed of each segment and observe the change from H0b-00.

8.3.3 Analog Control

■ Purpose

Take AI1 in source A as the speed reference source. The rotating speed can change

continuously from 0rpm to +1,000 rpm when voltage changes in the range of 0V-10V.

■ Procedure

Step	Operation
1	Prepare a DC power supply. Wire its positive polarity with AI1 and wire negative polarity with GND.
2	Select the control mode via H02-00=0 (speed control).
3	Select speed reference via H06-02=0 (source A).
4	Select speed reference source A via H06-00=1 (AI1)
5	Set parameters related to AI1 • Min. input : H03-50=0 (0V) • Min. input corresponding to setting value: H03-51=0 (0%) • Max. input : H03-52=10 (+10V) • Max. input corresponding to setting value: H03-53=1000 (100%)
6	Designate the speed indicated by 100% of analog via H03-80=1000 (1,000rpm).
7	Reduce the voltage to 0V. If the motor rotates, set AI1 zero offset via H03-54=300 (300mV), which depends on the motor current rotating speed. Tune the value of H03-54 until servomotor stops.
8	Turn the servo ON and twist the power supply’ s knob. You will find the motor rotating speed varies with voltage. When the input voltage exceeds the preset value, the motor runs at a constant speed. Note: The input voltage is no higher than 12V.
9	If you want to make the rotating speed change continuously in the range of 0rpm-1,000rpm, set H03-51=-1000 (-100%). Then turn the servo ON. You will find the motor rotates counterclockwise and the speed varies with voltage. When the input voltage exceeds the preset value, the motor runs at a constant speed. Note: The input voltage is no higher than 12V.

8.4 Examples of Trial Operation in Position Mode

8.4.1 Stepping Given

■ Purpose

Turn the servo ON. The motor stops after it rotates one revolution at 48rpm.

■ Procedure

Step	Operation
1	Select the control mode via H02-00=1 (position control).
2	Select position reference source A via H05-00=1 (stepping given).
3	Set stepping via H05-03=5000 (5,000 reference units).
4	Designate electric gear ratio via H05-07/H05-09=2 (2).
5	Allocate DI4 with signal FunIN.20 (/POSSTEP) via H03-08=20 so that the motor rotates after switching on DI4.
6	Restart the servo and switch on DI4. You will find the motor stops after it rotates one revolution at 48rpm from H0b-00.

7	To change the rotating speed, change the electric gear ratio. Speed (rpm) =24×Electrictric gear ratio (rpm).
8	To change the motor travel, change the stepping and electric gear ratio. Revolutions (r) = Stepping × Electric gear ratio/10,000.

8.4.2 Pulse Reference

■ Purpose

Take PLC pulse output as reference source. The motor rotates if there is pulse input and stops once the pulse input stops. The forward/reverse rotation is also controlled. The motor stops after it rotates one revolution at 6rpm every time.

■ Procedure

Step	Operation
1	Prepare a PLC that has been programmed and can implement intermittent output of 100kHz pulse. Each output lasts 10 seconds.
2	Wire Y00 of PLC with PULS- of CN1, COM1 of PLC with COM of CN1, and SIGN- of CN1 with COM of CN1.
3	Select the control mode via H02-00=1 (position control).
4	Select position reference source A via H05-00=0 (pulse reference).
5	Designate electric gear ratio via H05-07/H05-09=1/100 (1/100).
6	Turn the servo ON first. Then enable the PLC output. Note: Do not reverse the sequence. Otherwise, an error occurs. From H0b-00, you will find the motor runs CW at 6rpm, and stops after rotating one revolution every time.
7	After disconnecting SIGN-, you will find the motor immediately rotates CCW at 6rpm. It still stops after rotating one revolution every time.
8	To change the motor speed and travel, change the electrical gear ratio. Speed = 0.006×f×Electrical gear ratio, where “f” indicates pulse frequency (Hz). Revolutions (r) = Speed × Time

8.5 Examples of Trial Operation in Torque Mode

8.5.1 Digital Given

■ Purpose

Set the torque to be 10% of rated torque by digital given. To ensure safety, limit the motor speed within 1,200rpm and the torque within 20% of rated value.

■ Procedure

Step	Operation
1	Select the control mode via H02-00= 2 (torque control).
2	Select torque reference via H07-02=0 (source A).
3	Select torque reference source A via H07-00=0(digital given).
4	Set torque via H07-03=100 (10.0%).

5	Select speed limit source via H07-17=0 (internal limit).
6	Set speed limit via H07-19=1200 (1,200rpm).
7	Select torque limit source via H07-07=0 (internal limit).
8	Set forward torque limit via H07-09=200 (20.0%).
9	Set reverse torque limit via H07-10=200 (20.0%).
10	Turn the servo ON. You will find the motor accelerates to rotate but is finally limited at approximately 1,200rpm. Note: Motors of different inertias rotates at different speeds. Thus, it is probable that the speed is not limited.
11	You will find different situations from H0b-00 and H0b-02 if you change speed value limit and torque limit value.

8.5.2 Analog Control

■ Purpose

Take AI1 in source A as the speed reference source. Torque can change continuously from 0 to +10% when voltage changes in the range of 0V to 10V. To ensure safety, limit the motor speed within 1,200rpm and the torque within 20% of rated value.

■ Procedure

Step	Operation
1	Prepare a DC power supply. Wire its positive polarity with AI1 and wire negative polarity with GND.
2	Select the control mode via H02-00= 2 (torque control).
3	Select torque reference via H07-02=0 (source A).
4	Select torque reference source A via H07-00=1 (AI1).
5	Set parameters related to AI1: • Min. input: H03-50=0 (0V) • Min. input corresponding to setting value: H03-51=0 (0%) • Max. input: H03-52=10 (+10V) • Max. input corresponding to setting value: H03-53=100 (+10%)
6	Designate the Torque indicated by 100% of analog via H03-81=100 (one time of rated torque).
7	Select speed limit source via H07-17=0 (internal limit).
8	Set speed limit via H07-19=1200 (1,200rpm).
9	Select torque limit source via H07-07=0 (internal limit).
10	Set forward torque limit via H07-09=200 (20.0%).
11	Set reverse torque limit via H07-10=200 (20.0%).
12	Reduce the voltage to 0V. If the motor rotates, set AI1 zero offset via H03-54=300 (300mV), which depends on the motor current rotating speed. Tune the value of H03-54 until servomotor stops.
13	Turn the servo ON and twist the power supply’s knob. You will find the motor torque varies with voltage. When the input voltage exceeds the preset value, the motor torque remains unchanged and is finally limited at 10%. Note: The input voltage is no higher than 12V.

14	You will also find the motor accelerates to rotate but is finally limited at approximately 1,200rpm. Note: Motors of different inertias rotates at different speeds. Thus, it is probable that the speed is not limited.
15	You will find different situations from H0b-00 and H0b-02 if you change speed value limit and torque limit value.
16	To implement a continuous change of torque within 0 to 10%, set H03-51=100 (-10%). Then restart the servo and you will find the motor rotates in the reverse direction and torque varies with voltage. When the input voltage exceeds the preset value, the motor runs at a constant torque. Note: The input voltage is no higher than 12V.

8.6 Operation with the Servomotor Connected to the Machine

Before trial operation with the servomotor connected to the machine, perform zero-load trial as described above first.

DANGER
Once the servomotor is connected to the machine, maloperation may result in machine damage and even personal injury.

CAUTION
During no-load trial operation. overtravel protection signals (P-OT and N-OT) are not allocated to terminals. In this case, allocate them to the DI terminal to enable the protection function.

■ Procedure

Step	Operation
1	Turn ON the control power and main circuit power, and make protective settings such as over-travel, braking resistor and brake. • Select the braking resistor according to the load. • Enable the over-travel protective function and properly set the over-travel stop parameters. • When a servomotor with brake is used, before checking the brake operation, take advance measures to prevent the machine from falling due to gravity or vibrating due to external force and make sure that operations of servomotor and brake are normal.
2	Set the operation mode and the reference source in this mode.
3	Connect the servomotor to the machine with coupling, etc. in the state of power OFF.
4	After ensuring that the servodrive is turned OFF, turn ON the power of host controller. Check again that the settings of protective function in step 1 are normal. For steps 5 to 8, take advance measures for emergency stop so that the servomotor can stop safely when an error occurs during operation.
5	Perform trial operation according to “8.1.5 Trial Operation in the Position Control Mode”. Check that the result is the same as the trial operation for servomotor without load. Also check that the reference unit and direction are consistent with the machine operation.

Step	Operation
6	Check that the parameter settings comply with each control mode again. Check that the servomotor operates in accordance with the operating specifications of the machine.
7	Adjust the servo gain parameters and improve the control performance of the servomotor with load, if necessary. Note: The servomotor will not be broken in completely during the trial operation. Therefore, let the system run for a sufficient amount of additional time to ensure that it is properly broken in.
8	Record the parameters set for maintenance in the Parameter Recording Table. Then the trial operation with the servomotor connected to the machine is completed. Note: You can also manage the parameters in form of a file through the debugger.

9

Adjustments

Chapter 9 Adjustments

This chapter introduces the usage and precautions of various functions related to servomotor adjustments.

9.1 Basic Adjustments

9.1.1 About Adjustment

Once servodrive and servomotor are well matched, adjustment is aimed to optimize the servodrive's response performance that depends on the servo gain setting.

Servo gain is set by a combination of parameters (speed, position gain, filter and load moment of inertia ratio). When setting the servo gain, balance of values of these parameters must be taken into consideration. Therefore, parameter adjustment may only be performed by qualified personnel or you can ask Inovance for technical support.

Servo gain parameters have been set to a conservative stable value upon delivery. The user can adjust servo gain according to the machine status so as to improve the servo response performance.

9.1.2 Adjustment of Analog Control Signals

To observe the signal status while adjusting the servo gain, connect the oscilloscope and other measuring instruments to the servodrive's analog monitor connector.

Analog monitor specifications are as follows:

Item	Specification	Remark
CH No.	2CH	
Output range	0-10V	Linear effective range: within 2 to 8V
Resolution	0.1%	
Accuracy	5%	
Allowable maximum load current	10mA	
Setting Time	3ms(typ)	

CAUTION
Upon control power ON, analog monitor may output approximate 10V voltage within up to 200ms. Take it into consideration during the use.

For wiring of analog monitoring connector, refer to CN5 terminal definition.

■ Setting of Analog Monitoring Magnification

CH1 analog monitoring output voltage = CH1 signal selection (H04-50) × signal

magnification (H04-52) + offset voltage 1 (H04-51)

CH2 analog monitoring output voltage = CH2 signal selection (H04-53) × signal magnification (H04-55) + offset voltage (H04-54)

■ Related Signals

AO1 output variables can be specified via H04-50. The corresponding relationship between output variable and analog can be specified via H04-51 and H04-52.

Function Code	H04	H04	H04
	50	51	52
Name	AO1 Signal Selection	AO1 offset Voltage	AO1 magnification
Setting Range	00: Motor rotating speed (1V/1000rpm) default 01: Speed reference (1V/1000rpm) 02: Torque reference (1V/100%) 03: Position deviation (0.05V/1 reference unit) 04: Amplifier deviation (after electronic gear) (0.05V/1 encoder pulse unit) 05: Position reference speed (1V/1000 rpm) 06: Positioning complete reference (complete: 5V, incomplete: 0V) 07: Speed feed forward (1V/1000rpm)	0-10000mV	-99.99 to 99.99
Min. Unit	1	1mV	0.01times
Factory Setting	0	5000mV	1
When Enabled	Immediately	Immediately	Immediately
Data Type	Running Setting	Running Setting	Running Setting

Function Code	H04	H04	H04
	53	54	55
Name	AO2 signal selection	AO2 offset Voltage	AO2 magnification
Setting Range	00: (1V/1000rpm) Motor speed default 01: Speed reference (1V/1000rpm) 02: Torque reference (1V/100%) 03: Position deviation (0.05V/1 reference units) 04: Amplifier deviation (after electronic gear) (0.05V/1 encoder pulse unit) 05: Position reference speed (1V/1000 rpm) 06: Positioning complete reference (complete: 5V, incomplete: 0V) 07: Speed feed forward (1V/1000rpm)	0-10000mV	-99.99 to 99.99
Min. Unit	1	1mV	0.01 times
Factory Setting	0	5000mV	1

When Enabled	Immediately	Immediately	Immediately
Data Type	Running Setting	Running Setting	Running Setting

9.1.3 Adjustment of Safety Items

■ Setting of Over-travel

Perform the over-travel setting.

■ Setting of Torque Limit

Torque limit is set to prevent the output torque from exceeding the torque required for machine operation. It helps to reduce the impact caused by machine interference or collision. If the torque limit you set is less than the operation torque, overshoot or vibration may occur. You can set torque limit via H07-07.

■ Setting of Excessive Position Deviation Error Value

Excessive position deviation alarm is a protective function when the servodrive performs position control. When the motor motion is inconsistent with the reference, set an appropriate error value for excessive position deviation to detect abnormality and stop the motor. Motor position deviation indicates the difference between position reference value and the actual position.

Position deviation can be obtained by the following formula (including the position gain and the motor rotating speed)

$$\text{Position Deviation} = \frac{\text{Motor Rotating Speed}[rpm]}{\theta} \times \frac{\text{Motor Pulses/revolution [Reference Unit]}}{H\theta\ .\Omega}$$

Note that H08-02: Position loop gain (Min. unit is 0.1Hz)

Thus the excessive position deviation error value (H0a-11) can be set according to the following formula:

$$H0A.1 > \frac{\text{Motor Max. Rotating Speed}[rpm]}{\theta} \times \frac{\text{Motor Pulses/revolution [Reference Unit]}}{H\theta\ .\Omega} \times \underline{\underline{(1.2-2)}}$$

Double-underlined part (1.2-2) is the surplus coefficient that prevents frequently occurring faults due to excessive position deviation. As long as you set the value based on the formula above, the excessive position deviation error will not occur in normal operation.

When the acceleration/deceleration of the position reference exceeds the motor tracking capacity, the servomotor will not keep up with the position reference. As a result, position deviation cannot meet the above formula. In this case, reduce acceleration/deceleration of the position reference to the motor tracking value or increase the excessive position deviation error value.

Function Code	H0a
	11
Name	Excessive Position Deviation Error Value

Setting Range	1-32767 reference unit
Min. Unit	1 reference unit
Factory Setting	32767 reference unit
When Enabled	Immediately
Data Type	Stop Setting

9.2 Servo Response

This section introduces how to implement high-speed positioning.

9.2.1 Adjustment of Speed Loop

1） Adjustment of Servo Gain

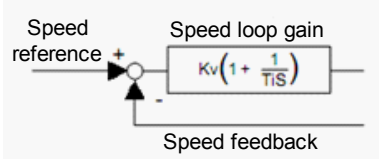
You can adjust servo gain through the following settings:

■ Setting of Speed Loop Gain

You can set speed loop gain via the following function codes as required:

Function Code	H08	H08
	00	01
Name	Speed Loop Gain	Speed Loop Integral Time Constant
Setting Range	1.0Hz-2000.0Hz	0.15ms-512.00ms
Min. Unit	0.1Hz	0.01ms
Factory Setting	400.0Hz	20.00ms
When Enabled	Immediately	Immediately
Data Type	Running Setting	Running Setting
Related Mode	PS	PS

The table here shows the servodrive internal speed loop gain and integral time constant. Higher the speed loop gain or smaller the speed loop integral time constant, faster the speed control response will be. But due to machine feature, machine vibration may result due to excessive speed loop gain. The unit of speed loop gain (Kv) is Hz.



■ Setting of Load Moment of Inertia Ratio

The load moment of inertia ratio is set via H08-15.

Function Code	H08-15
	15
Name	Load Moment of Inertia Ratio
Setting Range	1.00-200.00
Min. Unit	0.01
Factory Setting	1
When Enabled	Immediately
Data Type	Stop Setting
Related Mode	PST

$$\text{Moment of inertia ratio} = \frac{\text{Motor shaft conversion load moment of inertia (JL)}}{\text{Roter moment of inertia (JM)}}$$

The factory setting is Motor shaft conversion load moment of inertia = Rotor moment of inertia. According to the formula above, the moment of inertia ratio is 1. Then set the value of function code H08-15.

■ Setting of Position Loop Gain

You can set position loop gain via the following function codes as required:

Function Code	H08
	2
Name	Position Loop Gain
Setting Range	1.0Hz-2000.0Hz
Min. Unit	0.1Hz
Factory Setting	20.0Hz
When Enabled	Immediately
Data Type	Running Setting

Related Mode	P

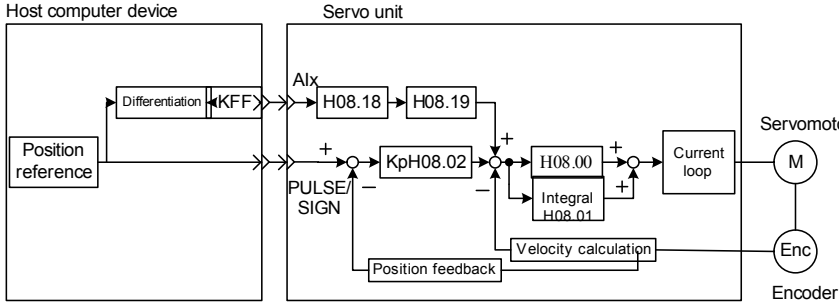
The table here shows the servodrive internal position loop gain. Higher the position loop gain, faster the position control response will be with fewer errors. But due to machine feature, machine vibration may result due to excessive position loop gain. The position loop gain is enabled in the zero-position fixed mode.

2） Adjustment of Speed Feed-forward

Speed feed-forward reference is the function that reduces the positioning time by feed-forward compensation in position control. Speed feed-forward can be connected externally. In this case, position reference is differentiated by host device to generate feedback reference. Feedback reference and position reference are input into the servodrive simultaneously.

■ Connection Mode

Position reference from the host device can be connected via reference pulse terminal. The speed feed-forward reference is connected via analog input terminals. Analog can be flexibly set to AI.x via function codes, where x = 1, 2 or 3.



Kp: Position loop gain KFF: Servo speed feed-forward gain

■ Related Parameters

Speed feed-forward sources can be selected via H05-19.

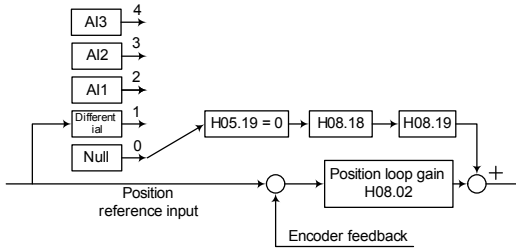
Function Code	H05 19
Name	Speed Feedback Control Selection
Setting Range	0: Non speed feed-forward 1: Internal speed feedback 2: Use AI1 as speed feed-forward input 3: Use AI2 as speed feed-forward input 4: Use AI3 as speed feed-forward
Min. Unit	1
Factory Setting	1

When Enabled	Immediately
Data Type	Stop Setting
Related Mode	P

When selecting AI, set the corresponding relationship between voltage and rotating speed via related function code and then set the feed-forward gain via H08-19.

Function Code	H08	H08
	18	19
Name	Speed Feed-forward Filter Time Parameter	Speed Feed-forward Gain
Setting Range	0.00ms-64.00ms	0.0%-100.0%
Min. Unit	0.01ms	0.10%
Factory Setting	0.00ms	0.00%
When Enabled	Immediately	Immediately
Data Type	Running Setting	Running Setting
Related Mode	P	P

Inside the servodrive, feed-forward compensation is performed in the position control so as to reduce the positioning time. However, it may cause machine vibration if the setting value is too large. Generally set the speed feed-forward gain below 80%. The logic block diagram of speed feed-forward is shown as below.



Terminology

Feed-forward Control: It indicates the necessary corrective action that is performed prior to external interference in the control system. Once it is activated, servo gain will rise and the response performance will be improved.

9.2.2 Adjustment of Torque Loop

1） Adjustment of Torque Reference Filter

Torque reference is configured with first-order low-pass filter. Servo drive may result in the mechanical vibration. Thus, it is possible to eliminate vibration by adjusting the torque

reference filter time parameters. Smaller the value, better high-response control will be. But it will be subject to mechanical inertia and load constraints.

Function Code	H07	H07
	5	6
Name	Torque reference filter time	Torque reference filter time 2
Setting Range	0.00ms-655.35ms	0.00ms-655.35ms
Min. Unit	0.01ms	0.01ms
Factory Setting	0.00ms	0ms
When Enabled	Immediately	Immediately
Data Type	Stop Setting	Stop Setting
Related Mode	PST	PST

Torque reference filter time is set as follows:

IIR first-order low-pass filter, $T(s)=\omega(s+\omega)$, where ω is the reciprocal of time constant, $\omega = 2\pi F$, F-Bandwidth, T-sampling period.

Time constant setting has an impact on control loop gain. Speed loop gain of H08-00 [HZ] and torque filter time constant of H07-05 [ms]. Adjustment value setting of stable control range is, H07-05 <= 1000 / (2π * H08-00 * 4). Adjust the value of the limit set, H07-05 <= 1000 / (2π * H08-00 * 1).

2） Adjustment of Torque Feed-forward

Torque feed-forward is the function that reduces the positioning time. It is valid in speed control and position control.

Torque feed-forward can be selected via H06-11. The gain of torque reference input can be set via H08-21F. The feed-forward filter time constant is set via H08-20.

Function Code	H06	H08	H08
	11	20	21
Name	Torque Feed-forward Selection	Torque Feed-forward Filter Time Parameter	Torque Feed-forward Gain
Setting Range	0: No torque feed-forward 1: Internal torque feed-forward	0.00ms-64.00ms	0.0%-100.0%
Min. Unit	1	0.01ms	0.10%
Factory Setting	0	0.00ms	0.00%
When Enabled	Immediately	Immediately	Immediately

Data Type	Stop Setting	Running Setting	Running Setting
Related Mode	PS	P	P

9.2.3 Other Adjustments

1） Adjustment of Proportional Operation Reference

If H08-25 is set to 1 and H08-26 is set to 4, input signal /P-CON serves as switch to change between PI control and P control.

P control is valid in speed/position control. This mode is named as Proportional Operation Reference.

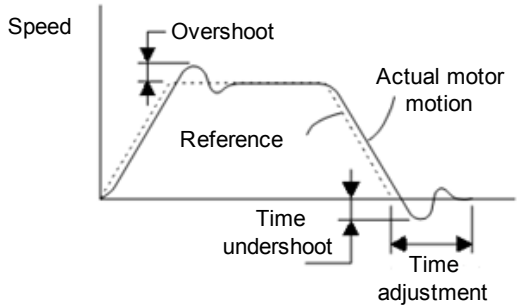
Function Code	H08	H08
	25	26
Name	Speed Loop Control Method	P-PI Switch Control Condition
Setting Range	0: PI control 1: switch control 2: I-P control 3: PDFF control	0: Use torque reference as detecting point 1: Use speed reference as detecting point 2: Use acceleration as detecting point. 3: Use position error pulse as detecting point. 4: Mode switch by an external DI
Min. Unit	1	1
Factory Setting	0	0
When Enabled	Immediately	Immediately
Data Type	Stop Setting	Stop Setting
Related Mode	PS	PS

When sending speed reference from host device to the servodrive, P control mode can be selected from the host device in particular operating conditions. This mode can suppress overshooting and shorten the adjustment time.

2） Adjustment of Mode Switch

The mode switch function is used in the following cases:

- For speed control, suppress overshooting during acceleration or deceleration
- For position control, suppress undershooting during positioning and reduce the adjustment time.



The mode switch function automatically switches the speed control mode from PI control mode to P control based on a comparison between the servo's internal values.

【Note】
- The mode switch is used in high-speed positioning when it is necessary to maximize the benefits of its capabilities. The speed response waveform must be observed to adjust Mode Switch.
- For normal use, complete speed/position control is implemented by setting Speed Loop Gain and Position Loop Gain. Even if overshooting or undershooting occurs, they can be suppressed by setting the host controller's acceleration/deceleration time constant, the servodrive's Soft Start Acceleration/Deceleration Time (H06-05)/(H06-06), or Position Reference Acceleration/Deceleration Time Constant (H05-06).

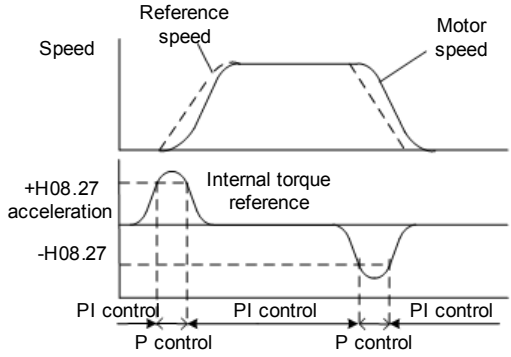
According to H08-26, the servodrive has five mode switches for choice.

H08-26 Setting	Mode Switch Selection	Parameter Containing Detection Point Setting	Setting Unit
0	Use torque reference as detecting point.	H08-27	0.1%
1	Use speed reference as detecting point.	H08-28	1rpm
2	Use acceleration as detecting point.	H08-29	1rpm/s
3	Use position error pulse as detecting point.	H08-30	1 reference unit
4	Mode switch by an external DI.	-	-

【Note】 PI control indicates proportional/integral control and P control indicates proportional control. In short, switching "from PI control to P control" reduces effective servo gain, making the servo system more stable.

■ Use Torque Reference as Detecting Point (Standard Setting)

When the torque reference exceeds the value set in H08-27, the speed loop is P Control. The servodrive regards this mode as the standard mode (factory setting).

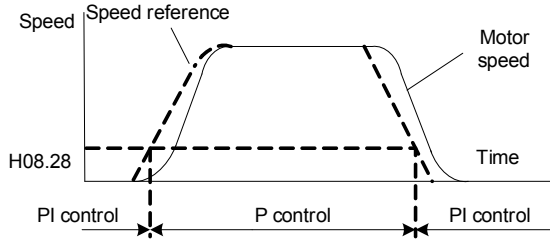


Example:

If the mode switch is not used (PI control is enabled), the motor may overshoot or undershoot due to torque saturation during acceleration or deceleration. Once the mode switch is used, torque saturation is suppressed and overshooting or undershooting is eliminated.

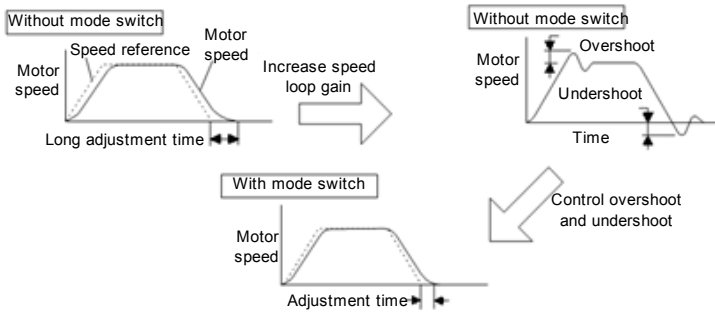
■ Use Speed Reference as Detecting Point

When the speed reference exceeds the value set in H08-28, the speed loop is switched to P control.



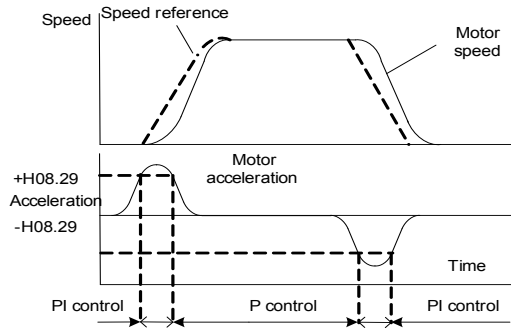
Example:

It is necessary to increase the speed loop gain to reduce the adjustment time, resulting in overshooting or undershooting, which can be suppressed by using the mode switch via speed reference.



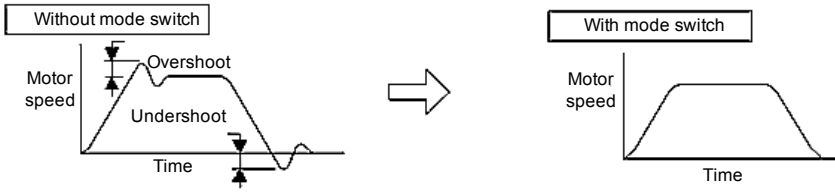
■ Use Acceleration as Detecting Point

When the motor acceleration exceeds the value set in H08-28, the speed loop is switched to P control.



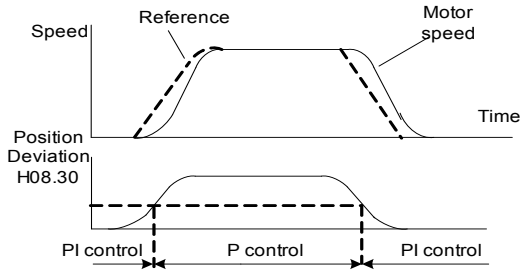
Example

If the mode switch is not used (PI control is enabled), the motor may overshoot or undershoot due to torque saturation during acceleration or deceleration. Once the mode switch is used, torque saturation is suppressed and overshooting or undershooting is eliminated.

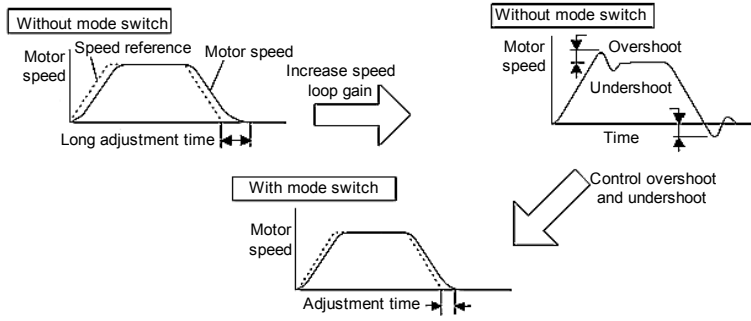


■ Use Position Error Pulse as Detecting Point

This setting is valid in position control only. When the position deviation pulse exceeds the value set in Pn10F, the speed loop is switched to P control.



It is necessary to increase the speed loop gain to reduce the adjustment time, resulting in overshooting or undershooting, which can be suppressed by using the mode switch via position error pulse.



9.3 Servo Gain

9.3.1 Parameters of Servo Gain

The servo gain is adjusted via the following parameters:

- H08-00: Speed loop gain
- H08-01: Speed loop integral time constant
- H08-02: Position loop gain
- H07-05: Torque reference filter time constant

Servodrive is used with the analog voltage reference in the speed control mode. The position loop is controlled on host controller, so adjust the position loop gain on the host controller.

When the gain cannot be adjusted on host controller, you can adjust the gain by corresponding analog to speed dimension. Depending on the setting, sometimes the servo motor will not reach maximum speed.

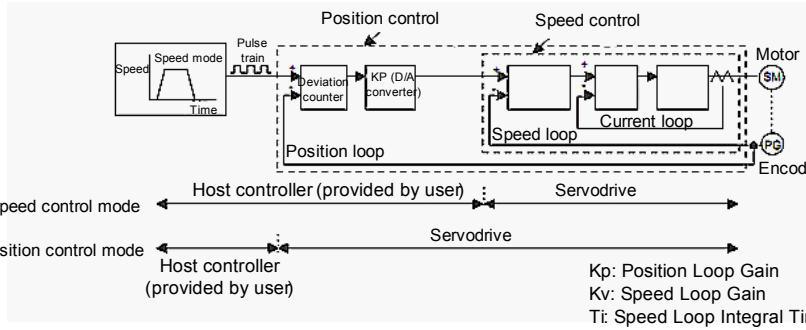
9.3.2 Basic Principle of Servo Gain Adjustment

The servo system has three feedback loops (position loop, speed loop and current loop).

The innermost loop must have the highest responsiveness. And the middle loop must have higher responsiveness than the outermost. If this principle is not followed, vibration or responsiveness decreases will result.

Since the current loop has good response performance, the user only needs to adjust position loop gain and speed loop gain.

The block diagram for servo system is as follows:



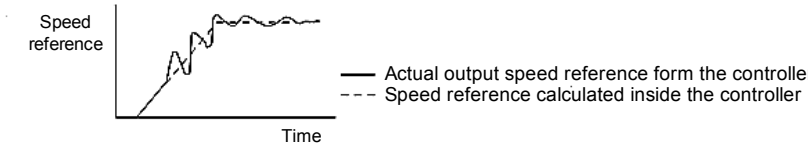
In general, the position loop response cannot be higher than the speed loop's. Therefore, to increase the position loop gain, increase the speed loop gain first. If only the position loop gain is increased, speed reference vibration may result, finally extending the positioning time.

When the mechanical system starts to vibrate after you increase the speed loop gain, stop the increase.

Once position loop response is higher than speed loop responsiveness, the speed references (position loop's output), which want to perform straight-line acceleration/ deceleration, will not catch up due to poor response. Then position loop deviation increases, so speed references need to be increased. As a result, the motor rotates excessively and position loop will begin to reduce the speed references.

However, the speed loop's response will thus become worse, leaving the motor not adaptable. Then speed reference vibration occurs as shown below. In this case, decrease the position loop gain, or increase the speed loop gain to eliminate the vibration.

The following figure shows the speed reference when the position loop gain and response of speed loop are unbalanced.



In general, the position loop gain cannot exceed the mechanical system natural vibration frequency range. For example, multi-joint robot's overall structure has low rigidity since it uses volatile gear reducer. Its natural vibration frequency is 10-20Hz. So the position loop gain of such machine is 10-20Hz only.

In contrast, SMT, IC couplers and other high-precision machines' natural vibration frequency is more than 70Hz, and there are machines that the position loop can be set to 70Hz above.

Therefore, except a demand for good responsiveness, the responsiveness of the used servo system including controller, servo amplifier, motor and detector is also very important. Meanwhile, please improve the rigidity of the mechanical system.

9.3.3 Manual Adjustment of Servo Gain

The factory setting of the servodrive cannot satisfy the responsiveness in some special applications. And the servodrive may not well adapt to the mechanical system with big interval or weak rigidity. You can adjust the servo gain manually based on the actual mechanical situation.

1） In Speed Control

Here introduces the parameters in speed control mode.

■ Speed Loop Gain (H08-00)

This parameter is used to determine the speed loop response. Within the range where the mechanical system does not vibrate, bigger the value set in H08-00, better the speed loop response. When moment of inertia ratio (H08-15) is set properly, the speed loop gain equals the value of H08-00.

The speed loop gain Kv equals the value of H08-00 and their unit is "Hz". Please set H8-15 to the following value:

$$\text{Value of H08-15} = \frac{\text{Motor shaft conversion load moment of inertia (π)}}{\text{Rotor moment of inertia (JM)}} \times 100\%$$

■ Speed Loop Integral Time Constant (H08-01)

The speed loop has an integral element so that the speed loop can respond to minute inputs. This integral element delays the operation of the servo system, resulting in a longer positioning settling time. As the value of the time constant increases, the response becomes slower. If the load inertia is large or the mechanical system is likely to vibrate, make sure that the speed loop integral time constant is large enough. Use the following formula to calculate the optimum integral time constant.

$$Ti \geq 2.3 \times \frac{1}{2\pi \times Kv}$$

Where: Ti: Integral time constant [s], Kv: Speed loop gain (calculated from the formula above) [Hz]

■ Torque Reference Filter Time Constant (H07-05)

If the mechanical system uses ball screws, torsional resonance may result. In this case, the oscillation may be minimized by increasing this parameter. Like the integral time constant, this filter causes a delay in the operation of the servo system. Therefore, do not increase it if unnecessary.

■ Setting Corresponding Relationship Between Speed Reference and Analog

When the speed reference source is selected to analog input, the speed reference gain can be adjusted by changing the corresponding relationship between analog input ± 10V and speed reference.

For example, analog input ± 10V, which corresponds to 2000rpm, is changed to correspond to 3000rpm. Then host device’s position loop gain is reduced by 1.5 times. It indicates that an equivalent decrease of position loop gain follows an increase of the speed reference input gain.

You can use this function to adjust the corresponding relationship, when it is necessary to correspond the speed reference output voltage range at the host controller to a specified speed range in the case that the host controller does not have the function for adjusting the position loop gain.

In normal operation, use the factory setting.

【Note】 If the servodrive is used in speed control mode, the position loop gain (H08-02) is effective in zero-position fixed mode only. In normal control operation, change the position loop gain via the host or change the speed reference input gain in the servo.

■ How to Perform Adjustment

1. Set the position loop gain to a relatively low value in the host controller. Then increase the speed loop gain (H08-00) within a range where no noise or oscillation occurs.
2. If the position loop gain cannot be changed via the host controller, increase the speed reference input gain set in Pn300 to a larger value.
3. Decrease the speed loop gain a little from the value set in step 1. Then increase the position loop gain via the host controller to a range where there is no noise or oscillation. Decrease the set value of Pn300 even if the position loop gain cannot be changed via the host controller.
4. Set the speed loop integral time constant in (H08-01) while observing the positioning settling time and the vibration of the mechanical system. If the constant is too large, positioning settling time will be long.
5. Set the torque reference filter to a small value in (H07-05) if the mechanical system has no apparent shaft torsional resonance. If the mechanical system generates oscillation noise in a high-pitched tone, shaft torsional resonance may be occurring. In that case, set (H07-05) to a larger value.
6. Finally, progressively make fine adjustments to parameters such as the position loop gain, speed loop gain, and integral time constant to find the optimal point.

2） In Position Control

Here introduces the parameters in position control mode.

■ Speed Loop Gain (H08-00)

This parameter is used to determine the speed loop response. Within the range where the mechanical system does not vibrate, bigger the value set in H08-00, better the speed loop response. When moment of inertia ratio (H08-15) is set properly, the speed loop gain equals the value of H08-00.

The speed loop gain Kv equals the value of H08-00 and their unit is “Hz”. Please set H8-

15 to the following value:

$$\text{Value of H08-15} = \frac{\text{Motor shaft conversion load momentof inertia (JL)}}{\text{Roter momentof inertia (JM)}} \times 100\%$$

To adjust servo gain manually, the user needs to set the value of H08-15.

■ Speed Loop Integral Time Constant (H08-01)

The speed loop has an integral element so that the speed loop can respond to minute inputs. This integral element delays the operation of the servo system, resulting in a longer positioning settling time. As the value of the time constant increases, the response becomes slower. If the load inertia is large or the mechanical system is likely to vibrate, make sure that the speed loop integral time constant is large enough. Use the following formula to calculate the optimum integral time constant.

$$Ti \geq 2.3 \times \frac{1}{2\pi \times Kv}$$

Where: Ti: Integral time constant [s]， Kv: Speed loop gain (calculated from the formula above) [Hz]

■ Torque Reference Filter Time Constant (H07-05)

If the mechanical system uses ball screws, torsional resonance may result. In this case, the oscillation may be minimized by increasing this parameter. Like the integral time constant, this filter causes a delay in the operation of the servo system. Therefore, do not increase it if unnecessary.

■ Position Loop Gain H08-02)

The responsiveness of the servo system is determined by the position loop gain.

The response increases if the position loop gain is set to a high value, and the time required for positioning will be shortened. In order to set the position loop gain to a high value, the rigidity and natural frequency of the mechanical system must be high.

The responsiveness of the whole servo system may become unstable if only the position loop gain is increased. Because the speed reference, as output from the position loop, is likely to become unstable. Increase the speed loop gain while observing the response.

■ How to Perform Adjustment

1. Set the position loop gain to a comparatively low value. Then increase the speed loop gain set in Pn100 to within a range where there is no noise or oscillation.
2. Decrease the speed loop gain a little from the value set in step 1. Then increase the position loop gain to within a range where there is no overshooting or oscillation.
3. Set the speed loop integral time constant in Pn101 while observing the positioning settling time and the vibration of the mechanical system. If the constant is too large, the positioning settling time will be too long.
4. Set the torque reference filter to a small value in Pn401 if the mechanical system has shaft torsional resonance. If the mechanical system generates oscillation noise in a high-pitched tone, shaft torsional resonance may occur. In that case, set Pn401 to a larger value.

5. Finally, progressively make fine adjustments to parameters such as the position loop gain, speed loop gain, and integral time constant to find the optimal points.

3） Functions of Improving Response Performance

The functions that can improve response performance include mode switch and feed-forward compensation. Such functions are not always effective. If they are used improperly, they will worsen the response. Please make adjustments while observing the actual responsiveness.

■ Mode Switch

Use the mode switch function to improve the transient characteristics of the servo system if there is torque reference saturation at the time of acceleration or deceleration.

The speed loop in PI (proportional and integral) control is switched over to P (proportional) control when the operation speed exceeds the set value in this function.

■ Feed-forward Compensation

The responsiveness is increased by using the feed-forward function. This function is not effective if the position loop gain is set to a high value. To adjust the feed-forward, do as follows:

1. Adjust speed and position loops according to the method described on this page.
2. Gradually increase feed-forward (H08-19) so that the positioning completion signal (/COIN) is output as early as possible.
3. Make sure that the positioning completion signal (/COIN) does not bounce (i.e., turned ON and OFF repeatedly within a short period) and that speed overshoot does not occur. These will likely occur if the feed-forward value is too high.
4. It is possible to add a primary delay filter (H08-18) to the feed-forward function. The primary delay filter may prevent the positioning completion signal from bouncing and the system speed from overshooting.

9.3.4 Reference Value of Gain Setting

Here lists the servo gain values for your reference when you adjust the gain in actual applications. Perform optimal gain adjustment based on the reference values and rigidity of the mechanical system.

The value range is for reference only, in which the mechanical system may have bad response performance sometimes due to vibration. Make adjustments while observing the waveform. Especially for high-rigidity machine, gain should be increased to a higher level.

■ High-rigidity Machine

Such machines are directly connected to ball screws, including chip mounting machine, bonding machine, and high-precision machine tool.

Position Loop Gain (H08-02) [Hz]	Speed Loop Gain (H08-00) [Hz]	Speed Loop Integral Time Constant (H08-01) [ms]
40-70	500-700	5-20

■ Medium-rigidity Machine

Such machines are driven by ball screws via speed reducers or long-length machines directly driven by screws, including general machine tool, transverse robot, and conveyor

Position Loop Gain (H08-02) [Hz]	Speed Loop Gain (H08-00) [Hz]	Speed Loop Integral Time Constant (H08-01) [ms]
20-40	300-500	10-40

■ Low-rigidity Machine

Such machines are driven by timing belts, chains, or machines with harmonic gear reducers, including conveyor and articulated robot.

Position Loop Gain (H08-02) [Hz]	(H08-00) [Hz]	Speed Loop Integral Time Constant (H08-01) [ms]
10-20	100-200	40-120

IMPORTANT

If the servodrive is used in speed control mode, the position loop gain (H08-02) is effective in zero-position fixed mode only. In normal control operation, change the position loop gain via the host or change the speed reference input gain in the servo.

In speed control mode, the position loop gain is set at the host controller. If that is not possible, set the position loop gain by adjusting the corresponding relationship between the servodrive's speed reference and analog. In speed control, position loop gain is effective in zero-clamp mode only.

9.3.5 Servo Gain Switchover

You can perform automatic gain switchover via internal parameter and manual switchover via external signal.

※ Switch to a lower gain to suppress vibration in motor stop (servolock) status.

※ Switch to a higher gain to shorten the positioning time in motor stop status.

※ Switch to a higher gain to get a better reference tracking performance in motor running status.

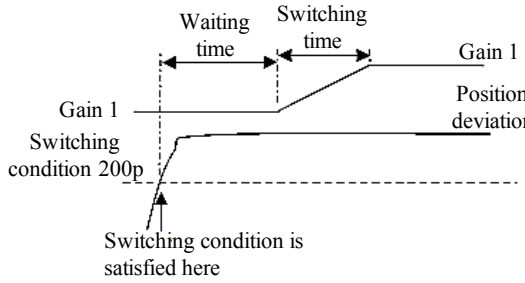
※ Switch to different gain settings via external signals according to the load equipment.

Manual gain switching external input signal: /G-SEL

- /G-SEL disabled: Gain 1
- /G-SEL enabled: Gain 2

■ Relationship Between Gain Switching/Waiting Time and Gain

For example, use the position pulse difference as detecting point to perform automatic switchover. Switch from gain 1 to gain 2. The gain switching waiting time (H08-08) is 10ms, gain switching time (H08-06) is 7ms and gain switching position pulse difference (H08-11) is 200p.



■ Related Parameters

Function Code	H08	H08	H08	H08	H08
	3	4	5	6	7
Name	Speed loop gain 2	Speed loop integral time parameter 2	Position loop gain 2	Gain switching time 1	Gain switching time 2
Setting Range	1.0 to 2000.0Hz	0.15 to 512.00ms	1.0 to 2000.0Hz	0 to 65535	0 to 65535
Min. Unit	0.1Hz	0.01ms	0.1Hz	1ms	1ms
Factory Setting	400.0Hz	20.00ms	20.0Hz	0	0
When Enabled	Immediately	Immediately	Immediately	Immediately	Immediately
Data Type	Running Setting	Running Setting	Running Setting	Running Setting	Running Setting
Related Mode	PS	PS	P	P	P

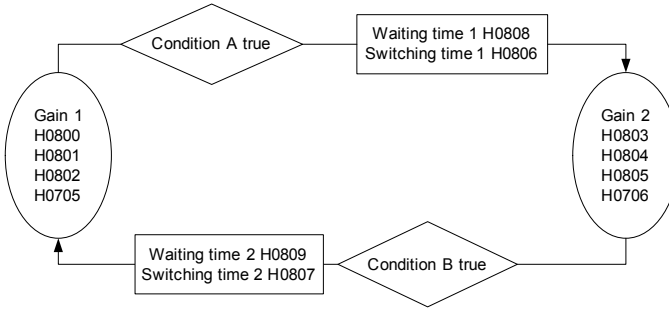
Function Code	H08	H08	H08
	8	9	10
Name	Gain switching waiting time 1	Gain switching waiting time 2	Gain Switching Selection
Setting Range	0-65535	0-65535	0: Disable gain switching to fix the gain 1 1: Manual gain switching via external input signal (G-SEL) switching gain 2: Use position pulse difference for automatic gain switching , while gain can switch amplitude 3: (H0811) The position reference filtering output is 0 subject to position pulse. 4: (H0812) Automatic gain switching subject to the speed reference, meanwhile gain switching amplitude 5: (H0813) Automatic gain switching subject to the torque reference, meanwhile the gain switching condition is amplitude (H0813).

Min. Unit	1ms	1ms	1
Factory Setting	0	0	0
When Enabled	Immediately	Immediately	Immediately
Data Type	Running Setting	Running Setting	Stop Setting
Related Mode	PS	PS	PS

Function Code	H08	H08	H08	H07
	11	12	13	6
Name	Gain Switching Position Deviation Amplitude (Threshold)	Gain Switching Speed Reference Amplitude (threshold)	Gain Switching Torque Reference Amplitude(threshold)	Torque Reference Filter time 2
Setting Range	0 to 65535	0 to 65535	0.0 to 300.0	0.00ms to 655.35ms
Min. Unit	P	rpm	%	0.01ms
Factory Setting	30	100	50	0.50ms
When Enabled	Immediately	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting	Stop Setting
Related Mode	PS	PS	PS	PST

【Note】 The switching threshold valves are all absolute values.

■ Function Principle



9.4 Manual Gain Tuning Function

Servo now has built-in inertia identification and manual gain tuning functions. Load inertia can be obtained by JOG operation. You can set the speed and position gain corresponding to each rigid level by changing a parameter value. Different rigidity levels correspond to different response speeds.

The manual gain tuning function includes load inertia ratio identification and rigid level table setting. The inertia identification part tests the load inertia ratio only but does not match the speed parameter with position parameter. Thus make sure to set the rigid level after identification.

9.4.1 Load Inertia Ratio Identification

■ About Load Inertia Ratio

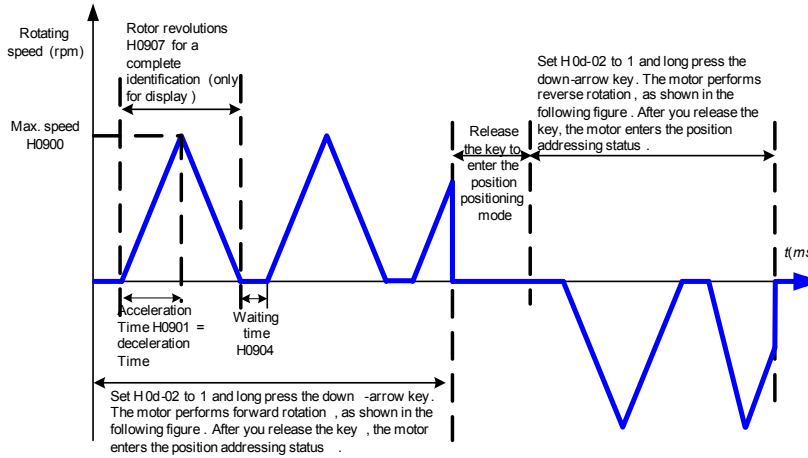
Load inertia ratio has great impact on motor control and acceleration/deceleration time. It is a physical quantity that determines the torque required for motor to accelerate/decelerate. Bigger load inertia ratio, larger impact generated by the momentum between the motor and the load, and longer time the servo will take to respond to the given speed.

Usually in high-response and high-precision applications, the inertia ratio should be less than 3-5 times. In general control applications, the inertia ratio is about 10 times. In applications not requiring high response and precision, the inertia ratio can be less than 30 times. It is more difficult to adjust if the inertia ratio is more than 30 times, which is applicable for a small number of the rotary device, and the acceleration/deceleration time cannot be too short.

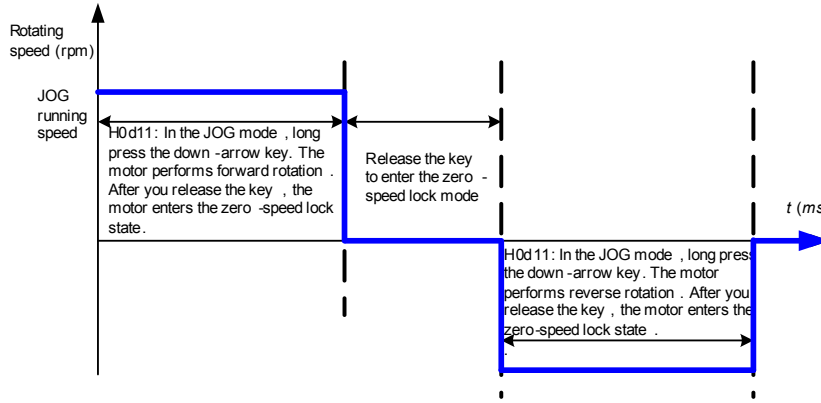
In high-response applications with large inertia, it can be compensated by PID algorithm that means increasing the rigidity level (increasing speed/position loop gain). However, the allowable rigidity level is limited by the servo bandwidth. In this application, the system oscillation will occur.

■ Description of Load Inertia Ratio Identification

Off-line inertia identification function means that the motor can drive the load according to the forward/reverse rotation curve. The function is similar to JOG, and its running curve (speed-time) is shown as below:



The curve in JOG mode is shown as follows:



After a complete identification, the nixie tube automatically updates the current inertia ratio. The whole off-line inertia identification requires Acceleration / Deceleration, which may result in big starting and stopping impact. This can be solved by reasonably setting the maximum identification, maximum speed and acceleration/deceleration time (H0900 and H0901).

■ How to Perform Load Inertia Ratio Identification

To perform load inertia ratio identification, do as follows

1. Ensure the servo is in rdy state and set H0d02 to 1.

   Then the servo enters the position mode and the nixie tube displays the inertia that moment, which is similar to the JOG mode.

2. Long press the up-arrow or the down-arrow.

The motor starts forward or reverse rotation to perform identification. Once you release the key, identification stops immediately and the motor enters the positioning status. After a complete identification, the nixie tube automatically updates the current inertia ratio. After several forward/reverse rotations, the program automatically filters the previous identification result and takes the average value. In addition, pay attention to the travel safety during identification.

【Note】 If the nixie tube does not update the identification result, increase the speed loop gain or to extend the acceleration time (H0901).

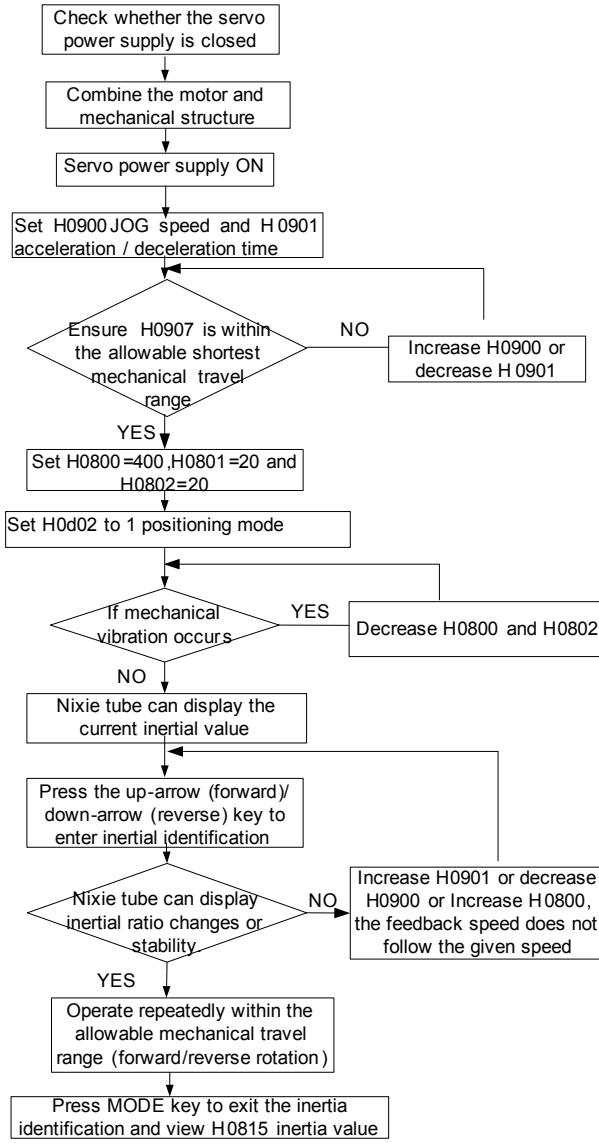
3. Press the MODE key to exit the inertia identification status. Check whether the average inertia (H0815) is reasonable. Otherwise, set H0815 manually.

【Note】 If mechanical travel is very short (for example, the motor is allowed to rotate one revolution), to identify the inertia within the allowable travel, you can adjust H0900 (maximum speed during identification) and H0901 (acceleration/deceleration time during identification) so as to make the H0907 (revolutions required for each identification) will be shorter than the allowable mechanical travel. In addition, to ensure the commissioner has enough reaction time, it is recommended to set longer waiting time (H0904) to (3000ms).

The following items may influence the identification performance:

- Load moment of inertia varies within the travel range.
- Load torque changes greatly within the travel range.
- Mechanical dynamic friction is large.
- Vibration occurs upon low rigid and positioning.
- Motor rotates less or more revolutions for a complete identification.
- The load inertia ratio is extremely large.

The flow chart of inertia identification is shown as below:



9.4.2 Setting of Rigidity Level

■ About Servo Rigidity

Servo rigidity indicates the capacity of rotor against the load inertia, also self-locking capacity of the rotor. Bigger the servo rigidity level, bigger the speed loop gain or position

loop gain and faster the system response.

Servo rigidity must be matched with the load inertia ratio. Bigger the mechanical load inertia ratio, smaller the servo rigidity. If the servo rigidity is much higher than the matching range of inertia ratio, high-frequency free-running oscillation will occur, that is, the motor makes a harsh noise. Conversely, if the servo rigidity is too low, the motor will be weak, that is, the load needs more time to get to the designated position.

■ Description of function of Setting Servo Rigidity

Only the load inertia ratio is measured via inertia identification. The speed and position parameters are not matched. Thus, remember to set the rigidity level (H09-05) after identification is complete.

The parameters associated with rigidity level H09-05 include position gain, speed loop gain, integral and torque filter system. Their corresponding relationship is shown as below:

Rigidity Level H0905	Position Loop Gain H0802 (HZ)	Speed Loop Gain H 0800 (HZ)	Speed Integral H0802 (ms)	Torque Filter H0705 (ms)	Corresponding Servo Response Speed	Corresponding Inertia Ratio	Corresponding Mechanical Standard
1	20	20	370	7			
2	23	25	280	6.5	Slow	Large	
3	26	30	220	6			Synchronous belt drive, chain drive, reducer with fluctuation gear
4	30	35	190	5.5			
5	36	45	160	5			
6	40	60	120	4.5			
7	45.3	75	90	3			
8	49.6	90	70	2.8			
9	53	110	60	2			
10	56.3	140	50	1.6			Flow through either the reducer ball screw controlled by the reducer or the machinery connected by the ball, such as general work machines, handling machines, etc.
11	61	180	40	1.26		Correspond to 10 times of inertia ratio	
12	70	200	35.5	1.14	Medium		
13	79	220	31	1.03		Medium	
14	87	270	25	0.84			
15	112	350	21	0.655			
16	128.5	400	17	0.57			
17	141	500	14	0.45			
18	156.5	550	13	0.42			
19	161.3	600	12	0.38			Ball screws connect to the machinery directly, such as surface mounting machines, machine tools, etc.
20	170.2	750	11	0.3			
21	184	825	10	0.27			
22	195	900	9	0.25			
23	206	1025	8.5	0.24			
24	228	1087.5	8.25	0.22	Fast	Small	
25	239	1150	8	0.2			
26	251	1212.5	7.75	0.11			

How to Set Servo Rigidity

To set the rigidity level, do as follows:

1. Ensure that inertia identification has been performed or inertia identification ratio is reasonable. Select the appropriate rigidity level H09-05 according to inertia ratio.

   Rigidity level 10 matches approximately 10 times of inertia ratio. Bigger the mechanical load inertia ratio, lower the servo allowable rigidity level.

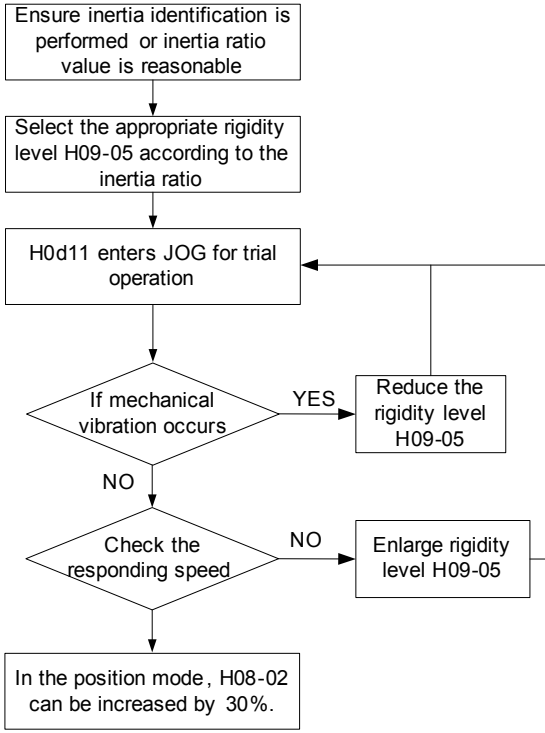
2. H0d11 enters JOG trail operation. Check whether the operation is normal and whether there is vibration noise. If vibration noise exists, reduce the rigidity level. Otherwise, try to increase the rigidity level until meeting the system requirements.

Speed loop gain, integral and torque filter parameters are matched reasonable. Only the setting of position loop gain is conservative. You can increase the position loop gain by 30% for actual debugging.

When rigidity level (H09-05) is changed, speed and position loop gain will be changed. Then you can perform fine-tuning ofH08-00 H08-01 H08-02 and H07-05, which will have no impact on H09-05.

System default rigidity level 0 indicates the default gain parameter (H0800 = 400; H0801 = 20; H0802 = 20).

The flow chart on setting rigidity level is shown as below:



■ Related Parameters

Function Code	H08	H08	H09
	15	16	00
Name	Average Value of Load Inertia Ratios	Current Value after Moment of Inertia Ratio Filter	Maximum Speed during Inertia Identification
Setting Range	0.90 time to 120.00 times	0.90 time to 120.00 times	300rpm-1000rpm
Min. Unit	0.01	0.01	1rpm
Factory Setting	1	1	500
When Enabled	Immediately	Immediately	Immediately
Data Type	Stop Setting	Stop Setting	Stop Setting
Related Mode	PST	PST	PST

Function Code	H09	H09	H09	H09
	1	4	5	7
Name	Acceleration/ deceleration Time during Inertia Identification	Inertia Identification Waiting Time	Rigidity Level	Rotating revolutions required for each Inertia ratio update
Setting Range	40ms-400ms	0-10000ms	0-30 levels	-
Min. Unit	1ms	1ms	level	0.001
Factory Setting	100	50	0	1.2
When Enabled	Immediately	Immediately	Immediately	Display
Data Type	Stop Setting	Stop Setting	Stop Setting	-
Related Mode	PST	PST	PST	PST

10

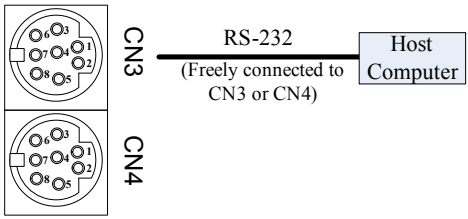
Communication

Chapter 10 Communication

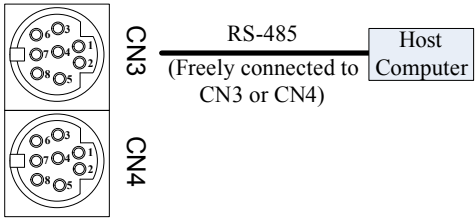
10.1 Hardware Connection

The servodrive supports RS232/RS485 communication function. You can query/change parameters and monitor the servodrive system via PC communication software. The RS485 protocol supports multi-drive networking in "Single-master Multi-slave" mode. RS232 does not support such networking.

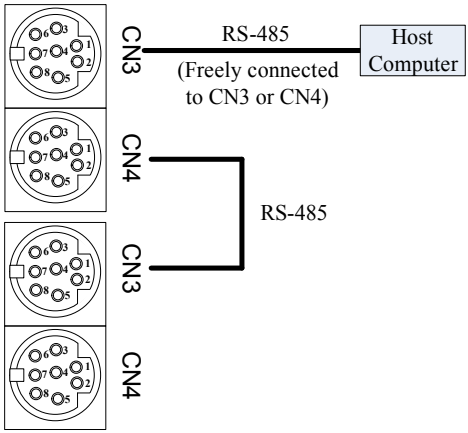
1. RS-232 Connection Diagram



2. RS-485 Connection Diagram



3. Multi-drive networking Connection Diagram



CAUTION
• Under low-noise environment, the communication cable is 15 meters long. If the communication rate is more than 38400bps. A cable within 15 meters is recommended to ensure the transmission accuracy. • RS485 can be connected to 32 servodrives simultaneously. If more servodrives need to be connected, you must install an amplifier, which can extend the connection of up to 247 servodrives. • If RS485 communication is adopted but the PC supports RS232 only, it's recommended to use RS232/RS485 converter.

10.2 Communication Parameter Setting

Function Code	H0c
	00
Name	Servo Shaft address
Setting Range	1-247, 0 indicates broadcast address
Min. Unit	1
Factory Setting	1
When Enabled	Immediately
Data Type	Running Setting

Specify the shaft address via H0c-00. Upon multi-servodrive networking, each servodrive have a unique address. Otherwise, abnormal communication will result. The host computer performs the write-in operation via broadcast address. Then the servodrives receive the frame of the broadcast address and perform corresponding operation without any response.

Function Code	H0c
	02
Name	Serial Baudrate Setting
Setting Range	0: 2400 1: 4800 2: 9600 3: 19200 4: 38400 5: 57600
Min. Unit	1
Factory Setting	5
When Enabled	Immediately
Data Type	Running Setting

CAUTION
Communication speed of the servodrive must be consistent with that of the host computer. Otherwise, there will be no communication.

Function Code	H0c
	3
Name	Data format
Setting Range	0: No check 1: Even parity check 2: Odd parity check
Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Running Setting

Upon even parity or odd parity, actual transmission bit of each byte is 11-bit, in which 1 start bit, 8 data-bit, 1 parity-bit and 1 stop-bit. When selecting no parity, actual transmission bit of each byte is 11 bits actual transfer, in which 1 start bit, 8 data bits, and 2 stop bits.

CAUTION
Data format of the servodrive must be consistent with the host computer’ s data format, otherwise there is no communication.

10.3 MODBUS Communication Protocol

Servodrives support MODBUS RTU protocol to read function code (0x03), write 16-bit function code (0x06) and write 32-bit function code (0x10).

10.3.1 Read Function Code (0x03)

■ Request Frame Format

START	It is greater than or equals 3.5 characters free time, indicating that one frame start.
ADDR	Servo shaft address: 1-247 Note: Numbers from 1 to 247 are expressed in decimal format here and need to be converted to HEX format when they are filled in ADDR.
CMD	Reference code, 0x03
DATA[0]	Start function code group number For example, in function code H06-11, 06 is the group number. Note: Number 06 is expressed in HEX format and does not need conversion when it is filled in the DATA [0].

DATA[1]	Start function code offset In function code H06-11, 11 is the offset. Notes: Number 11 is expressed in decimal format here and needs to be converted to Hexadecimal number 0x0B when it is filled in the DATA [1].
DATA[2]	Read function code number (high 8 bits), hexadecimal
DATA[3]	Read function code number (low 8 bits), hexadecimal
CRCL	CRC checksum low enabled byte
CRCH	CRC checksum high enabled byte
END	It is greater than or equals 3.5 characters free time, indicating that one frame ends.

■ Response Frame Format

START	It is greater than or equals 3.5 characters free time, indicating that one frame starts.
ADDR	Servo shaft address, hexadecimal
CMD	Reference code, 0x03
DATALENGTH	Function code byte number is equal to the read function code number N * 2.
DATA[0]	Start function code value, high 8 bits
DATA[1]	Start function code value, low 8 bits
DATA[…]	
DATA[N*2-1]	Final function code, low 8 bits
CRCL	CRC checksum low enabled byte
CRCH	CRC checksum high enabled byte
END	It is greater than or equals 3.5 characters free time, indicating that one frame ends.

【Note】 When reading 32-bit function code, the function code value in the response frame follows the principle that high 16-bit is before low 16-bit.

10.3.2 Write 16-bit Function Code (0x06)

■ Request Frame Format

START	It is greater than or equals 3.5 characters free time, indicating that one frame starts.
ADDR	Servo shaft address: 1-247 Note: Numbers from 1 to 247 are expressed in decimal format here and need to be converted to HEX format when they are filled in ADDR.
CMD	Reference code, 0x06
DATA[0]	Written function code group number For example, in writing function code H06-11, 06 is the group number. Note: Number 06 is expressed in HEX format and does not need conversion when it is filled in the DATA [0].

DATA[1]	Written function code In function code H06-11, 11 is the offset. Notes: Number 11 is expressed in decimal format here and needs to be converted to hexadecimal 0x0B when it is filled in the DATA [1].
DATA[2]	Write-in date high byte, hexadecimal
DATA[3]	Write-in date low byte, hexadecimal
CRCL	CRC checksum low enabled byte
CRCH	CRC checksum high enabled byte
END	It is greater than or equals 3.5 characters free time, indicating that one frame ends.

■ Response Frame Format

START	It is greater than or equals 3.5 characters free time, indicating that one frame starts.
ADDR	Servo shaft address, hexadecimal
CMD	Reference code, 0x06
DATA[0]	Written function code group number For example, function code H06-11 is written as 0x06.
DATA[1]	Written function code offset For example, function code H06-11 is written as 0x0B
DATA[2]	Write-in date high byte, hexadecimal
DATA[3]	Write-in date low byte, hexadecimal
CRCL	CRC checksum low enabled byte
CRCH	CRC checksum high enabled byte
END	It is greater than or equals 3.5 characters free time, indicating that one frame ends.

10.3.3 Write 32-bit Function Code (0x10)

■ Request Frame Format

START	It is greater than or equals 3.5 characters free time, indicating that one frame starts.
ADDR	Servo shaft address: 1-247 Note: Numbers from 1 to 247 are expressed in decimal format here and need to be converted to HEX format when they are filled in ADDR.
CMD	Reference code, 0x10
DATA[0]	Written start function code group number For example, to write function code H11-12, 11 is the function code group number. Note that 11 is a hexadecimal number here and does not need conversion when it is filled in DATA[0].
DATA[1]	Written start function code offset For example, to write function code H11-12, 12 is the offset. Note: 12 is a decimal number here and needs to be converted to hexadecimal 0x0C when it is filled in DATA[1].

DATA[2]	The number of function codes, high 8 bits M(H) A 32-bit function code is expressed in two frames. For example, to write H0507 only, DATA[2] is 00, DATA[3] is 02 and M=H0002.
DATA[3]	The number of function codes, low 8 bits M(L)
DATA[4]	The number of function codes corresponding to the number of bytes M*2 For example, to write H0507 only, DATA[4] is H04.
DATA[5]	High 8 bits of write-in start function code, hexadecimal
DATA[6]	Low 8 bits of write-in start function code, hexadecimal
DATA[7]	High 8 bits of write-in start function code + 1, hexadecimal
DATA[8]	Low 8 bits of write-in start function code + 1, hexadecimal
DATA[9]	High 8 bits of write-in start function code + 2, hexadecimal
DATA[10]	Low 8 bits of write-in start function code + 2, hexadecimal
...	...
CRCL	CRC checksum low enabled byte
CRCH	CRC checksum high enabled byte
END	It is greater than or equals 3.5 characters free time, indicating that one frame ends.

■ Response Frame Format

START	It is greater than or equals 3.5 characters free time, indicating that one frame starts.
ADDR	Servo shaft address, hexadecimal
CMD	Reference code, 0x10
DATA[0]	Written start function code group number For example, function code H11-12 is written as 0x11.
DATA[1]	Written start function code offset For example, function code H11-12 is written as 0x0C.
DATA[2]	The number of written function code, high 8 bits M(H)
DATA[3]	The number of written function code, low 8 bits M(H)
CRCL	CRC checksum low enabled byte
CRCH	CRC checksum high enabled byte
END	It is greater than or equals 3.5 characters free time, indicating that one frame ends.

【Note】 Do not write in 16-bit function code in the 0x10 format. Otherwise, unexpected error may result.

10.3.4 Error Response Frame

■ Error Response Frame Format

START	It is greater than or equals 3.5 characters free time, indicating that one frame starts.
ADDR	Servo shaft address, hexadecimal
CMD	Reference code, 0x03/0x06/0x10

DATA[0]	0x80
DATA[1]	0x01
DATA[2]	Error code high 8-bit
DATA[3]	Error code low 8-bit
CRCL	CRC checksum low enabled byte
CRCH	CRC checksum high enabled byte
END	It is greater than or equals 3.5 characters free time, indicating that one frame ends.

■ Error Code

Error Code	Description
0x0002	Reference code is not 0x03/0x06/0x10.
0x0004	The CRC code servo receives from data from is not equal to that in the data frame.
0x0006	The input factory password is incorrect.
0x0008	The accessed function code does not exist.
0x0010	The value of the function code to be written exceeds the limit.
0x0020	The written function code is readable only.
0x0030	Write 16-bit function code in the 0x10 format.
0x0040	The accessed function code is in the password locked status.
0x0060	The read-out data length is 0.
0x0080	The written function code can be modified in servo stop status only, but the servo is running currently.

10.3.5 Communication Examples

1. The master a request frame is:

01	03	02	02	00	02	CRCL	CRCH

Read 0x0002 word length data from H02-02 of the servodrive with shaft address 01 to start register.

The slave response frame is:

01	03	04	00	01	00	00	CRCL	CRCH

The salve returns 2-word (4-byte) length data and data content is x0001 and 0x0000

If the slave response frame is:

01	03	80	01	00	02	CRCL	CRCH

Communication error occurs and the error code is 0x0002. 0x8001 indicates the error.

4. The master request frame is:

01	06	02	02	00	01	CRCL	CRCH

Write 0x0001 into function code H02-02 of the servodrive with shaft address 01.

The slave response frame is:

01	06	02	02	00	01	CRCL	CRCH

The write-in is successful.

If the slave response frame is:

01	06	80	01	00	02	CRCL	CRCH

Communication error occurs and the error code is 0x0002. 0x8001 indicates the error.

5. Read 32-bit function code H05-07.

The master request from is:

01	03	05	07	00	02	CRCL	CRCH

The slave response frame is:

01	03	04	00	00	00	01	CRCL	CRCH

Value of function code H05-07 is 0x00000001。

6. Write 32-bit function code H05-07.

There are two request frames to write 32-bit function code: 0x06 and 0x10.

If 0x06 is used, two write-in references are required to write H05-07 and H05-08, respectively.

01	06	05	07	00	02	CRCL	CRCH

01	06	05	08	00	01	CRCL	CRCH

【Note】 This frame writes 0x00010002, that is 65538, into function code H05-07.

Only one write-in reference is required if 0x10 is used.

01	10	05	07	00	02	04	00	01	00	02	CRCL	CRCH

【Note】 High-bit 0x0001 is before low-bit 0002.

10.3.6 CRC

Communication between the host computer and servodrive is implemented via consistent CRC algorithm. Otherwise, it may result in CRC error. The servodrive use 16-bit CRC with low-byte followed by high-byte. CRC function is as follows:

```
Uint16 COMM_CrcValueCalc(const Uint16 *data, Uint16 length)
{
   Uint16 crcValue = 0xffff;
   int16 i;
```

```
    while (length--)
    {
        crcValue ^= *data++;
        for (i = 0; i < 8; i++)
        {
            if (crcValue & 0x0001)
            {
                crcValue = (crcValue >> 1) ^ 0xA001;
            }
            else
            {
                crcValue = crcValue >> 1;
            }
        }
    }
    return (crcValue);
}
```

10.3.7 Signed Number in HEX

To write in 16-bit signed function code, it is necessary to express the data in the HEX complementary code format. If the data is greater than or equals 0, the value of complementary code equals that of original code, without conversion. If the data is negative, its complementary code = 0xFFFF - absolute value + 1.

To write in 16-bit signed function code, it is necessary to express the data in the HEX complementary code format. If the data is greater than or equals 0, the value of complementary code equals that of original code, without conversion. If the data is negative, its complementary code = 0xFFFFFFFF- absolute value + 1.

For example, the HEX complementary code of 16-bit number 100 is 0x0064. So the HEX complementary code of 16-bit number -100 is 0xFFFF – 0x0064 + 0x0001 = FF9C.

The HEX complementary code of 32-bit number 100 is 0x00000064. So the HEX complementary code of 32-bit number -100 is 0xFFFFFFFF – 0x00000064 + 0x00000001 = FFFFFF9C.

10.3.8 32-bit Function Code Addressing

32-bit function codes are with setting range out of -65535 to +65535, such as H05-07, H05-09 and H11-12. A 32-bit function code covers two consecutive function code SNs. For example, H11-12 and H11-13 together express “1st-segment Displacement”. The function code of low SN stores low 16-bit value, while that of high SN stores high 16-bit value. For example, if the “1st-segment Displacement” is 0x40000000 (1073741824 in decimal format) reference units, H11-12 stores 0x0000 and H11-13 stores 0x4000.

When reading 32-bit function code via MODBUS reference, take the address of lower SN as base address and one-time reading length is 2. For example, the MODBUS reference for reading “1st-segment Displacement” H11-12 is:

Servo shaft address	03	11	0C	00	02	CRCL	CRCH

When writing 32-bit function codes via MODBUS reference (0x06), write the high address first and then the low address. For example, the MODBUS reference for writing 0x12345678 into “1st-segment Displacement” H11-12 is:

Servo shaft address	06	11	0D	12	34	CRCL	CRCH

Servo shaft address	06	11	0C	56	78	CRCL	CRCH

When writing 32-bit function codes via MODBUS reference (0x10), only one reference is required. For example, the MODBUS reference for writing 0x12345678 into 1st-segment Displacement" H11-12 is:

Servo shaft address	10	11	0C	00	02	04	12	34	56	78	CRCL	CRCH

10.3.9 Definition of Communication Address of Function Code

Function code communication address is made up of function code group number and offset. For example, communication address of H11-12 is 0x110C. When modifying function codes via communication, pay attention to the function code setting range, unit, when enabled, data type and HEX conversion of positive and negative numbers. For more details, refer to the function code description.

CAUTION

When PLC/HMI MODBUS reference is programmed, the register address is not actual register address but "actual register address+1. This is because standard MODBUS reference register address starts with 0 but register address of many devices begins from 0 (such as servodrive),

For compatibility, PLC/HMI manufacturers subtract 1 from programming register address during actual physical transmission. Programmers must read and write servodrive's function codes correctly when MODBUS communication is implemented between such PLC/HMI and servodrive.

For example, read (write) register address is 0x0201 during programming. But the actually read (write) function code is H02 - 00.

If you're not sure whether the PLC/HMI register address is actual register address when programming MODBUS reference, select two adjacent function codes that have unequal values. Use 0x03 (read) reference to read the larger one for the function code. If the function code you have read is equal to the smaller one, then 'register address=the actual register address + 1' when programming.

10.3.10 Communication Virtual DI/DO (VDI/VDO)

Like DI terminals, VDI can be allocated with FunIN.x. When VDI is enabled, it means DI terminals are increased. There are a total of 16 VDIs, namely, VDI1 ... VDI16. If VDI and DI are allocated with the same FunIN.x DI, Er.130 will be reported.

Like DO terminals, VDO can be allocated with FunOUT.x. When VDO is enabled, it means DO terminals are increased. There are a total of VDOs, namely, VDO1 ... VDO16. If VDO and DO are allocated with the same FunOUT.x, Er.131 will be reported.

The VDIx value is determined by H31-00 that can be written and read. VDO value is determined by H31-01 that is readable only.

Function Code	H31	H17
	00	32
Name	VDI Virtual Level	VDO Virtual Level
Setting Range	Bit0: VDI1 virtual level …… Bit15: VDI16 virtual level	Bit0: VDO1 virtual level … Bit15: VDO16 virtual level
Min. Unit	-	-
Factory Setting	-	-
When Enabled	-	-
Data Type	-	-
Related Mode	PST	-

Note that bit-operation is not allowed for the communication to modify VDIx value. The write action on H31-00 will affect all VDIs.

To configure VDI with FunIN.1 and enable servo via MODBUS reference, do as follows:

1. Set H0c-09 to 1.

   The communication virtual VDI is enabled.

2. Make sure that FunIN.1 is not allocated to any DI or VDI.

   As factory setting, FunIN.1 is allocated to DI5 and H03-10 is 1.

3. Set H17-00 to 1 and map FunIN.1 to VDI1.

4. Set logical selection of VDI1

   The default value is 0, indicating VDI is enabled when 1 is written.

5. Write 1 to Bit0 in H31-00 to complete servo enabled.

   If 0 is written to Bit0, the servo is disabled.

Suppose shaft address is 1. The MODBUS reference for enabling the servo is as follows:

01	06	31	00	00	01	CRCL	CRCH

CAUTION

If VDIx is set to 0, it is equivalent to setting DI to low level or high level enabled. If VDIx is set to 1, it is equivalent to setting DI to edge enabled.

To configure VDO with FunOUT.5, do as follow:

1. Set H0C.11 to 1.

   The communication virtual VDO is enabled.

2. Make sure that FunOUT.5 is not allocated to any DO or VDO.
3. Set H17.33 to 5 and map FunOUT.5 to VDO1.
4. Set logical selection of VDO1.

   The default value is 0, indicating that 1 is o6utput when it is enabled.
5. Read H17.32.

If position is reached, H17.32 Bit0 is 1. If the position is not reached, H17.32 Bit0 is 0.

Suppose shaft address is 1. The MODBUS reference for reading H17-32 is as follows:

01	03	17	20	00	01	CRCL	CRCH

10.3.11 Function Code Change Via Communication not Stored in EEPROM

If you frequently modify function codes via communication, the modification will be updated to EEPROM simultaneously, which will lower service life of EEPROM. If it is not necessary to update the value stored in EEPROM, set H0C-13 to 0.

10.3.12 Servo Delays to Reply

H0C-25 (Servo Delays to Reply) indicates that servo delays the time set in H0C-25 and then replies to the host controller after it receives the reference.

Function Code	H0C
	25
Name	MODBUS reference replay delay
Setting Range	0-5000ms
Min. Unit	1
Factory Setting	0
When Enabled	Immediately
Data Type	Running setting
Related Mode	-

10.3.13 High/Low 16-bit Transmission Sequence of 32-bit Function Code

Function Code	H0C
	26
Name	MODBUS 32-bit Function Code Transmission Sequence
Setting Range	0: High 16 bit before low 16 bit (It is set to 0 when function code is modified or read on backstage.) 1: Low 16 bit before high 16 bit.
Min. Unit	1

Factory Setting	0
When Enabled	Immediately
Data Type	Running setting
Related Mode	-

For example,

- When H0C-26=0, the MODBUS reference for writing H00010002 into H05-07 is (the following references are expressed in HEX):

  Host sends reference: 01 10 05 07 00 02 04 00 01 00 02 5D 18

  Slave feedback: 01 10 05 07 00 02 F0 C5

- When H0C-26=1, the MODBUS reference for writing H00010002 into H05-07 is:

  Host sends reference: 01 10 05 07 00 02 04 00 02 00 01 ED 19

  Slave feedback: 01 10 05 07 00 02 F0 C5

- When H0C-26=0, the current value of H05-07 is H00010002.

  Host reads reference: 01 03 05 07 00 02 75 06

  Slave feedback: 01 03 04 00 01 00 02 2A 32

- When H0C-26=1, the current value of H05-07H00010002.

  Host reads reference: 01 03 05 07 00 02 75 06

  Slave feedback: 01 03 04 00 02 00 01 9A 33

11

Inspection and Maintenance

Chapter 11 Inspection and Maintenance

11.1 Troubleshooting

The servodrive alarm is graded into two levels:

- Level I (Error): The servodrive alarms and has to stop when an error occurs. DO outputs signal /ALM.
- Level II (Warning): The servodrive sends out warning status, which will not damage the machine temporarily. But there will be a higher level of error output if the warning status is not handled timely. DO outputs signal /WARN.

11.1.1 Error Display List

Errors are classified into:

- NO.1 Error (non-resettable)
- NO.1 Error (resettable)
- NO.2 Error (resettable)

Where, NO.1 and NO.2 indicate error stop method.

- NO.1: Corresponding to H02-05
- NO.2: Corresponding to H02-06

The relationships between error codes and coding H/L are shown in the following table. Error code is displayed as Er. xxx.

Error Code	Error Name	Meaning	Stop Method	Error Reset	Error Code Output		
					AL0	AL1	AL2
Er.101	EEPROM Parameter Error	The parameter in the servo is incorrect.	NO.1	Non-resettable	H	H	H
Er.102	Programmable Logic Configuration Error	The logic device error or device configuration is inconsistent with the drive models.	NO.1	N/R	H	H	H
Er.105	System Error	Restore to the factory default value when the data of the parameter in the servo is incorrect.	NO.1	N/R	H	H	H
Er.107	Model selection error	Disabled motor model or driver model	NO.1	N/R	H	H	H
Er.108	Parameter storage error	Parameter storage device error	NO.1	N/R	H	H	H

Error Code	Error Name	Meaning	Stop Method	Error Reset	Error Code Output		
					AL0	AL1	AL2
Er.110	Encoder Output Pulse Setting Error	The encoder output pulse is out of the setting range and does not satisfy the setting conditions.	NO.1	N/R	H	H	H
Er.120	Product Matching Error	The power level of the motor cannot match the driver’ s. Or the other unsupported product component types are connected into the servo (such as the encoder, etc).	NO.1	N/R	H	H	H
Er.121	Servo ON reference disabled error	Enter the servo ON reference to the PC after executing the relevant auxiliary function (such as inertia identification, JOG function)	NO.1	Resettable	H	H	H
Er.130	DI Allocation Error	Multiple DI are allocated to the same function	NO.1	Resettable	H	H	H
Er.131	DO Allocation Error	Multiple D0 are allocated to the same function	NO.1	Resettable	H	H	H
Er.135	Read and write Encoder EEPROM Parameter Error	Encoder EEPROM Error	NO.1	N/R	H	H	H
Er.136	Encoder Checksum Error	Encoder EEPROM Error	NO.1	N/R	H	H	H
Er.140	AI Setting Error	The same AI can be allocated to the different reference sources.	NO.1	Resettable	H	H	H
Er.200	Driver over-current 1	The power cable wiring of the servo motor has the phase sequence error, open phase and power cable short circuit to ground. The power transistor is detected to be over-current by the software. The encoder is abnormal.	NO.1	N/R	L	L	H

Error Code	Error Name	Meaning	Stop Method	Error Reset	Error Code Output		
					AL0	AL1	AL2
Er.201	Driver over-current 2	The power cable wiring of the servo motor has the phase sequence error, open phase and power cable short circuit to ground. The power transistor is detected to be over-current by the software. Encoder wiring error or encoder damaged The blow-off pipe is detected to be over-current is by the hardware.	NO.1	N/R	L	L	H
Er.210	Short circuit to ground upon self-checking	The servo power cable is short circuit to ground when self	NO.1	N/R	L	L	H
Er.400	Over-voltage	Main circuit DC voltage is excessively high.	NO.1	Resettable	L	L	H
Er.410	Under-voltage	Main circuit DC voltage is excessively low.	NO.2	Resettable	H	H	L
Er.420	Power Cables Open Phase	With the open phase, voltage was low for more than 1 second in an R, S or T phase.	NO.2	Resettable	H	H	L
Er.500	Over-speed	The servomotor speed is excessively high.	NO.2	Resettable	L	H	L
Er.510	Over-speed of Encoder Output Pulse Rate	The motor speed upper limit of the set encoder output pulse is exceeded.	NO.1	Resettable	L	L	L
Er.600	Inertia Identification Error	Inertia Identification runs timeout	NO.1	Resettable	L	L	L
Er.610	Driver Overload	Run with load, it will exceed the overload time which is set by the inverse-time-limit curve. UVW output might be open phase or phase sequence error.	NO.2	Resettable	L	L	L

Error Code	Error Name	Meaning	Stop Method	Error Reset	Error Code Output		
					AL0	AL1	AL2
Er.620	Motor Overload	Run with load, it will exceed the overload time which is set by the inverse-time-limit curve. UVW output might be open phase or phase sequence error.	NO.2	Resettable	L	L	L
Er.650	Heat Sink Overheated	The heat sink temperature exceeds the setting value.	NO.2	Resettable	L	L	L
Er.740	Encoder Interference Error 1	Incremental Encoder Z Signal with Interference	NO.1	N/R	H	H	H
Er.741	Encoder Noise interference Error 2	Incremental Encoder AB Signal with Interference	NO.1	N/R	H	H	H
Er.831	AD Sampling Error 1	AD Initialization Error	NO.1	N/R	H	H	H
Er.832	AD Sampling Error 2	AD Conversion Error	NO.1	N/R	H	H	H
Er.833	Current Sampling Error	Current Detection Circuit Error	NO.1	N/R	H	H	H
Er.850	Encoder Angle Error	Excessive Encoder Deviation Angle upon Re-initialization	NO.1	N/R	H	H	H
Er.A21	Programmable Logic Error	The Programmable logic Initialization is unfinished.	NO.1	N/R	L	H	L
Er.A34	Encoder Echoback Error	Encoder communication is error.	NO.1	N/R	L	H	L
Er.b00	Position Error	Position error exceeded the value (H0a-11) set in the excessive position error.	NO.1	N/R	L	L	H
Er.b03	Electronic Gear Setting Error	Electronic gear ratio exceeds the specification range [0.001, 4000]	NO.2	Resettable	L	L	H

11.1.2 Warning Display List

The relationships between warning codes and coding H/L are shown in the following table. Warning code is displayed as Er.9xx.

Error Code	Error Name	Meaning	Error Code Output		
			AL0	AL1	AL2
Er.900	Too large Position pulse deviation	Accumulated position pulse deviation exceeds preset value.	H	H	H
Er.909	Motor Overload	Warning before reaching the motor overload value	L	H	H
Er.910	Driver Overload	Warning before reaching the driver overload value	L	H	H
Er.922	External Regenerative Resistance Insufficient	External regenerative resistance is less than the minimum value required by the servodrive.	L	L	H
Er.941	Change of Parameters Requires Restart	The changed parameters will be effective after a restart.	H	L	L
Er.942	Write EEPROM Frequent	EEPROM is operated frequently.	H	H	L
Er.950	Over-travel	1. Pot and Not will be efficient at the same time, generally in the table will not occur at the same time. 2. Servo shaft will over-travel in a certain direction, and can be automatically relieved.	L	L	L
Er.960	Absolute Encoder Angle Initialization	Encoder deviation angle is excessive upon re-initialization.	L	L	L
Er.971	Under-voltage	Bus voltage is lower than the error value, the error display for nearing the under-voltage error	L	L	L
Er.981	Heat Sink Overheated	Exceed the error setting value of the heat sink, not reach the error setting value.	H	L	L
Er.990	Input Phase Missing	Two-phase running with three-phase driver input	H	L	L
Er.991	Communication Module Self-checking Failure	The communication module fails to self-check.	H	L	L
Er.992	Communication Module Abnormal	Communication module has abnormal communication.	H	L	L

11.1.3 Troubleshooting of Errors

When an error occurs to the servodrive, the digital panel will display “Er.xxx”. The troubleshooting is shown in the following table.

If the error cannot be cleared, please contact our service center.

Error Name	Cause	Confirmation	Solution
Er.101 (The parameter data in the servo is incorrect.)	The control power supply voltage suddenly dropped.	Measure the power supply voltage.	Set the power supply voltage within the specified range, and restore the factory setting of H02-31.
	The power supply is turned OFF while changing a parameter setting.	Check the power-off time	Restore the factory setting of H02-31 and then set the parameter again.
	The number of times that parameters were written exceeded the limit.	Check whether the parameters are frequently changed at the host controller	Change the parameter write-in method and then re-write. The servodrive may fail. Repair or replace the servo drive.
	Malfunction caused by noise from the AC power supply or grounding line, static electricity noise, etc.	Turn the power supply ON and OFF several times. If the error still occurs, there may be noise interference.	Take countermeasures against noise.
	Gas, water drops, or cutting oil entered the servo drive and caused failure of the internal components.	Check the setting conditions.	The servodrive may fail. Repair or replace the servodrive. Change the parameter write-in method.
	6.Servo Drive Error	Turn the power supply ON and OFF several times. If the error still occurs, the servodrive fails.	The servodrive may fail. Repair or replace the servodrive.
Programmable Logic Configuration Error	Logic device error	Turn the power supply ON and OFF several times. If the error still occurs, the servodrive fails.	Repair or replace the servodrive.
Er.105 The inside procedure is incorrect.)	1. EEPROM error	According to Er.101	Re-power on the servodrive after restoring the default value of H02-31.
	2. Servo drive error	Turn the power supply ON and OFF several times. If the error still occurs, the servodrive fails.	Repair or replace the servodrive.
Er.107 (Product model selection error)	The product code does not exist (such as motor).	Check whether the product code is in the manual.	Reselect the correct product code

Error Name	Cause	Confirmation	Solution
Er.108 Parameter storage Error	Parameter storage error is occurred.	Change a parameter, and then power-on again to see whether the parameter value is saved.	Turn the power supply OFF and then ON again. If the error still occurs, the servodrive should be replaced.
Er.110 Encoder Output Pulse Setting Error	The encoder output pulse is out of the setting range and does not satisfy the setting conditions.	Incremental encoder: encoder frequency pulse value cannot exceed the number of lines of the encoder; Absolute encoder: encoder pulse value cannot exceed the number of its resolution of 1/4.	Change the pulse value function code of the encoder to satisfy the specified range.
Er.120 (Product Matching Error)	Several product combinations are not proper, for example, the motor and the driver power level do not match each other.	Set the parameter to a value within the specified range.	Replace the mismatched products
	Access the unsupported encoder for the selection driver (for example, the P/A-type driver and the absolute encoder do not correspond.	View the user manual to check the product specifications, and select the correct model.	Select the proper encoder or replace the other driver.
Er.121 (Servo ON Reference Disabled)	After executing the auxiliary function to turn ON the power to the motor, the servo ON reference was sent from the host controller.	Check whether executing the utility function to turn ON the power to the motor while the servo ON reference was sent from the host controller.	Change the incorrect operation modes.
Er.130 (Different DI can be allocated to the same function)	The same variable can be assigned for DI for DI assignment	Check whether there is the same configuration among H03-02, H03-04 to H03-20.	Change the repetitive allocated DI variable.
Er.131 Different DO can be allocated to the same function	The same variable can be assigned for DO assignment	Check whether there is the same configuration among H04-00, H04-02 to H04-14.	Change the repetitive allocated DO variable.

Error Name	Cause	Confirmation	Solution
Er.135 (Motor Encoder EEPROM Parameter Error	Serial encoder motor EEPROM error occurred during read/ write.	Check whether the motor encoder wiring is correct and the motor encoder is serial.	Reconnect the encoder cable or replace the correct motor type.
	Motor storage Error	Turn the power supply OFF and then ON again. Er.136 still occurs after removing the above reasons.	Repair or replace the servo motor
Er.136 (Motor encoder EEPROM Data Checksum Error)	Serial Encoder Motor EEPROM Checksum Error	Check whether the motor encoder wiring is correct and the motor encoder is serial.	Reconnect the encoder cable or replace the correct motor type.
	Our H-type drive with the initialization serial-type motor have not used.	Check whether the serial-type motor is initialized by our driver.	Contact us to rewrite the motor parameter to EEPROM.
	Motor storage Error	Turn the power supply OFF and then ON again. Er.136 still occurs after removing the above reasons.	Repair or replace the servo motor

Error Name	Cause	Confirmation	Solution
Er.140 (AI Setting Error))	AI is repetitively allocated in any control mode (for example AI1 can be not only the A reference source for the torque control, but also the V_LMT source for the speed limit.	In the torque mode, check H07-00, H07-01, H07-07 and H07-08 (H07-07 is enabled when it's set to 2 /3), and then determine whether there is repetitive configuration of AI resources.	Change the value of the related function code
		In the speed mode (including the combination mode for the speed control),view H06-00, H06-01, H06-11 and H07-08 (H07-07 is enabled when it's set to 2/3), and then determine whether there is repetitive configuration of AI resources.	
		In the position mode (including the combination mode for the position control), view H06-00, H06-01, H06-11 and H07-08(H07-07 is enabled when it's set to 2 /3), and then determine whether there is repetitive configuration of AI resources.	

Error Name	Cause	Confirmation	Solution
Er.200 (Over-current 1) Er.201 (Over-current 2)	Incorrect wiring or contact error of main circuit cable or motor main circuit cable.	Check the wiring. Refer to the ‘main circuit cable’ for detail.	Correct the wiring.
	Short-circuit or ground error of main circuit cable or motor main circuit cable.	Check for short-circuits across the servomotor terminals U, V, and W, or between the grounding and servomotor terminal U, V, or W.	Replace damaged cables.
	Short-circuit or ground error inside the servomotor.	Check for short-circuits across the servomotor terminals U, V, and W, or between the grounding and servomotor terminal U, V, or W.	The servomotor may fail. Replace the servomotor.
	Short-circuit or ground error inside the servomotor	Check for short-circuits across the servomotor terminals U, V, and W, or between the grounding and servomotor terminal U, V, or W.	The servomotor may fail. Replace the servomotor.
	The encoder wiring is aging and corrosive The encoder plug is loosened. The drive signal cable is loosened.	Check the encoder wiring and check the drive signal cable	Weld or plug encoder cables and drive signal cables.
	Function code H0a-04 is set too small.	Check the value of H0a-04.	Change H0a-04 to an appropriate value.
	The external regenerative resistance will be too small or short-circuit.	Measure the regenerative resistance.	Replace with the satisfied regenerative resistance.
Er.210	The servo motor is short circuited.	Check short-circuits for the power cable UVW	Replace the motor.
	The power cable UVW is short-circuit or ground error	Check short-circuits for the power cable UVW	Correct the wiring.

Error Name	Cause	Confirmation	Solution
ER.234 (Over-speed pre-warning fault)	UVW phase sequence error	Check the phase sequence of UVW.	Reconnect UVW.
	Encoder wiring error or model error	Check the encoder information.	Re-check the motor type, encoder type, the encoder wiring.
Er.400 Over-voltage	For AC220V (AC380) with DC power supply input: The power supply voltage exceeded 420V (760V) The power supply voltage is higher than the input voltage.	Measure the power supply voltage.	Set AC power supply voltage within the specified range.
	The power supply is unstable, or is influenced by a lightning surge.	Measure the power supply voltage.	Improve the power supply conditions by installing a surge absorber, etc. Then, turn the power supply ON again. If the error still occurs, the servodrive may fail. Replace the servo drive.
	Acceleration/ deceleration was executed under the high voltage condition.	Check the power supply voltage and the speed and torque during operation.	Set AC power supply voltage within the specified range.
	Bus voltage sampling value has big deviation	Check the sampling value and actual value	Adjust the bus voltage sampling gain (ask for the technical support)
	Servo Drive Error	-	Then, turn the power supply ON again. If the error still occurs, the servodrive may fail. Replace the servo drive.
Er.410 Under-voltage	For AC220V (AC380) with DC power supply input: The power supply voltage is below 220V (380V) The power supply voltage is below the input voltage.	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	The power supply voltage dropped during operation	Measure the power supply voltage.	Increase the power supply capacity.
	Transient power failure	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	Servo Drive Error	-	The servodrive may be fail. Replace the servo drive.

Error Name	Cause	Confirmation	Solution
Er.420 Power Cables Open Phase	Incorrect power cable wiring	Check the wiring	Confirm that the power cable is correctly wired.
Er.500 Motor Over-speed	The order of phases U, V and W in the servomotor wiring is incorrect.	Check the servomotor wiring.	Confirm that the servomotor is correctly wired.
	Reference input value exceeding the over-speed detection level was input.	Check the input reference	Reduce the reference value or adjust the gain.
	The motor speed exceeded the maximum.	Check the servomotor speed waveform.	Reduce the speed reference input gain, adjust the servo gain, or reconsider the operation conditions.
	Servo Drive Error	-	The servodrive may fail. Replace the servo drive.
Er.510 Over-speed of Encoder Output Pulse Rate	The encoder output pulse output frequency exceeded the limit (1.6MHZ).	Check the encoder output pulse output setting.	Decrease the setting of the encoder output pulse.
Er.600 Inertia Identification Error	Inertia Identification runs overtime	Load torque is too large (such as motor was stalling) or excessive load inertia	Remove mechanical reasons against motor shaft stalling or replace the motor that is matching the current system motor (inertia match and power levels match)
Er.602	Angle identification fault	UVW identification error	Perform angle identification again
Er.610 (Drive overload) Er.620 (Motor overload)	Incorrect wiring or contact error of servomotor and encoder.	Check the wiring.	Confirm that the servomotor and encoder are correctly wired.
	Operation beyond the overload protection features	Check the servomotor overload features and executed run reference.	Reconsider the load conditions and operation conditions. Or, increase the servomotor capacity.
	Excessive load was applied during operation, because the servomotor was not driven due to mechanical problems.	Check the running reference and motor rotating speed	Improve the mechanical problems.
	Servo Drive Error	-	The servodrive may fail. Replace the servo drive.

Error Name	Cause	Confirmation	Solution
Er.650 Radiator overheated	The ambient temperature is too high.	Check the ambient temperature	Decrease the ambient temperature by improving the servomotor installation conditions.
	The overload error has been reset by turning OFF the power too many times.	Check overload error	Change the error reset method, considering the load operation conditions
	Servo-drive installation directions The space of the servo drive between the other servo drive is unreasonable.	Check the setting status of the servo drive	Install according to the standard installation of the servo-drive
	Servo Drive Error	-	The servodrive may fail. Replace the servo drive.
Er.740 (Encoder Z interference)	There was interference on encoder Z UVW wiring is incorrect The encoder cable is loosened.	Check the encoder wiring.	Take the shielding measures for the encoder cable. Tighten the encoder wiring terminals.
Er.741 (Encoder AB interference)	There was interference on encoder Z UVW wiring is incorrect The encoder cable is loosened.	Check the encoder wiring.	Take the shielding measures for the encoder cable. Tighten the encoder wiring terminals.
Er.831 (AD sampling Error 1)	AD data is abnormal. AD data is abnormal. The drive signal cable is loosened when replacing the control board.	AD module error or servo drive error Check the drive signal cables.	Turn the power supply OFF and then ON again. If the error still occurs, please replace the servo drive, asking for the technical support or plug the cables again.
Er.832 (AD Sampling Error 2)	AD data is abnormal. The drive signal cable is loosened when replacing the control board.	AD module error or servo drive error Check the drive signal cables.	Turn the power supply OFF and then ON again. If the error still occurs, please replace the servo drive, asking for the technical support or plug the cables again.
Er.833 (Current sampling Error)	Current sampling abnormal The drive signal cable is loosened when replacing the control board.	Current sampling module error or servo drive error; Check the drive signal cables.	Turn the power supply OFF and then ON again. If the error still occurs, please replace the servo drive, asking for the technical support or plug the cables again.
Er.834	AI-channel over-voltage fault	AI channel voltage is larger than 11.5V	Check the cable is connected correctly, or analog voltage is too high.

Error Name	Cause	Confirmation	Solution
Er.850	Sliding phenomena appeared for long-time working of the servo motor.	Ask for technical support.	Replace the servo drive or asking for the technical support.
Er.A21	Programmable Logic Error	Ask for technical support.	Replace the servo drive or asking for technical support.
Er.A34 Encoder Echoback Error	Encoder disconnected; Encoder cable is loosened.	Check the wiring,	Incorrect wiring or contact error of encoder.
	The motor model selection may be faulty.	Ask for technical support.	Ask for technical support.
	Encoder type selection may be faulty.	Ask for technical support.	Ask for technical support.
ER.A35	Signal Z loss	Encoder wiring or contact error	Check wiring
Er.b00	UVW wiring is incorrect.	Check the main circuit cable	Incorrect wiring or contact error of encoder.
	Servodrive gain is too small	Check the servo drive gain is too small	Increase the gain(H08-02)
	The frequency of the position reference pulse is too high.	Reduce the pulse frequency to operate.	Reduce the position reference pulse frequency or reference acceleration. Or, reconsider the electronic gear ratio.
	The position reference acceleration is too fast.	Reduce the reference acceleration to operate.	Apply the smoothing function, such as using position reference acceleration/ deceleration time constant.
	Excessive Position Error Error Level is low against the operating condition.	Check the error level (Pn520) to see if it is set to an appropriate value.	Properly set the H0a-11 value.
	Servo Drive Error	-	Turn the power supply ON again. If the error still occurs, the servodrive may fail. Replace the servo drive.
Er.b03 (Electronic Gear Setting Error)	Electronic gear ratio exceeds the specification range [0.001, 4000]	Check ratio of the function code H05-11/H05-10	Set the H05-11/H05-10 ratio within the specified range.

11.1.4 Troubleshooting of Warnings

When the servodrive sends out a warning, the digital panel will display “Er.9xx”. The

troubleshooting is shown in the following table.

If the warning cannot be reset, please contact our service center.

Error Code	Cause	Confirmation	Solution
Er.922 (External regenerative resistance is too small.)	External regenerative resistance is less than the minimum value of the driver.	Measure the resistance and check the function code H02-27.	Replace with the specified external regenerative resistance while change the function code H02-27.
Er.960 (Absolute Encoder Angle initialization Error	Initialize the serial motor for the first use.	Re-initialize the motor and the error will disappear.	Ignore the error.
	Motor shaft is braking or excessive load torque.	Check the connection between the motor and the machine.	Run the motor with no load and restart the initialization.
	Motor encoder or servo drive error	Excluded for the reasons mentioned above, operate again, if this error is still reported.	Contact us to replace the servomotor or servodrive.

11.1.5 Troubleshooting of Other Abnormalities

Problem	Cause	Confirmation	Solution
		Turn the Servodrive OFF Before Troubleshooting.	
Servomotor does not start	The control power supply is not ON.	Check voltage between power supply terminals.	Correct the control power circuit.
	The main circuit power supply is not ON.	Check the voltage between power supply terminals.	Correct the power circuit.
	Wiring of I/O signal connector CN1 error or disconnected.	Check the CN1 connector.	Correct the connector CN1 connection.
	Servomotor or encoder wiring disconnected.	Check the wiring.	Correct the wiring.
	Overload	Trail run under no load status.	Reduce load or replace with larger capacity servomotor.
	Speed/position references not input	Check the input speed/ position reference signal	Input speed/position references correctly.
	Setting control mode is incorrect (H02-00)	Check the setting of the control mode (H02-00)	Set the control mode (H02-00) correctly.
	Encoder type differs from parameter setting	Check the encoder type	Set the encoder type correctly.
	Servo ON (/S-ON) input signal stays OFF.	Check the setting value of input parameters (H03)	Correctly set the input parameter and servo ON status.
	Speed control: speed reference input is incorrect.	Check the control mode and input	Set or input the control parameter correctly.
	Torque control: torque reference input is incorrect.	Check the control mode and input	Set or input the control parameter correctly.
	Position control: Reference input is incorrect.	Check (H05-15) reference pulse form or sign + pulse signal.	Set or input the control parameter correctly.
	Deviation count clear signal stay ON Status	Check CLR+ and CLR- input (CN1-14, 15)	Set CLR+ and CLR- input to OFF.
	The forward run disabled (P-OT) and reverse run disabled (N-OT) input signals are turned OFF.	Check P-OT or N-OT input signal.	Turn P-OT or N-OT input signal OFF.
	Servo Drive Error	Servo drive circuit board error	Replace the servo drive
Servomotor Moves Instantaneously, and then Stops	Motor wiring is incorrect.	Check the motor wiring.	Correct the wiring.
	Encoder wiring is incorrect.	Check the encoder wiring.	Correct the wiring.
Servomotor Speed Unstable	Wiring connection to servomotor is incorrect.	Check connections of main circuit cable (phases U, V and W) and encoder connectors.	Tighten any loose terminals or connectors.

Problem	Cause	Confirmation	Solution
		Turn the Servodrive OFF Before Troubleshooting.	
Servomotor Rotates Without Reference Input	Speed control: Speed reference input is incorrect.	Check V-REF and SG to confirm if the control method and the input are agreed.	Correct the control mode selection parameter, or the input signal.
	Torque control: Torque reference input is incorrect.	Confirm whether the control mode (H02-00) and the input are agreed.	Correct the control parameter or the input signal.
	Speed reference offset is incorrect.	The servo motor offset is adjusted incorrectly.	Adjust the servo drive offset.
	Position control: Reference pulse input is incorrect.	Check (05-15) reference pulse form or sign + pulse signal.	Correct the control parameter or the input signal.
	Servo Drive Error	Servo drive circuit board error	Replace the servo drive
Abnormal Noise from Servomotor	A mechanical installation is incorrect.	Check if there are any loose mounting screws.	Tighten the mounting screws.
		Check if there is misalignment of couplings.	Align the couplings.
		Check if there are unbalanced couplings.	Balance the couplings.
	Bearings are defective.	Check for noise and vibration around the bearings.	Contact our service centre.
	Noise interference due to input signal wire specifications.	The encoder cable must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm2 min.	Use the specified encoder cable.
	Noise interference due to length of encoder cable wiring	Check the length of the encoder cable is 3m.The impedance is below 100Ω.	Use the specified input signal wire length.
	Noise interference due to the length of input/output signal cable.	The encoder cable must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm2 min.	Use the specified input signal wires.
	Noise interference due to the length of input/output signal cable.	Check the maximum length is 20m.	Use the specified input signal wire length.
	Noise interference due to damaged encoder cable	Check if the encoder cable is damaged or bent.	Replace the encoder cable and modify the encoder cable layout.
	Terminal potential varies because of influence of machines such as welders at the servomotor.	Check whether the machines are correctly grounded.	Ground machines correctly, and prevent diversion to the encoder wires.
	Servo drive pulse counting error due to noise interference	Noise interference to the encoder signal cables	Take measures against noise in the encoder wiring.
	Excessive vibration and shock to the encoder	Check if vibration from the machine occurred or servomotor installation is incorrect (mounting surface accuracy, fixing, alignment)	Reduce vibration from the machine, or secure the servomotor installation.
	An encoder error occurred.	An encoder error occurred.	Replace the servomotor.

Problem	Cause	Confirmation	Solution
		Turn the Servodrive OFF Before Troubleshooting.	
Servomotor Vibrates at Frequency of Approx 200 to 400 Hz	Speed loop gain value (H08-00) too high.	Factory setting: 400.0Hz Perform gain adjustment according to the user manual.	Correctly set speed loop gain (H08-00).
	Position loop gain value (H08-02) too high.	Factory setting: 20.0Hz Perform gain adjustment according to the user manual.	Correctly set speed loop (H08-02).
	Incorrect speed loop integral time (Pn101) setting	Factory setting: 20.00ms Perform gain adjustment according to the user manual.	Correct the speed loop integral time constant (H08-01) setting.
	Incorrect moment of inertia ratio data (H08-17)	Check the moment of inertia ratio setting (H08-17)	Correct the moment of inertia ratio (H08-17) setting.
High Rotating Speed Overshoot on Starting and Stopping	Speed loop gain value (H08-00) too high.	Factory setting: 400.0Hz Perform gain adjustment according to the user manual.	Correctly set speed loop gain value (H08-00)
	Position loop gain value (H08-02) too high.	Factory setting: 20.0Hz Perform gain adjustment according to the user manual.	Correctly set position loop gain value (H08-02)
	Incorrect speed loop integral time (H08-01) setting	Factory setting: 20.00ms Perform gain adjustment according to the user manual.	Correctly set speed loop integral time (H08-01)
	Incorrect moment of inertia ratio data	Check the moment of inertia ratio setting	Correct the moment of inertia ratio (H08-17) setting or select switched-mode

Problem	Cause	Confirmation	Solution
		Turn the Servodrive OFF Before Troubleshooting.	
Over-travel (OT)	Forward or reverse input signal is disabled to reach P-OT or N-OT	Check whether the over-travel limit switch operates properly.	Correct the over-travel limit switch wiring.
		Check if the over-travel limit switch operates properly.	Correct the over-travel limit switch wiring.
	Forward or reverse run disabled signal malfunctioning.	Check if the over-travel limit switch operates correctly.	Stabilize the operation of the over-travel limit switch.
		Check if the over-travel limit switch wiring is correct. (Checks for damaged cables or loose screws.)	Correct the over-travel limit switch wiring.
	Forward or reverse run disabled signal malfunctioning.	Check if forward drive input signal (P-OT) setting (H03) is disabled.	Correct forward drive input signal (P-OT)setting (H03)
		Check if reverse drive input signal (P-OT) setting (H03) is disabled.	Correct reverse drive input signal (P-OT)setting (H03)
	Incorrect servomotor stop method selection	(H02-05) Check emergency stop setting when servo OFF	(H02-05) Correct emergency stop setting when servo OFF
		(H07-15) Check emergency stop setting when torque control	(H07-15) Correct emergency stop setting when torque control
	Improper Over-travel Position	The over-travel limit switch position is too short for the coasting distance.	Set the over-travel limit switch position to proper status.
	Noise interference due to the length of input/output signal cable.	The encoder cable must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm2 min.	Use the specified input signal wires.
	Noise interference due to length of encoder cable wiring	Check if the maximum wiring length is 20m.	Use the specified input signal wires.
	Noise interference due to damaged encoder cable	Check if noise interference due to cable meshing and damaged.	Replace the encoder cable and modify the encoder cable layout.
	Terminal potential varies because of influence of machines such as welders at the servomotor.	Check whether the machines are correctly grounded.	Ground machines correctly, and prevent diversion to the encoder wires.
	Servo drive pulse counting error due to noise interference	Noise interference to the encoder signal cables	Take measures against noise in the encoder wiring.
	Excessive vibration and shock to the encoder	Check if vibration from the machine occurred or servomotor installation is incorrect (mounting surface accuracy, fixing, alignment)	Reduce vibration from the machine, or secure the servomotor installation.
	The encoder error occurred.	Check if the encoder error occurred.	Replace the servomotor.
	The drive error occurred.	Check if the drive error occurred.	Replace the servodrive.

Problem	Cause	Confirmation	Solution
		Turn the Servodrive OFF Before Troubleshooting.	
Position Error	The coupling between the mechanism and servo motors is abnormal.	Check if position error occurred on couplings between the mechanism and servo motors	Correctly connect the couplings between the mechanism and servo motors.
	Noise interference due to input signal wire specifications.	The encoder cable must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm2 min.	Use the specified encoder cable.
	Noise interference due to length of encoder cable wiring	Check the length of the encoder cable is 3m.The impedance is below 100Ω.	Use the specified length for the input signal wire.
	The encoder error occurred.	The encoder error occurred.	Replace the servomotor.
Servomotor Overheated	The ambient temperature is too high.	Measure the ambient temperature of the servomotor.	The ambient temperature is below 40℃.
	Servo motor surface is not clean.	Inspection	Clean the dust and oil on the surface of servo motor.
	Overload	No-load trail operation	Reduce load or replace with larger capacity servomotor.

11.2 Maintenance and Inspection of Servo Drive

11.2.1 Servo Motor Inspection

It is necessary to carry out routine maintenance on AC servo motor without brush. The inspection time in the table is the general standard. Please decide the most appropriate inspection time according to the service condition and operational environment.

IMPORTANT

Do not remove the servo motor for the maintenance and inspection.

Item	Frequency	Procedure	Comments
Vibration and Noise	Daily	Touch and listen	Vibration and noise must not be greater than normal levels.
Exterior	According to degree to contamination	Clean with cloth or air gun.	-
Insulation Resistance Measurement	At least once a year	Disconnect the motor from the servo drive and test insulation resistance at 500V megger, Must exceed 10MΩ measure across the servomotor FG and the phase-U, V and W power line.	Contact our service centre if the insulation resistance is below 10MΩ.
Replacing Oil Seal	At least once every 5000 hours	Remove the servo motor and then replace the oil seal.	Applies only to servo motors with oil seals.

Overhaul	At least once every 20000 hours or 5 years	Contact our service centre.	Do not remove the servo motor by yourself.

11.2.2 Servo Drive Inspection

Although you do not carry out routine inspection, please check more than once a year.

Item	Frequency	Procedure	Comments
Clean main circuit and circuit board	At least once every year	Without dust, oil stains, etc	Clean with cloth or air gun.
Loosened Screws		Check if any loose mounting screws for the installation of the terminal and connector.	Tighten
Part error		No discoloration, breakage and dash due to heating.	Contact our service centre

11.2.3 Standard of Servodrive Internal Parts Replacement

Electrical and electronic components will suffer mechanical wear and aging. Therefore, it is necessary to perform periodical maintenance.

For servodrives repaired by Inovance, the parameters are restored to the factory setting. Remember to reset these parameters before operation.

Part Name	Service Life	Replacement	Operating Condition
Cooling Fan	4 to 5 years	Replace with the new one	Ambient temperature: 30℃ every year Load Ratio: Below 80 % operation ratio: 20 hours every day
Smooth Capacitor	7 to 8 years	Replace with the new one (After checking)	
Relay	-	Determine whether to replace after Inspection	
Fuse	10 years	Replace with the new one	
Aluminium Electrolysis Capacitor on Printed Circuit Board	5 years	Replace with the new circuit board(After checking)	

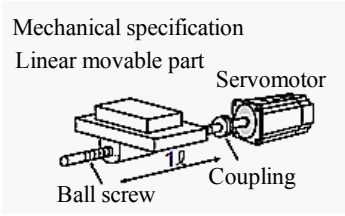
12

Appendix

Chapter 12 Appendix

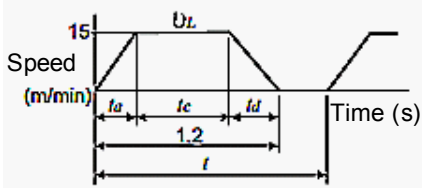
12.1 Capacity Selection of Servo Motor

12.1.1 Example of Speed Control Selection



- Loading Speed: $V_L = 15\,\text{m/ min}$
- Weight of Linear Motion Part: $m = 500\,\text{kg}$
- Ball Screw Length: $_B = 1.4\,\text{m}$
- Diameter of Ball Screw: $d_B = 0.04\,\text{m}$
- Ball Screw Pitch: $P_B = 0.01\,\text{m}$
- Coupling Weight: $m_c = 1\,\text{kg}$
- Outside Diameter of Coupling: $d_c = 0.06\,\text{m}$
- Feeding Number of Times: $n = 40\,\text{times/min}$
- Feeding Length: $\ell = 0.275\,\text{m}$
- Feeding Times: $t_m = 1.2s$ below
- Friction Coefficient: $\mu = 0.2$
- Mechanical Efficiency: $\eta = 0.9(90\%)$

1. Speed Diagram



$$t = \frac{60}{n} = \frac{60}{40} = 1.5(\text{s})$$

$$t_a = t_d$$

$$t_a = tm \frac{60\times}{V_L} = 1.2 \frac{60\times 0.275}{15} = 0.1(\text{s})$$

$$tc = 1.2 - 0.1\times 2 = 1.0(\text{s})$$

2. Rotating speed

- Rotating speed of Bearing Axle

$$n_L = \frac{V_L}{P_B} = \frac{15}{0.01} = 1500(\text{min}^{-1})$$

- Rotating Speed of Motor Shaft

Due to coupling directly links, reduction ratio: 1/R=1/1

$$n_M = n_L \bullet R = 1500\times 1 = 1500(\text{min}^{-1})$$

3. Loading Torque

$$T_L = \frac{9.8\mu \bullet m \bullet P_B}{2\pi R \bullet \eta} = \frac{9.8\times 0.2\times 500\times 0.01}{2\pi\times 1\times 0.9} = 1.73(\text{N}\bullet\text{m})$$

4. Loading Moment of Inertia

- Linear Motion Part

$$J_{LI} = m\left(\frac{P_B}{2\pi R}\right)^2 = 500\times\left(\frac{0.01}{2\pi\times 1}\right) = 12.7\times 10^{-4}\ (\text{kg}\bullet\text{m}^2)$$

- Ball Screw

$$J_B = \frac{\pi}{32}\rho \bullet {}_B \bullet d_B^4 = \frac{\pi}{32}\times 7.87\times 10^3 \times 1.4\times (0.04)^4 = 27.7\times 10^{-4}\ (\text{kg}\bullet\text{m}^2)$$

- Coupling

$$J_C = \frac{1}{8} m_C \bullet d_C^2 = \frac{1}{8}\times 1\times (0.06)^2 = 4.5\times 10^{-4}\ (\text{kg}\bullet\text{m}^2)$$

5. Loading Travelling Power

$$P_O = \frac{2\pi n_M \bullet T_L}{60} = \frac{2\pi\times 1500\times 1.73}{60} = 272(\text{W})$$

6. Loading Accelerating Power

$$P_a = \left(\frac{2\pi}{60} n_M\right)^2 \frac{J_L}{t_a} = \left(\frac{2\pi}{60} \times 1500\right)^2 \times \frac{44.9 \times 10^{-4}}{0.1} = 1108(\mathrm{W})$$

7. Temporary Setting of Servo Motor

a） Selection Conditions

- $T_L \leq$ Motor Rated Torque
- $P_a + P_o = (1\text{-}2) \times$ Motor Rated
- $n_M \leq$ Motor Rated Rotating
- $J_L \leq$ Allowable Loading Momentof Inertia of Servo Unit

Follow the Selection Conditions:

- Servo Motor: ISMH3-85B15CD-U131X
- Servo Drive: IS500AT5R4I

b） Parameters of Servo Motor and Servo Drive

- Rated Output: 850 (W)
- Rated Rotation Speed: 1500 (min-1)
- Rated Torque: 5.39 (N·m)
- Max. Torque: 13.8 (N·m)
- Motor Rotor Moment of Inertia: 13.0×10-4 (kg·m2)
- Allowable Loading Moment of Inertia: 69.58×10-4（kg•m2）

8. Servo Motor Confirmation

- Torque Confirmation

$$T_P = \frac{2\pi n_M (J_M + J_L)}{60 t_a} + T_L = \frac{2\pi \times 1500 \times (13.0 + 44.9) \times 10^{-4}}{60 \times 0.1} + 1.73$$

$$= 11\,(\mathrm{N \cdot m}) < \text{Instant Max. Torque (Available)}$$

- Torque Confirmation

$$T_S = \frac{2\pi n_M (J_M + J_L)}{60 t_d} - T_L = \frac{2\pi \times 1500 \times (13.0 + 44.9) \times 10^{-4}}{60 \times 0.1} - 1.73$$

$$= 7.5(\mathrm{N \cdot m}) < \text{Instant Max. Torque (Available)}$$

- Torque Effective Value Confirmation

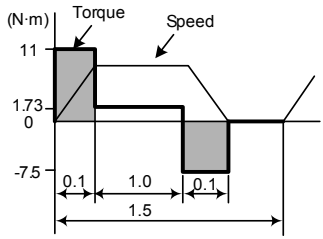
$$T_{rms} = \sqrt{\frac{T_P^2 \cdot t_a + T_L^2 \cdot t_c + T_S^2 \cdot t_d}{t}} = \sqrt{\frac{(1)^2 \times 0.1 + (1.3)^2 \times 1.0 + (7.5)^2 \times 0.1}{1.5}}$$

$$\approx 3.2\ (\mathrm{N \cdot m}) < \text{Rated Torque (Available)}$$

9. Selection Result

The above servo motor and servo drives are available.

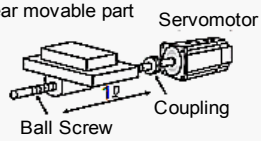
Torque diagram is shown below.



12.1.2 Example of Position Control Selection

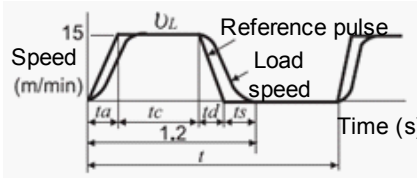
Mechanical Specification

Linear movable part



- Loading Speed: $V_L = 15\,\mathrm{m/min}$
- Weight of Linear Motion Part: $m = 80\,\mathrm{kg}$
- Ball Screw Length: $\ell_B = 0.8\,\mathrm{m}$
- Diameter of Ball Screw: $d_B = 0.016\,\mathrm{m}$
- Ball Screw Pitch: $P_B = 0.005\,\mathrm{m}$
- Coupling Weight: $m_c = 0.3\,\mathrm{kg}$
- Outside Diameter of Coupling: $d_c = 0.03\,\mathrm{m}$
- Feeding Number of Times: $n = 40\ \mathrm{Times/min}$
- Feeding Length: $\ell = 0.25\,\mathrm{m}$
- Feeding Times: $t_m = 1.2s$ (below)
- Electrical Stop accuracy: $\delta = \pm 0.01\,\mathrm{mm}$
- Friction Coefficient: $\mu = 0.2$
- Mechanical Efficiency: $\eta = 0.9(90\%)$

1. Speed Diagram



$$t = \frac{60}{n} = \frac{60}{40} = 1.5(\text{s})$$

$$ts = 0.1(\text{s})$$

$$ta = tm - ts - \frac{60\ell}{VL} = 1.2 - 0.1 - \frac{60 \times 0.25}{15} = 0.1(\text{s})$$

$$tc = 1.2 - 0.1 - 0.1 \times 2 = 0.9(\text{s})$$

2. Rotating Speed

- Rotating speed of Bearing Axle

$$nL = \frac{VL}{PB} = \frac{15}{0.005} = 3000(\text{min}^{-1})$$

- Rotating Speed of Motor Shaft

Due to coupling directly links, reduction ratio: 1/R=1/1.

$$nM = nL \bullet R = 3000 \times 1 = 3000(\text{min}^{-1})$$

3. Loading Torque

$$TL = \frac{9.8\mu \bullet m \bullet PB}{2\pi R \bullet \eta} = \frac{9.8 \times 0.2 \times 80 \times 0.005}{2\pi \times 1 \times 0.9} = 0.139(\text{N} \bullet \text{m})$$

4. Loading moment of inertia

- Linear Motion Part

$$JLI = m\left(\frac{PB}{2\pi R}\right)^2 = 80 \times \left(\frac{0.005}{2\pi \times 1}\right)^2 = 0.507 \times 10^{-4}\ (\text{kg} \bullet \text{m}^2)$$

- Ball Screw

$$JB = \frac{\pi}{32} \rho \bullet {}_B \bullet dB^4 = \frac{\pi}{32} \times 7.87 \times 10^3 \times 0.8 \times (0.016)^4 = 0.405 \times 10^{-4}\ (\text{kg} \bullet \text{m}^2)$$

- Coupling

$$JC = \frac{1}{8} mc \bullet dc^4 = \frac{1}{8} \times 0.3 \times (0.03)^2 = 0.338 \times 10^{-4}\ (\text{kg} \bullet \text{m}^2)$$

5. Loading Travelling Power

$$P_O = \frac{2\pi n_M \bullet T_L}{60} = \frac{2\pi \times 3000 \times 0.139}{60} = 43.7(\mathrm{W})$$

6. Loading Accelerating Power

$$P_a = \left(\frac{2\pi}{60} n_M\right)^2 \frac{J_L}{t_a} = \left(\frac{2\pi}{60} \times 3000\right)^2 \times \frac{1.25 \times 10^{-4}}{0.1} = 123.4(\mathrm{W})$$

7. Temporary Setting of Servo Motor

a） Selection Conditions

$T_L \leq$ Motor Rated Torque

$P_a + P_o = (1 \sim 2) \times$ Motor Rated Output

$n_M \leq$ Motor Rated Torque

$J_L \leq$ Allowable Loading Momentof Inertia of Servo Unit

Follow the Selection Conditions

- Servo Motor: ISMH1-20B30CB-U131X
- Servo Drive: IS500AS2R8I

b） Parameters of Servo Motor and Servo Drive

- Rated Output: 200 (W)
- Rated Rotation Speed: 3000 (min-1)
- Rated Torque: 0.637 (N·m)
- Max. Torque: 1.91 (N·m)
- Motor Rotor Moment of Inertia: 0.158×10-4 (kg·m2)
- Allowable Loading Moment of Inertia: 2.79×10-4 (kg·m2)
- Encoder Pulse Number: 2500 (P/R)

8. Servo Motor Confirmation

- Torque Confirmation

$$T_P = \frac{2\pi n_M (J_M + J_L)}{60 t_a} + T_L = \frac{2\pi \times 3000 \times (0.158 + 1.25) \times 10^{-4}}{60 \times 0.1} + 0.139$$

$= 0.581(\mathrm{N} \bullet \mathrm{m}) <$ Instant Max. Torque (Available)

- Torque Confirmation

$$T_S = \frac{2\pi n_M (J_M + J_L)}{60 t_d} - T_L = \frac{2\pi \times 3000 \times (0.158 + 1.25) \times 10^{-4}}{60 \times 0.1} - 0.139$$

$\fallingdotseq 0.303(\mathrm{N \cdot m}) < \text{Instant Max. Torque (Available)}$

- Torque Effective Value Confirmation

$$Trms = \sqrt{\frac{TP^2 \cdot ta + TL^2 \cdot tc + TS^2 \cdot td}{t}} = \sqrt{\frac{(0.581)^2 \times 0.1 + (0.139)^2 \times 0.9 + (0.303)^2 \times 0.1}{1.5}}$$

$\fallingdotseq 0.201(\mathrm{N \cdot m}) <$ RRated Torque (Available)

The above servo motor and servo drives are available. The analysis for position control is shown below.

9. PG Feedback pulse frequency division ratio Setting of Electronic Gear

Since electrical stop accuracy, set position detection units $\Delta = 0.01\,\mathrm{mm/pulse}$

$$\frac{P_B}{\Delta} \times \left(\frac{\mathrm{B}}{\mathrm{A}}\right) = \frac{5}{0.01} \times \left(\frac{\mathrm{B}}{\mathrm{A}}\right) = 2500 \times 4$$

$$k = \left(\frac{\mathrm{B}}{\mathrm{A}}\right) = \frac{2500 \times 4}{500}$$

10. Reference Pulse Frequency

$$V_S = \frac{1000 \times V_L}{60 \times \Delta} = \frac{1000 \times 15}{60 \times 0.01} = 25{,}000(\mathrm{pps})$$

11. Offset Counters Stay Pulse

Set Position Loop Gain $Kp = 30(1/\mathrm{s})$

$$\varepsilon = \frac{V_S}{K_p} = \frac{25{,}000}{30} = 833(\mathrm{pulse})$$

12. Electrical Stop Accuracy

$$+\Delta\varepsilon = \pm \frac{\varepsilon}{(servo\ unit\ control\ range) \times \frac{n_M}{n_R}} = \pm \frac{833}{5000 \times \frac{3000}{3000}}$$

$= \pm 0.17 < \pm 1(\mathrm{pulse}) = \pm 0.01(mm/\mathrm{pulse})$

The above servo motor and servo drives are available.

12.2 Function Code Table

Parameter Group	Description
H00	Servomotor Parameters
H01	Factory Parameters
H02	Basic Control Parameters
H03	Terminal Input Parameters
H04	Terminal Output Parameters
H05	Position Control Parameters

H06	Speed Control Parameters
H07	Torque Control Parameters
H08	Gain Parameters
H09	Auto-tuning Parameters
H0a	Error and Protection Parameters
H0b	Display Parameters
H0c	Communication Parameters
H0d	Auxiliary Function Parameters
H11	MS Position Functions
H12	MS Speed Functions
H17	VDI/VDO Functions
H30	Communications read servo status variables, the panel is not available
H31	Communications give related variables, the panel is not available

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
Group H00 Servo Motor Parameters								
H00	00	Motor Model	0-65534 65535: Motor model is null. (Factory setting depends on drive model)	1	xxxx	After restart	Stop setting	-
*H00	08	Motor Power Cable Phase Sequence	0: CCW 1: Clockwise	-	-	-	-	
*H00	09	Rated Voltage	0: 220V 1: 380V	-	-	-		
*H00	10	Rated Power	0.01-655.35KW	0.01KW	-	-	-	
*H00	11	Rated Current	0.001-655.35A	0.01A	-	-	-	
*H00	12	Rated Torque	0.10Nm-655.35Nm	0.01Nm	-	-	-	
*H00	13	Max. Torque	0.10Nm-655.35Nm	0.01Nm	-	-	-	
*H00	14	Rotation Speed	1rpm-9000rpm	1rpm	-	-	-	
*H00	15	Max. Speed	1rpm-9000rpm	1rpm	-	-	-	
*H00	16	Moment of Inertia Jm	0.01kgcm²-655.35 kgcm²	0.01 kgcm²	-	-	-	
Group H00 Servo Motor Parameters								

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
*H00	17	Permanent Magnet Synchronous Motor of Pole Pairs	2 to 360 pair poles	One pair poles	-	-	-	
*H00	18	Stator Resistance	0.001Ω-65.535Ω	0.001Ω	-	-	-	
*H00	19	Stator Inductance Lq	0.01mH-655.35mH	0.01mH	-	-	-	
*H00	20	Stator Inductance Ld	0.01mH-655.35mH	0.01mH	-	-	-	
*H00	21	EMF coefficient	0.01mV/rpm-655.35mV/rpm	0.01mV/rpm	-	-	-	
*H00	22	Torque coefficient Kt	0.01Nm/Arms-655.35Nm/Arms	0.01Nm/Arms	-	-	-	
*H00	23	Electric Constant Te	0.01ms-655.35ms	0.01ms	-	-	-	
*H00	24	Mechanical Constant Tm	0.01ms-655.35ms	0.01ms	-	-	-	
*H00	28	Initial Position of Absolute Encoder	0-1073741824	1	-	-	-	
*H00	30	Encoder Selection (HEX)	0000: Incremental encoder (UVW – ABZ); 001: Wire-saving encoder (ABZ (UVW)); 002: Incremental encoder (without UVW); 010: Tamagawa absolute encoder (single-ring &multi-ring encoder and automatic Identification); 012: Serial encoder (Incremental or absolute); 020: SIN/COS encoder; 021: Resolver	1	-	-	-	
*H00	31	Encoder Revolution	1 pulse /rev-107374 1824 pulse /rev	1 pulse / rev	2500 pulse/rev	-	-	
*H00	33	Initialization Electric Degree	0.0° -360.0°	0.1°	0.0°	-	-	
*H00	34	U-phase Electric Degree	0.0° -360.0°	0.1°	0.0°	-	-	

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
* This parameter can only be modified by manufacturers, and the debugger can be modified without a password.								
Group H01 Factory Parameters								
H01	00	Software version Number	Type: XXY.YY XX specification: 00: p model 01: A model 02: H model Y.YY specification: Software version number				Display	-
H01	01	FPGA Software version Number					Display	
The other parameters can only be modified by manufacturers, and the debugger can be modified without a password.								
Group H02 Control Parameters								
H02	00	Control Mode Selection	0: Speed mode 1: Position mode (default) 2: Torque mode 3: Speed mode⇔Torque mode 4: Position mode⇔Speed mode 5: Position mode⇔Torque mode 6: Position mode⇔Speed mode⇔Torque mode	1	1	Immediately	Stop Setting	-
H02	02	Mode Reference Direction Selection	0: Reference direction is positive. 1: Reference direction is negative.	1	0	Immediately	Running setting	PST
H02	03	Output Feedback Direction Selection	0: Take CCW direction as the forward direction (A leading B) 1: Take CW direction as the forward direction (Reverse mode，A is delayed)	1	0	After Restart	Stop Setting	PST
H02	05	Error Stop Mode NO.1 Selection	0: Coast to stop, keep the running status	1	0	Immediately	Stop Setting	PST
H02	06	Error Stop Mode NO.2 Selection	0: Coast to stop 1: Zero-velocity Stop	1	0	Immediately	Stop Setting	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H02	07	Stop Method during Overtravel	0: Coast to stop 1: Take the emergency stop torque setting as the maximum torque so as to stop the motor reducer, and then enter the servo-locked 2: Take the emergency stop torque setting as the maximum torque so as to stop the motor reducer, and then enter the free running	1	0	Immediately	Stop Setting	PS
H02	10	Holding Brake Reference – Servo OFF Delay Time	1ms-500ms	1ms	100ms	Immediately	Stop Setting	P
H02	11	Holding Brake Reference Output Speed Limit Value	0rpm-1000rpm	1rpm	100rpm	Immediately	Stop Setting	P
H02	12	Servo OFF: Holding Brake Reference Waiting Time	100ms-1000ms	1ms	500ms	Immediately	Stop Setting	P
H02	15	LED Warning Display Selection	0: LED Immediately output warning signals; 1: LED do not output warning signals	1	0	Immediately	Stop Setting	PST
H02	21	Drive Allowable Minimum Value of Regenerative Resistance	1-1000 Ω (Read only)	1 Ω	Model dependent	Immediately	Stop Setting	-
H02	22	Built-in Regenerative Resistance Power Capacity	1-65535W (Read only)	1W	Model dependent	Immediately	Stop Setting	-
H02	23	Built-in Regenerative Resistance	1 Ω-1000 (Read only)	1 Ω	Model dependent	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H02	25	Regenerative Resistance Setting	0: Built-in regenerative resistance; 1: External regenerative resistance and natural cooling; 2: External regenerative resistance and forced air cooling; 3: Without the regenerative resistance, dependent on the capacity	1	0	Immediately	Stop Setting	-
H02	26	External Regenerative Resistance Power Capacity	1W-65535W	1W	Different models have different default values	Immediately	Stop Setting	-
H02	27	External Regenerative Resistance	1 Ω-1000 Ω	1 Ω	Different models have different default values	Immediately	Stop Setting	-
H02	30	User Password	0-65535	1	0	After Restart	Stop Setting	-
H02	31	Parameter Initialization	0: No operation; 1: Restore factory default setup value; 2: Clear error record	1	0	After Restart	Stop Setting	-
H02	32	Panel Default Display Function	00- Switch to H0B.00 01- Switch to H0B.01 And so on 50- No switching	1	50	Immediately	Stop Setting	-
H02	40	Reserved Parameters	-	-	-	-	-	-
H02	41	Reserved Parameters	-	-	-	-	-	-
Group H03 Terminal Input Parameter								

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H03	00	FunINL is not allocated (HEX).	0-0xFFFF Bit0 corresponds to FunIN.1; Bit1 corresponds to FunIN.2; …… Bit15 corresponds to FunIN.16.	1	0	After Restart	Running Setting	-
H03	01	FunINH is not allocated (HEX).	0-0xFFFF Bit0 corresponds to FunIN.17; Bit1 corresponds to FunIN.18; …… Bit15 corresponds to FunIN.32.	1	0	After Restart	Running Setting	-
H03	02	DI1 Terminal Function Selection	Input Function Code: 0, 1-32 0: No Definition 1-32: FunIN.1-32 (Refer to DI/DO Basic Function Code Table)	1	6	After Restart	Running Setting	-
H03	03	DI1 Terminal Logic Selection	Input Polarity: 0-4 0: Low level is enabled 1: High level is enabled 2: Rising edge enabled 3: Falling edge enabled 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-
H03	04	DI2 Terminal Function Selection	Input function code: 0, 1-32 0: No Definition 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	7	After Restart	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H03	05	DI2 Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled; 1: High level is enabled; 2: Rising edge is enabled; 3: Falling edge is enabled; 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-
H03	06	DI3 Terminal Function Selection	Input function code: 0, 1-32 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	5	After Restart	Running Setting	-
H03	07	DI3 Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled 1: High level is enabled 2: Rising edge is enabled 3: Falling edge is enabled 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-
H03	08	DI4 Terminal Function Selection	Input function code: 0, 1-32; 0: No Definition 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	2	After Restart	Running Setting	-
H03	09	Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled; 1: High level is enabled; 2: Rising edge is enabled; 3: Falling edge is enabled; 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H03	10	Terminal Function Selection	Input function code: 0, 1-32; 0: No Definition 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	1	After Restart	Running Setting	-
H03	11	DI5 Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled; 1: High level is enabled; 2: Rising edge is enabled; 3: Falling edge is enabled; 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-
H03	12	DI6 Terminal Function Selection	Input function code: 0, 1-32; 0: No Definition 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	12	After Restart	Running Setting	-
H03	13	DI6 Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled; 1: High level is enabled; 2: Rising edge is enabled; 3: Falling edge is enabled; 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-
H03	14	DI7 Terminal Function Selection	Input function code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	8	After Restart	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H03	15	DI7 Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled; 1: High level is enabled; 2: Rising edge is enabled; 3: Falling edge is enabled; 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-
H03	16	DI8 Terminal Function Selection	Input function code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	9	After Restart	Running Setting	-
H03	17	DI8 Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled; 1: High level is enabled; 2: Rising edge is enabled; 3: Falling edge is enabled; 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-
H03	18	DI9 Terminal Function Selection	Input function code: 0, 1-32; 0: PHip input; 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	0	After Restart	Running Setting	-
H03	19	DI9 Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled; 1: High level is enabled; 2: Rising edge is enabled; 3: Falling edge is enabled; 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H03	20	DI10 Terminal Function Selection	Input function code: 0, 1-32; 0: NHip input 1-32: FunIN.1-32 (Refer to DIDO Basic Function Code Table)	1	0	After Restart	Running Setting	-
H03	21	DI10 Terminal Logic Selection	Input polarity: 0-4 0: Low level is enabled; 1: High level is enabled; 2: Rising edge is enabled; 3: Falling edge is enabled; 4: Both rising and falling edge are enabled	1	0	After Restart	Running Setting	-
H03	50	AI1 Minimum Input	-10.00V-10.00V	0.01V	-10.00V	Immediately	Stop Setting	-
H03	51	AI1 Minimum Value Corresponds to the Setting Value	-100.0%-100.0%	0.1%	-100.0%	Immediately	Stop Setting	--
H03	52	AI1 Maximum Input	-10.00V-10.00V	0.01V	10.00V	Immediately	Stop Setting	-
H03	53	AI1 Maximum Value Corresponds to the setting Value	-100.0%-100.0%	0.1%	100.0%	Immediately	Stop Setting	-
H03	54	AI1 Zero Offset	-500.0mV-500.0mV	0.1mV	0mV	Immediately	Running Setting	-
H03	56	AI1 Filtering Time	0.00ms-655.35ms	0.01ms	2.00ms	Immediately	Stop Setting	-
H03	57	AI1 minimum input	-10.00V-10.00V	0.01V	-10.00V	Immediately	Stop Setting	-
H03	58	AI1 Minimum Value Corresponds to the setting Value	-100.0%-100.0%	0.1%	-100.0%	Immediately	Stop Setting	-
H03	59	AI2 Maximum Input	-10.00V-10.00V	0.01V	10.00V	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H03	60	AI2 Maximum Value Corresponds to the setting Value	-100.0%-100.0%	0.1%	100.0%	Immediately	Stop Setting	-
H03	61	AI2 Zero Offset	-500.0mV-500.0mV	0.1mV	0mV	Immediately	Running Setting	-
H03	63	AI2 Input Filtering Time	0.00ms-655.35ms	0.01ms	2.00ms	Immediately	Stop Setting	-
H03	64	AI3 Minimum Input	-10.00V-10.00V	0.01V	-10.00V	Immediately	Stop Setting	-
H03	65	AI1 Minimum Value Corresponds to the Setting Value	-100.0%-100.0%	0.1%	-100.0%	Immediately	Stop Setting	-
H03	66	AI3 Maximum Input	-10.00V-10.00V	0.01V	10.00V	Immediately	Stop Setting	-
H03	67	AI3 Maximum Value Corresponds to the setting Value	-100.0%-100.0%	0.1%	100.0%	Immediately	Stop Setting	-
H03	68	AI3 Zero Offset	-500.0mV-500.0mV	0.1mV	0mV	Immediately	Running Setting	-
H03	70	AI3 Input Filtering Time	0.00ms-655.35ms	0.01ms	2.00ms	Immediately	Stop Setting	-
H03	80	Analog100% Corresponding Speed Value	0rpm-9000rpm	1rpm	3000rpm	Immediately	Stop Setting	-
H03	81	Analog100% Corresponding Torque Value	One time- eight times rated torque	One time rated torque	One time rated torque	Immediately	Stop Setting	-
Group H04 Terminal Parameters								
H04	00	DO1 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	1	Immediately	Stop Setting	-
H04	01	DO1 Terminal Logic Level Selection	Reverse Setting of Output Polarity: 0-1 0: Output low level when enabled; 1: Output high level when enabled	1	0	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H04	02	DO2 Terminal function selection	Output code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	4	Immediately	Stop Setting	-
H04	03	DO2 Terminal Logic Level Selection	Reverse Setting of Output Polarity: 0-1 0: Output low level when enabled; 1: Output high level when enabled	1	0	Immediately	Stop Setting	-
H04	04	DO3 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	3	Immediately	Stop Setting	-
H04	05	DO3 Terminal Logic Level Selection	Reverse Setting of Output Polarity: 0-1 0: Output low level when enabled; 1: Output high level when enabled	1	0	Immediately	Stop Setting	-
H04	06	DO4 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	10	Immediately	Stop Setting	-
H04	07	DO4 Terminal Logic Level Selection	Reverse Setting of Output Polarity: 0-1 0: Output low level when enabled; 1: Output high level when enabled	1	0	Immediately	Stop Setting	-
H04	10	DO6 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	12	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H04	11	DO6 Terminal Logic Level Selection	Reverse Setting of Output Polarity: 0-1 0: Output low level when enabled; 1: Output high level when enabled	1	0	Immediately	Stop Setting	-
H04	12	DO7 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	13	Immediately	Stop Setting	-
H04	13	DO7 Terminal Logic Level Selection	Reverse Setting of Output Polarity: 0-1 0: Output low level when enabled 1: Output high level when enabled	1	0	Immediately	Stop Setting	-
H04	14	DO8 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	14	Immediately	Stop Setting	-
H04	15	DO8 Terminal Logic Level Selection	Reverse Setting of Output Polarity: 0-1 0: Output low level when enabled 1: Output high level when enabled	1	0	Immediately	Stop Setting	-
H04	22	DO Source Selection	Bit0-DO1 Source …… Bit7-DO8 Source Bit8-Bit15 Reserved 0: Driver Reference; 1: Communication Reference	-	0	Immediately	Stop Setting	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H04	50	AO1 Signal Selection	00: Default motor speed (1V/1000rpm); 01: Speed reference (1V/1000rpm); 02: Torque reference (1V/100%); 03: Position deviation (0.05V/1 Reference units); 04: Amplifier deviation (electronic gear) (0.05V/1 encoder pulse unit); 05: Position reference speed (1V/1000 rpm); 06: Positioning completion reference (complete: 5V; incomplete: 0V); 07: Speed feedforward (1V/1000rpm)	1	0	Immediately	Running Setting	-
H04	51	AO1 offset Voltage	0-10000mV	1mV	5000mV	Immediately	Running Setting	-
H04	52	AO1 MF	-99.99-99.99	0.01 times	1	Immediately	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H04	53	AO2 Signal Selection	00: Default motor speed (1V/1000rpm); 01: Speed reference (1V/1000rpm); 02: Torque reference (1V/100%); 03: Position deviation (0.05V/1 Reference units); 04: Amplifier deviation (electronic gear) (0.05V/1 encoder pulse unit); 05: Position reference speed (1V/1000 rpm); 06: Positioning completion reference (complete: 5V; incomplete: 0V); 07: Speed feedforward (1V/1000rpm)	1	0	Immediately	Running Setting	-
H04	54	AO2 offset Voltage	0-10000mV	1mV	5000mV	Immediately	Running Setting	-
H04	55	AO2 MF	-99.99-99.99	0.01 times	1.00	Immediately	Running Setting	-
Group H05 Position Control Parameters								
H05	00	Master Position Reference A Source	0: Pulse Reference (default); 1: Stepping Given; 2: MS Position Reference Given; 3: Communication Given	1	0	Immediately	Stop Setting	P
H05	03	Stepping	-9999-9999 reference units	1 reference unit	50	Immediately	Stop Setting	P
H05	04	S-curve Acceleration Slope Time	0ms-1000ms	1ms	0ms	Immediately	Stop Setting	P
H05	05	Position Reference S smoothing	0ms-1000ms	1ms	0ms	Immediately	Stop Setting	P
H05	06	Position Reference Moving average Time	0.0ms-128.0ms	0.1ms	0.0ms	Immediately	Stop Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H05	07	Electronic Gear Ratio 1 (Numerator)	1-1073741824	1	4	Immediately	Running Setting	P
H05	09	Electronic Gear Ratio 1 (Denominator)	1-1073741824	1	1	Immediately	Running Setting	P
H05	11	Electronic Gear Ratio 2 (Numerator)	1-1073741824	1	4	Immediately	Running Setting	P
H05	13	Electronic Gear Ratio 2 (Denominator)	1-1073741824	1	1	Immediately	Running Setting	P
H05	15	Reference Pulse Mode	0: Direction + pulse, positive logic (default value); 1: Direction + pulse. negative logic; 2: Phase A + Phase B Orthogonal pulses, 4 multiple frequency; 3-CW+CCW	1	0	After Restart	Stop Setting	P
H05	16	Clear Action Selection	0: Servo OFF and clear position deviation pulse upon error; 1: Clear position deviation pulse upon error; 2: Not clear position deviation pulse (clear via CLR high level); 3: Not clear position deviation pulse(clear via CLR low level); 4-: Not clear position deviation pulse (clear via CLR rising edge); 5: Not clear position deviation (clear via CLR falling edge)	1	0	Immediately	Stop Setting	P
H05	17	Encoder pulse	16-1073741824 P/Rev	1P/Rev	2500P/Rev	After Restart	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H05	19	Speed Feedforward Control Selection	0: No speed feedforward; 1: Internal speed feedforward; 2: AI1 is used to be the speed feedforward input; 3: AI2 is used to be the speed feedforward input; 4: AI3 is used to be the speed feedforward.	1	1	Immediately	Stop Setting	P
H05	20	Positioning Completion Signal (COIN) Output Condition	0: Position deviation absolute value is less than position completion amplitude output; 1: Position deviation absolute value is less than position completion amplitude output, and the reference is zero after position reference filtering; 2: Position deviation absolute value is less than position completion amplitude output and the reference is zero after position reference filtering.	1	0	Immediately	Stop Setting	P
H05	21	Positioning Completion Amplitude	1-65535 reference unit	1 reference unit	7 reference units	Immediately	Stop Setting	P
H05	22	Positioning Completion Approach Signal Amplitude	1-65535 reference units	1 reference unit	65535 reference units	Immediately	Stop Setting	P
H05	23	Interrupt Length Enabled	0: Disable Interrupt Length; 1: Enable Interrupt Length	/	0	After Restart		P
H05	24	Interrupt Length Reference	0-1073741824 reference units	1 reference unit	10000	Immediately	Stop Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H05	26	Interrupt Length Running Speed	1rpm-9000rpm	rpm	200	Immediately	Stop Setting	P
H05	27	Interrupt Length Acceleration / Deceleration time	0-1000	1ms	10ms	Immediately	Stop Setting	P
H05	29	Interrupt Length Completion Lock Status Enabled	0: Disabled; 1: Enabled	1	1	Immediately	Running Setting	P
H05	30	Origin Return Enabled Control	0: Disable origin return function; 1: Enable origin return via DI Input OrgChufa; 2: Enable origin return via DI Input OrgChufa; 3: Start origin return after power-on; 4: Origin return immediately, when this funcode is set; 5: Start electric return to origin command; 6: Take the current position as origin。	1	0	Immediately	Running Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H05	31	Origin Return Mode	0: Origin of forward origin return deceleration point represents origin switch; 1: Origin of reverse origin return deceleration point represents origin switch; 2: Origin of forward origin return deceleration point represents signal Z; 3: Origin of reverse origin return deceleration point represents signal Z; 4: Origin of forward origin return deceleration point represents; 5: Origin of reverse origin return deceleration point represents origin switch;	1	0	Immediately	Stop Setting	P
H05	32	High-speed Search for Original Switch Signal Speed	0-3000	1rpm	100rpm	Immediately	Stop Setting	P
H05	33	Low-speed Search for Origin Switch Speed	0-1000	1rpm	10rpm	Immediately	Stop Setting	P
H05	34	Limit Acceleration / Deceleration Time when Search Origin	0-1000	ms	1000	Immediately	Stop Setting	P
H05	35	Limit the time to search origin	0-65535	ms	10000	Immediately	Stop Setting	P
H05	36	Mechanical Origin Offset	-1073741824-1073741824	1 reference unit	0	Immediately	Stop Setting	P
H05	38	Servo Pulse Output Source Selection	0: Encoder output; 1: Pulse reference synchronous output	1	0	After Restart	Stop Setting	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H05	39	Gear ratio real-time modification and DI switching enable	0- Non-real-time switching 1- Real-time switching	1	0	Immediately	Stop Setting	-
Group H06 Speed Control Parameters								
H06	00	Master Speed Reference A Source	0: Digital given (H0603); 1: AI1; 2: AI2; 3: AI3; 4: Jog speed reference	1	0	Immediately	Stop Setting	S
H06	01	Auxiliary Speed Reference B Source	0: Digital given (H0603); 1: AI1; 2: AI2; 3: AI3; 4: Jog speed reference; 5: MS speed reference	1	3	Immediately	Stop Setting	S
H06	02	Speed Reference Selection	0: Master speed instruction A source; 1: Auxiliary speed instruction B source; 2: A+B; 3: A/B switch; 4: Communication given	1	0	Immediately	Stop Setting	S
H06	03	Speed Reference Ketboard Setting Value	-9000rpm-9000rpm	1rpm	200rpm	Immediately	Running Setting	S
H06	04	Jog Speed Setting Value	0rpm-9000rpm	1rpm	300rpm	Immediately	Running Setting	S
H06	05	Speed Reference acceleration slope time	0ms-10000ms	1ms	0ms	Immediately	Stop Setting	S
H06	06	Speed Reference deceleration slope time	0ms-10000ms	1ms	0ms	Immediately	Stop Setting	S
H06	07	Maximum Rotation Sped Limit Value	0rpm-9000rpm	1rpm	9000rpm	Immediately	Stop Setting	S
H06	08	Speed Forward Limit	0rpm-9000rpm	1rpm	9000rpm	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H06	09	Speed Reverse Limit	0rpm-9000rpm	1rpm	9000rpm	Immediately	Stop Setting	S
H06	11	Torque Feedforward Selection	0: No torque feedforward; 1: Internal torque feedforward	1	0	Immediately	Stop Setting	PS
H06	15	Zero Fixed Rotation Limit Value	0rpm-1000rpm	1rpm	10rpm	Immediately	Stop Setting	S
H06	16	Motor Rotation Signal Speed Threshold	0rpm-1000rpm	1rpm	20rpm	Immediately	Stop Setting	PST
H06	17	Speed Arrive Signal Width	0rpm-100rpm	1rpm	10rpm	Immediately	Stop Setting	PST
Group H07 Torque Control Parameters								
H07	00	Master Torque Reference A Source	0: Digital given (H07-03); 1: AI1; 2: AI2; 3: AI3	1	0	Immediately	Stop Setting	T
H07	01	Auxiliary Torque Reference Source B	0: Digital given (H07-03); 1: AI1; 2: AI2; 3: AI3	1	1	Immediately	Stop Setting	T
H07	02	Torque Reference Selection	0: Master reference A source; 1: Auxiliary torque reference B source; 2: A+B source; 3: A/B switching; 4: Communication given	1	0	Immediately	Stop Setting	T
H07	03	Torque Reference Keyboard Setting Value	-100.0%-100.0%	0.1%	0.0%	Immediately	Running Setting	T
H07	05	Torque Reference Filtering Time	0.00ms-655.35ms	0.01ms	0ms	Immediately	Stop Setting	PST
H07	06	Torque Reference Filtering Time 2	0.00ms-655.35ms	0.01ms	0ms	Immediately	Stop Setting	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H07	07	Torque Limit Source	0: Positive and negative internal torque limit (default); 1: Positive and negative external torque limit (use P-CL and N-CL selection); 2: Take T-LMT as external torque limit input; 3: Take positive and negative external torque and minimum T-LMT value as the torque limit.	1	0	Immediately	Stop Setting	PST
H07	08	T-LMTSelection	1: AI1; 2: AI2; 3: AI3	1	2	Immediately	Stop Setting	PST
H07	09	Forward Internal Torque Limit	0.0%-800.0% (100% corresponds to one time rated torque)	0.1%	300.0%	Immediately	Stop Setting	PST
H07	10	Reserve Internal Torque Limit	0.0%-800.0% (100% corresponds to one time rated torque)	0.1%	300.0%	Immediately	Stop Setting	PST
H07	11	External Torque Limit at forward Side	0.0%-800.0% (100% corresponds to one time rated torque)	0.1%	300.0%	Immediately	Stop Setting	PST
H07	12	External Torque Limit at Reserve Side	0.0%-800.0% (100% corresponds to one time rated torque)	0.1%	300.0%	Immediately	Stop Setting	PST
H07	15	Emergency Stop Torque	0.0%-800.0% (100% corresponds to one time rated torque)	0.1%	100.0%	Immediately	Stop Setting	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H07	17	Speed Limit Source Selection	0: Internal speed limit(speed limit upon torque control); 1: Take V-LMT as external speed limit input	1	0	Immediately	Stop Setting	T
H07	18	V-LMTSelection	1: AI1; 2: AI2; 3: AI3	1	3	Immediately	Stop Setting	T
H07	19	Internal Speed Limit Value upon Torque Control	0rpm-9000rpm	1rpm	1000rpm	Immediately	Stop Setting	T
Group H08 Gain Parameters								
H08	00	Speed-loop Gain	1.0Hz-2000.0Hz	0.1Hz	400.0Hz	Immediately	Running Setting	PS
H08	01	Speed-loop Integration Time Parameters	0.15ms-512.00ms	0.01ms	20.00ms	Immediately	Running Setting	PS
H08	02	Position-loop Gain	1.0Hz-2000.0Hz	0.1Hz	20.0Hz	Immediately	Running Setting	P
H08	03	2nd speed-loop Gain	1.0Hz-2000.0Hz	0.1Hz	400.0Hz	Immediately	Running Setting	PS
H08	04	2nd Speed Integration Time Parameters	0.15ms-512.00ms	0.01ms	20.00ms	Immediately	Running Setting	PS
H08	05	2nd Position-loop Gain	1.0Hz-2000.0Hz	0.1Hz	20.0Hz	Immediately	Running Setting	P
H08	06	Gain Switching Time 1	0-65535	1ms	0	Immediately	Running Setting	P
H08	07	Gain Switching Time 2	0-65535	1ms	0	Immediately	Running Setting	P
H08	08	Gain Switching Waiting Time 1	0-65535	1ms	0	Immediately	Running Setting	PS
H08	09	Gain Switching Waiting Time 2	0-65535	1ms	0	Immediately	Running Setting	PS
H08	15	Average Value of Load Inertia Ratio	0.90-120.00	0.01	1.00	Immediately	Running Setting	-
H08	16	Current Value of Load Inertia Ratio	0.90-120.00	0.01	1.00	Immediately	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H08	10	Gain Switching Selection Switch	0: Disable Gain Switch to fix the 1st gain; 1: Manual gain switch via external input signal (G-SEL) switching gain; 2: Use position pulse difference for automatic gain switch , the gain can switch condition amplitude (H0811); 3: The position instruction filtering output is 0 subject to position pulse; 4: Automatically gain switch subject to the speed instruction, meanwhile gain can switch the amplitude (H0812); 5: Automatically gain switch subject to the torque instruction, meanwhile the gain switch condition is amplitude (H0813).	1	0	Immediately	Stop Setting	PS
H08	11	Gain Switch Position Deviation	0-65535	P	30	Immediately	Stop Setting	P
H08	12	Gain SWITCH Speed Reference Condition Amplitude (Threshold)	0-65535	rpm	100	Immediately	Stop Setting	PS
H08	13	Gain Switch Torque Reference Condition Amplitude (Threshold)	0-300.0	0.1%	20.0	Immediately	Stop Setting	PS
H08	15	Load Rotating Inertia Ratio	1.00-200.00	0.01	1.00	Immediately	Stop Setting	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H08	18	Speed Feedforward Filtering Time Parameter	0.00ms-64.00ms	0.01ms	0.00ms	Immediately	Running Setting	P
H08	19	Speed Feedforward Gain	0.0%-100.0%	0.1%	0.0%	Immediately	Running Setting	P
H08	20	Torque Feedforward Filtering Time Parameter	0.00ms-64.00ms	0.01ms	0.00ms	Immediately	Running Setting	P
H08	21	Torque Feedforward Gain	0.0%-100.0%	0.1%	0.0%	Immediately	Running Setting	P
H08	22	Speed Feedback Filtering	0: Disable speed feedback filter; 1: Enable speed feedback filter	1	0	Immediately	Stop Setting	PS
H08	25	Speed-loop Control Method	0: PI Contorl; 1: P-PI switch control; 2: PI Contorl	1	0	Immediately	Stop Setting	PS
H08	26	P-PI Switch Control Condition	0: Base on internal torque insutruction; 1: Base on speed instruction; 2: Base on acceleration; 3: Base on position deviation pulse; 4: Base on external switch (DI)	1	0	Immediately	Stop Setting	PS
H08	27	P-PI Switch Condition Torque Reference	0.0%-800.0%	0.1%	30.0%	Immediately	Stop Setting	PS
H08	28	P-PI Switch Condition Speed Reference	0rpm-9000rpm	1rpm	0rpm	Immediately	Stop Setting	PS
H08	29	P-PI Switch Condition Acceleration	0rpm/s-30000rpm/s	1rpm/s	200rpm/ms	Immediately	Stop Setting	PS
H08	30	P-PI Switch Condition Position Deviation	0-10000 reference Units	1 reference Unit	0 reference Unit	Immediately	Stop Setting	
Group H09 Auto-tuning Parameters								
H09	00	Max. Speed at Inertia Identification	300-2000rpm	1rpm	600rpm	Immediately	Stop Setting	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H09	01	Max. Speed at Inertia Identification	20ms-400ms	1ms	120ms	Immediately	Running Setting	PST
H09	04	Waiting Time of Inertia Identification	0ms-10000ms	1ms	50ms	Immediately	Running Setting	PST
H09	05	Current Rigid Level	0-25	1	0	Immediately	Stop Setting	PST
H09	07	Circles the motor rotates for one Inertia ratio update		One Circle	1.200 Circles	Display	Display	
Group H0a Error and Protection Parameter								
H0a	00	Power Input Open Phase Protection Selection	0: Enable error and disable warning; 1: Enable error and warning; 2: Disable error and warning	1	0	Immediately	Stop Setting	-
H0a	04	Motor Overload Protection Gain	50%-150%	1%	100%	Immediately	Stop Setting	
H0a	05	Overload Warning Value	1%-100%	1%	80%	Immediately	Stop Setting	-
H0a	06	Motor Overload Current Derating	10%-100%	1%	100%	Immediately	Stop Setting	-
H0a	08	Main circuit is due to the voltage of feature selection	0: Non-detect main circuit under-voltage warning; 1: Detect main circuit under-voltage warning	1	0	Immediately	Stop Setting	-
H0a	10	Position Deviation Excessive Warning Value	1-32767 reference units	1 reference unit	32767 reference units	Immediately	Stop Setting	-
H0a	11	Position Deviation Excessive Error Value	1-32767 reference units	1 reference unit	32767 reference units	Immediately	Stop Setting	-
H0a	12	Speed limit protection function (switch ER.234)	0: Speed limit protection disabled (ER.234 OFF) 1: Speed limit protection enabled (ER.234 ON)	1	1	Immediately	Stop Setting	-
Group H0b Display Parameter								
H0b	00	Actual Motor Speed	-	1rpm	-	-	Display	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H0b	01	Speed Reference	-	1rpm	-	-	Display	PS
H0b	02	Internal Torque Reference (relative to rated torque)	-	0.1%	-	-	Display	PST
H0b	03	Input Signal Monitoring DI	-	-	-	-	Display	PST
H0b	05	Output Signal Monitoring DO	-	-	-	-	Display	PST
H0b	07	Absolute position counter (32-bit decimal display) can be the power-off memory	-	1 reference unit	-	-	Display	P
H0b	09	Mechanical Angle (Starting from the origin of pulse number)	-	1p	-	-	Display	P
H0b	10	Rotation Angle (Electrical angle)	-	0.1°	-	-	Display	PST
H0b	11	Enter Position Corresponding Speed	-	1rpm	-	-	Display	P
H0b	12	Deviation Counter (position deviations) (Enabled only when in the position control)	-	1 reference unit	-	-	Display	P
H0b	13	Enter Reference Pulse Counter (32-bit decimal display)	-	1 reference unit	-	-	Display	P
H0b	17	Feedback Pulse counter (Encoder pulse of 4 times frequency data: display 32-bit decimal) can be the power-off memory	-	1p	-	-	Display	P
H0b	19	Total Power-on Time (32-bit decimal display)	0.0-429496729.6s	0.1s	-	-	Display	-
H0b	21	AI1 Sampling Voltage	-	1mV	-		Display	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H0b	22	AI2 Sampling Voltage	-	1mV	-		Display	-
H0b	23	AI3 Sampling Voltage	-	1mV	-		Display	
H0b	24	Phase-current RMS	-	0.01A	-		Display	
H0b	26	Bus Voltage	-	0.1V	-		Display	
H0b	27	Module Temperature	-	° C	-		Display	-
H0b	31	Turns of Multi-Loop Absolute Encoder	-	r	-		Display	
H0b	33	Error Record Display	0: Current Error; 1: Previous error; 2: Previous 2 errors; 9: Previous 9 errors	1	0	Immediately	Running Setting	-
H0b	34	Error Code	-	-	First error code	-		-
H0b	35	Error Time-stamping	-	0.1s		-	Display	-
H0b	37	Rotating speed upon Selected Error	-	1rpm	-	-	Display	-
H0b	38	Present Current U upon Selected Error	-	0.01A	-	-	Display	-
H0b	39	Present Current V upon Selected Error		0.01A		-	Display	-
H0b	40	Bus Voltage upon Selected Error	-	0.1V	-	-	Display	-
H0b	41	Input Terminal Status upon Error	-	-	-	-	Display	-
H0b	42	Input Terminal Status upon Selected Error	-	-	-	-	Display	-
Group H0c Communication Parameters								
H0c	00	Servo Shaft Address	1-247; 0 indicates the broadcast address.	1	1	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H0c	02	Serial Baud rate Setting	0: 2400; 1: 4800; 2: 9600; 3: 19200; 4: 38400; 5: 57600	Bps Error +-5%	5	Immediately	Stop Setting	-
H0c	03	Modbus Data Format	0: No check; 1: Even parity Check; 2: Odd Parity Check	1	0	Immediately	Running Setting	-
H0c	09	Virtual Communication	0: Disabled 1: Enabled	1	0	Immediately	Stop Setting	PST
H0c	11	Virtual Communication VDO	0: Disabled 1: Enabled	1	0	Immediately	Stop Setting	PST
H0c	12	VDO function is selected to 0 (default value)	Bit0-VDO1: default value ····· Bit15-VDO16: default value	1	0	Immediately	Stop Setting	PST
H0c	13	“Communication write function code value” is updated to EEPROM	0: EEPROM No update 1: EEPROM Update	1	1	Immediately	Running Setting	PST
H0C	14	ER.992 error type	0x0002: x03/0x06/0x10 is not the command code. 0x0004: CRC check code is not the same as data frame check code. 0x0008: Access function code does not exist. 0x0010: Write function code value exceeds the upper/lower limit. 0x0030: 0x10 writes 16-digit function code 0x0060: Read data length is 0. 0x0080: Function code is written only in the status to modify the servo, while the servo is currently running.			Display	Display	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
Group H0d Auxiliary Function Parameter								
H0d	00	Software Reset	0: No Operation; 1: Software Reset	1	0	Immediately	Stop Setting	-
H0d	01	Error Reset	0: No Operation; 1: Error Reset	1	0	Immediately	Stop Setting	-
H0d	02	Moment of Inertia of Identification Function	0: No Operation; 1: Enable moment of inertia of identification	1	0	Immediately	Stop Setting	-
H0D	03	Encoder Angle Identification	0: No operation 1: Start Angle Identification	1	0	Immediately	Stop Setting	-
H0d	10	Analog Channel Automatic Adjustment	0: No Operation; 1-3 AI1-3 Adjustment	1	0	Immediately	Stop Setting	-
H0d	11	JOG Function	0-Rated Rotation Speed	1rpm	100	Immediately	Stop Setting	-
Group H11 MS Position Function								
H11	00	MS Position Running Mode	0: Single run (Perform H1101 segment selection); 1: Cycle run (Perform H1101 segment selection); 2: DI switch run (select via DI); 3: Sequence run (perform H1101 segment selection)	1	0	Immediately	Stop Setting	P
H11	01	Displacement Reference End Segment Selection	1-16	1	1	Immediately	Stop Setting	P
H11	02	Margin Processing Method	The other three modes are enabled expect DI switch mode 0: Continue to run; 1: Run again from segment 1	1	0	Immediately	Stop Setting	P
H11	03	Waiting Time Unit	0-ms 1-s	1	0	Immediately	Stop Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H11	04	Displacement Reference Type Selection	0: Relative displacement reference 1: Absolute displacement reference	1	0	Immediately	Stop Setting	-
H11	12	1st Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	14	Maximum Running Speed at 1st Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	15	Acceleration / Deceleration Time at 1st Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	16	Waiting Time after 1st Segment Displacement Completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	17	2nd Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	19	Maximum Running Speed at 2nd Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	20	Acceleration / Deceleration Time at 2nd Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	21	Waiting Time after 2nd Segment Displacement Completion	0-10000	1ms(1s)	10	Immediately	Running Setting	P
H11	22	3rd Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	24	Maximum Running Speed at 3rd Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	25	Acceleration / Deceleration Time at 3rd Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H11	26	Waiting Time after 3rd Segment Displacement Completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	27	4th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	29	Maximum Running Speed at 4th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	30	Acceleration / Deceleration Time at 4th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	31	Waiting Time after 4th Segment Displacement Completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	32	5th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	34	Maximum Running Speed at 5th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	35	Acceleration / Deceleration Time at 5th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	36	Waiting Time after 5th Segment Displacement Completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	37	6th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	39	Maximum Running Speed at 6th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	40	Acceleration / Deceleration Time at 6th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	41	Waiting Time after 6th Segment Displacement Completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H11	42	7th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	44	Maximum Running Speed at 7th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	45	Acceleration / Deceleration Time at 7th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	46	Waiting Time after 7th Segment Displacement Completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	47	8th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	49	Maximum Running Speed at 8th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	50	Acceleration / Deceleration Time at 8th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	51	Waiting Time after 8th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	52	9th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	54	Maximum Running Speed at 9th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	55	Acceleration / Deceleration Time at 9th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	56	Waiting Time after 9th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	57	10th Segment Displacement	-1073741824-1073741824 reference units	1 reference units	10000 reference units	Immediately	Running Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H11	59	Maximum Running Speed at 10th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	60	Acceleration / Deceleration Time at 10th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	61	Waiting Time after 10th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	62	11th Segment Displacement	-1073741824-1073741824 reference units	1 reference units	10000 reference units	Immediately	Running Setting	P
H11	64	Maximum Running Speed at 11th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	65	Acceleration / Deceleration Time at 11th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	66	Waiting Time after 11th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	67	12th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	69	Maximum Running Speed at 12th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	70	Acceleration / Deceleration Time at 12th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	71	Waiting Time after 12th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	72	13th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	74	Maximum Running Speed at 13th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H11	75	Acceleration / Deceleration Time at 13th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	76	Waiting Time after 13th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	77	14th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	79	Maximum Running Speed at 14th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	80	Acceleration / Deceleration Time at 14th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	81	Waiting Time after 14th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	82	15th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	84	Maximum Running Speed at 15th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	85	Acceleration / Deceleration Time at 15th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P
H11	86	Waiting Time after 15th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
H11	87	16th Segment Displacement	-1073741824-1073741824 reference units	1 reference unit	10000 reference units	Immediately	Running Setting	P
H11	89	Maximum Running Speed at 16th Segment Displacement	0rpm-9000rpm	rpm	200	Immediately	Running Setting	P
H11	90	Acceleration / Deceleration Time at 16th Segment Displacement	0-1000	1ms	100ms	Immediately	Running Setting	P

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H11	91	Waiting Time after 16th Segment Displacement completion	0-10000	1ms (1s)	10	Immediately	Running Setting	P
Group H12 MS Speed Running Reference								
H12	00	MS Speed Reference Running Mode	0: Single run (Perform H1201 segment selection); 1: Cycle run (Perform H1201 segment selection); 2: Switch via external DI	1	1	Immediately	Stop Setting	S
H12	01	Speed Reference End-segment Selection	1-16	1	16	Immediately	Stop Setting	S
H12	02	Running Time Unit Selection	0-sec; 1-min	1	0	Immediately	Stop Setting	S
H12	03	Acceleration Time 1	0ms-10000ms	1ms	10ms	Immediately	Stop Setting	S
H12	04	Deceleration 1	0ms-10000ms	1ms	10ms	Immediately	Stop Setting	S
H12	05	Acceleration Time 2	0ms-10000ms	1ms	50ms	Immediately	Stop Setting	S
H12	06	Deceleration 2	0ms-10000ms	1ms	50ms	Immediately	Stop Setting	S
H12	07	Acceleration Time 3	0ms-10000ms	1ms	100ms	Immediately	Stop Setting	S
H12	08	Deceleration 3	0ms-10000ms	1ms	100ms	Immediately	Stop Setting	S
H12	09	Acceleration Time 4	0ms-10000ms	1ms	150ms	Immediately	Stop Setting	S
H12	10	Deceleration 4	0ms-10000ms	1ms	150ms	Immediately	Stop Setting	S
H12	20	1st Segment Reference	-9000-+9000rpm	1rpm	0rpm	Immediately	Stop Setting	S
H12	21	1st Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H12	22	1st Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	23	2nd Segment Reference	-9000rpm to +9000rpm	1rpm	100rpm	Immediately	Stop Setting	S
H12	24	2nd Segment Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S
H12	25	2nd Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	26	3rd Segment Reference	-9000rpm to +9000rpm	1rpm	300rpm	Immediately	Stop Setting	S
H12	27	3rd Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H12	28	3rd Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	29	4th Segment Reference	-9000rpm to +9000rpm	1rpm	500rpm	Immediately	Stop Setting	S
H12	30	4th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S
H12	31	4th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	32	5th Segment Reference	-9000rpm to +9000rpm	1rpm	700rpm	Immediately	Stop Setting	S
H12	33	5th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H12	34	5th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	35	6th Segment Reference	-9000rpm to +9000rpm	1rpm	900rpm	Immediately	Stop Setting	S
H12	36	6th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S
H12	37	6th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	38	7th Segment Reference	-9000rpm to +9000rpm	1rpm	600rpm	Immediately	Stop Setting	S
H12	39	7th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0 s (min)	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H12	40	7th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	41	8th Segment Reference	-9000rpm to +9000rpm	1rpm	300rpm	Immediately	Stop Setting	S
H12	42	8th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S
H12	43	8th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	44	9th Segment Reference	-9000rpm to +9000rpm	1rpm	100rpm	Immediately	Stop Setting	S
H12	45	9th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H12	46	9th Segment Acceleration / Deceleration Time	0: Zero acceleration / deceleration Time; 1: Acceleration / deceleration Time 1; 2: Acceleration / deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	47	10th Segment Reference	-9000rpm to +9000rpm	1rpm	-100rpm	Immediately	Stop Setting	S
H12	48	10th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S
H12	49	10th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / deceleration Time 1; 2: Acceleration / deceleration Time 2; 3: Acceleration / deceleration Time 3; 4: Acceleration / deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	50	11th Segment Reference	-9000rpm to +9000rpm	1rpm	-300rpm	Immediately	Stop Setting	S
H12	51	11th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H12	52	11th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	53	12th Segment Reference	-9000 rpm to +9000rpm	1rpm	-500rpm	Immediately	Stop Setting	S
H12	54	12th Segment Instruction Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S
H12	55	12th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	56	13th Segment Reference	-9000-+9000rpm	1rpm	-700rpm	Immediately	Stop Setting	S
H12	57	13th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H12	58	13th Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	59	14th Segment Reference	-9000rpm to +9000rpm	1rpm	-900rpm	Immediately	Stop Setting	S
H12	60	14th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S
H12	61	14th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	62	15th Segment Reference	-9000rpm to +9000rpm	1rpm	-600rpm	Immediately	Stop Setting	S
H12	63	15th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H12	64	15th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H12	65	16th Segment Reference	-9000rpm to +9000rpm	1rpm	-300rpm	Immediately	Stop Setting	S
H12	66	16th Segment Reference Running Time	0-6553.5	0.1s (min)	5.0s (min)	Immediately	Stop Setting	S
H12	67	16th Segment Acceleration / Deceleration Time	0: Zero Acceleration / Deceleration Time; 1: Acceleration / Deceleration Time 1; 2: Acceleration / Deceleration Time 2; 3: Acceleration / Deceleration Time 3; 4: Acceleration / Deceleration Time 4	1	0	Immediately	Stop Setting	S
H17 VDI/VDO Functions								
H17	00	VDI1 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	01	VDI1 Terminal Logic Selection	Input polarity: 0-1 0: Valid VDI1 by writing value 1; 1: Valid VDI1 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	02	VDI2 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	03	VDI2 Terminal Logic Selection	Input polarity: 0-1 0: Valid VDI2 by writing value 1; 1: Valid VDI2 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	04	VDI3 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	05	VDI3 Terminal Logic Selection	Input polarity: 0-1 0: Valid VDI3 by writing value 1; 1: Valid VDI3 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	06	VDI4 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	07	VDI4 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI4 by writing value 1; 1: Valid VDI4 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	08	VDI5 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	09	VDI5 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI5 by writing value 1; 1: Valid VDI5 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	10	VDI6 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	11	VDI6 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI6 by writing value 1; 1: Valid VDI6 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	12	VDI7 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	13	VDI7 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI7 by writing value 1; 1: Valid VDI7 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	14	VDI8 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	15	VDI8 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI8 by writing value 1; 1: Valid VDI8 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	16	VDI9 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	17	VDI9 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI9 by writing value 1; 1: Valid VDI9 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	18	VDI10 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	19	VDI10 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI10 by writing value 1; 1: Valid VDI10 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	20	VDI11 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	21	VDI11 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI11 by writing value 1; 1: Valid VDI11 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	22	VDI12 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	23	VDI12 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI12 by writing value 1; 1: Valid VDI12 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	24	VDI13 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	25	VDI13 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI13 by writing value 1; 1: Valid VDI13 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	26	VDI14 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	27	VDI14 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI14 by writing value 1; 1: Valid VDI14 by writing value change from 0 to 1	1	0	After Restart		-
H17	28	VDI15 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	29	VDI15 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI15 by writing value 1; 1: Valid VDI15 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	30	VDI16 Terminal Function Selection	Input Function Code: 0, 1-32; 0: No Definition; 1-32: FunIN.1-32 (Refer to DIDO basic function table)	1	0	After Restart	Running Setting	-
H17	31	VDI16 Terminal Logic Selection	Input polarity：0-1 0: Valid VDI16 by writing value 1; 1: Valid VDI16 by writing value change from 0 to 1	1	0	After Restart	Running Setting	-
H17	32	VDO Virtual Level	Bit0: VDO1 Virtual Level; ··· Bit15: VDO16 Virtual Level	-	-	-	-	-
H17	33	VDO1 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	34	VDO1 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	35	VDO2 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	36	VDO2 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	37	VDO3 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	38	VDO3 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	39	VDO4 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	40	VDO4 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	41	VDO5 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	42	VDO5 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	43	VDO6 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	44	VDO6 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	45	VDO7 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	46	VDO7 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	47	VDO8 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	48	VDO8 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	49	VDO9 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	50	VDO9 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately		-
H17	51	VDO10 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	52	VDO10 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	53	VDO11 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately		-
H17	54	VDO11 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	55	VDO12 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	56	VDO12 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	57	VDO13 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	58	VDO13 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	59	VDO14 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-
H17	60	VDO14 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H17	61	VDO15 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H17	62	VDO15 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled; 1: Output 0 upon enabled	1	0	Immediately		-
H17	63	VDO16 Terminal Function Selection	Output Code: 1-16 0: No Definition; 1-16: FunOUT.1-16 (Refer to DIDO function selection code definition)	1	0	Immediately		-
H17	64	VDO16 Terminal Logic Level Selection	Output polarity reversal setting: 0-1 0: Output 1 upon enabled 1: Output 0 upon enabled	1	0	Immediately	Stop Setting	-
H30 Communications read servo status variables, the panel is not available								
H30	00	Communication Read Servo Status	Bit0-11: Reserved Bit12-13: Servo Running Status Bit14-15: Reserved Bit12-13=0: Servo Not Ready; Bit12-13=1: Servo Ready; Bit12-13=2: Servo Running Status	-	-	-	-	PST
H30	01	FunOut Communication Read	Bit0-FunOUT1 …… Bit15-FunOUT16	1	-	-	-	PST
H30	02	FunOut Communication Read	Bit0-FunOUT17 …… Bit15-FunOUT32	1	-	-	-	PST
H30	03	Communication Read Input Pulse Reference Sampling Value	-	1	-	-	-	P
H31 Communications give related variables, the panel is not available								
H31	00	VDI Virtual Level	Bit0-VDI1 Virtual Level …… Bit15-VDI16 Virtual Level	-	-	-	-	PST

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H31	04	Communication Given DO Output Status	Bit0-DO1 Bit1-DO2 Bit2-DO3 Bit3-DO4 Bit4-Blank Bit5-DO6 Bit6-DO7 Bit7-DO8 Bit8-Bit15 (Reserved) 1: DO output low level (Optocoupler conduction); 0: DO output high level (Optocoupler OFF)	-	-	Immediately	Running Setting	PST
H31	07	Communication Given Position Increment	-2147483647-2147483647	1 reference unit	0	Immediately	Running Setting	P
H31	09	Communication Given Speed	-9000000-9000000	0.001rpm	0	Immediately	Running Setting	S
H31	11	Torque Reference	-100000-100000	0.001%	0	Immediately	Running Setting	T
H31	15	Max. Motor Speed When Communication Given Position Increment (equal to actual speed when electronic gear ratio is 1:1.)	0-9000	1rpm	1500	Immediately	Running Setting	-

CAUTION

- If VDIx logic is set to 0, DI terminal logic is set to low level enabled or high level enabled. If VDIx logic is set to 1, DI terminal logic is set to edge enabled.
- “-” indicates that this item is irrelevant.

12.3 DI/DO Basic Function Description

Code	Signal Name	Function Name	Description	Status	Remarks
DI Input Signal Function Description					
FunIN.1	/S-ON	Servo Enabled	Enabled: Servomotor power-on enabled; Disabled: Servo motor power-on prohibited	Allocation	-

Code	Signal Name	Function Name	Description	Status	Remarks
FunIN.2	/ALM-RST	Error Reset Signal	According to the warning type, the servo can continue to work after the warning reset. This feature is edge enabled level. The edge is enabled when the terminal is set to level enabled.	Allocation	-
FunIN.3	/P-CON	Proportional Motion Switch	Enabled: Speed control loop is P control; Disabled: Speed control loop is PI control.	Allocation	-
FunIN.4	/CMD-SEL	Main and Auxiliary Running Reference Switch	Enabled: Current running reference is B; Disabled: Current running reference is A.	Allocation	-
FunIN.5	/DIR-SEL	MS Running Reference Direction Selection	Enabled: Reference in the reverse direction; Disabled: Default reference direction	Allocation	-
FunIN.6	CMD1	Internal Reference Switch CMD1	16-segment reference selection	Allocation	By default, 0000 indicates segment 1 which is of zero velocity.
FunIN.7	CMD2	Internal Reference Switch CMD2	16-segment reference selection	Allocation	-
FunIN.8	CMD3	Internal Reference Switch CMD3	16-segment reference selection	Allocation	-
FunIN.9	CMD4	Internal Reference Switch CMD4	16-segment reference selection	Allocation	-
FunIN.10	M1-SEL	Mode Switch M-SEL	Switch among speed, position and toque according to the selected control mode (3, 4, 5),	Allocation	Switch with Two DI
FunIN.11	M2-SEL	Mode Switch M-SEL	Switch among speed, position and toque according to the selected control mode (3, 4, 6),	Allocation	Switch with Two DI

Code	Signal Name	Function Name	Description	Status	Remarks
FunIN.12	/ZCLAMP	Zero-Position Fixed Function Enabled Signal	Enabled: Enabled zero-fixed function; Disabled: Zero-position fixed function prohibited	Allocation	ZCLAM function is used in the speed control, and the references source is analog.
FunIN.13	/INHIBIT	Pulse Disabled	Enabled: Reference pulse input prohibited; Disabled: Reference pulse input allowed	Allocation	Only the position-loop with pulse control is enabled.
FunIN.14	P-OT	Forward Drive Disabled	When the mechanical motion exceeds the range, enter the overtravel disabled function. Enabled: Forward drive prohibited; Disabled: Forward drive allowed	Allocation	-
FunIN.15	N-OT	Reverse Drive Disabled	When the mechanical motion exceeds the range, enter the overtravel disabled function. Enabled: Reverse drive prohibited; Disabled: Reverse drive allowed	Allocation	-
FunIN.16	/P-CL	Forward External Torque Limit ON	Enabled: External torque limit enabled; Disabled: External torque limit disabled	Allocation	-
FunIN.17	/N-CL	Reverse external torque limit ON	Enabled: External torque enabled; Disabled: External torque limit disabled	Allocation	-
FunIN.18	/JOGCMD+	Forward Jog	Enabled: Input according to the reference; Disabled: Running reference stop input	Allocation	External pop-up button
FunIN.19	/JOGCMD-	Reverse Jog	Enabled: Reverse input according to the reference; Disabled: Running reference stop input	Allocation	External pop-up button
FunIN.20	/POSSTEP	Position Step Input DI Variable	Enabled: Execute the reference of reference step; Disabled: Reference is zero	Allocation	External pop-up button

Code	Signal Name	Function Name	Description	Status	Remarks
FunIN.21	HX1	Handwheel MF Signal 1	HX1 enabled, HX2 disabled: X10 HX1 enabled，HX2 disabled: X100 Others: X1	Allocation	
FunIN.22	HX2	Handwheel MF Signal 2		Allocation	
FunIN.23	HX_EN	Handwheel Enable Signal	Disabled: Position control according to H05-00 function code; Enabled: In the position mode, receive the handwheel pulse signal for position control.	Allocation	
FunIN.24	GEAR_ SEL	Electronic Gear Selection	Enabled: Electronic Gear Ratio 1; Disabled: Electronic Gear Ratio 2	Allocation	
FunIN.25	TOQDirSel	Torque Reference Direction Setting	Disabled: Forward; Enabled: Reverse	Allocation	
FunIN.26	SPDDirSel	Speed Reference Direction Setting	Disabled: Forward; Enabled: Reverse	Allocation	
FunIN.27	POSDirSel	Position Reference Direction Setting	Disabled: Forward; Enabled: Reverse	Allocation	
FunIN.28	PosInSen	MS Running Reference Trigger Signal	Disabled: Not trigger; Enabled: Trigger	Allocation	
FunIN.29	XintFree	Interrupt Length Status Clear Signal	Disabled: No response; Enabled: Clear interrupt response status	Allocation	
FunIN.30	G-SEL	Gain Switch	Disabled: 1st gain; Enabled: 2nd gain	Allocation	
FunIN.31	OrgNear	Origin Switch	Disabled: Without trigger; Enabled: Trigger	Allocation	
FunIN.32	OrgChufa	Origin Return Enabled	Disabled: Prohibited; Enabled: Enabled	Allocation	

Code	Signal Name	Function Name	Description	Status	Remarks
DO Output Signal Function Description					
FunOUT.1	/S-RDY+-	Servo Ready	Servo is ready to receive S-ON signal. Enabled: Servo ready; Disabled: Servo Not ready	Allocation	
FunOUT.2	/TGON+-	Motor Rotation Output Signal	The rotation speed of servo motor is faster than the speed threshold values (H06-16). Enabled: Motor rotation signal enabled; Disabled: Motor rotation signal disabled	Allocation	
FunOUT.3	/ZERO+-	Zero Speed	Servo motor output signal upon stop. Enabled: The rotation speed servo motor is zero; Disabled: The rotation speed of servo motor is not zero.	Allocation	Output when feedback speed is zero
FunOUT.4	/V-CMP+-	Speed Arrival	In the speed control, it is enabled when the difference absolute value between servo motor speed and speed reference is less than H06-17 speed deviation.	Allocation	-
FunOUT.5	/COIN+-	Position Arrival	In the position control, it is enabled when ‘position deviation’ arrives ‘position complete amplitude H05-21’.	Allocation	-
FunOUT.6	/NEAR+-	Position Approach Signal	In the position control mode, this signal is enabled when the value of position deviation pulse arrives at the set value of Positioning Completion Approach Signal Amplitude (H05-22).	Allocation	-
FunOUT.7	/C-LT+-	Torque Limit Signal	Torque limit confirm signal Enabled: motor speed confined; Disabled: motor speed not confined	Allocation	-

Code	Signal Name	Function Name	Description	Status	Remarks
FunOUT.8	/V-LT+-	Rotation Speed Limit	Speed confined signal upon torque control Enabled: motor speed confined; Disabled: motor speed is not confined	Allocation	-
FunOUT.9	/BK+-	Brake Output Signal	Brake Signal Output: Enabled: Closed, remove the brake; Disabled: Start the brake	Allocation	Enabled simultaneously with the servo ON signal and output only after servo OFF.
FunOUT.10	/WARN+-	Warning Output	Enabled when warning is detected	Allocation	-
FunOUT.11	/ALM+-	Error Output	Enabled when error is detected	Allocation	-
FunOUT.12	ALMO1	Output 3-digit Error Code	Output 3-digit error code	Allocation	Allocate these three signals to terminal DO6/7/8.
FunOUT.13	ALMO2	Output 3-digit Error Code	Output 3-digit error code	Allocation	
FunOUT.14	ALMO3	Output 3-digit Error Code	Output 3-digit error code	Allocation	
FunOUT.15	Xintcoin	Interrupt Length Completion signal	Output after interrupt length completion	Allocation	-
FunOUT.16	OrgOk	Origin Return Output	Origin Return Status Enabled: Origin return; Disabled: Not return	Allocation	-
FunOUT.17	OrgOkElectric	Electric Return to Origin Output	Electric Return Output Status Enabled: Electric Return to Origin; Disabled: Electric not Return to Origin	Allocation	

12.4 Commonly Used Function Code Reference Table

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H00	00	Motor Model	0-65534 65535: Motor model is null (Factory setting value is associated with the drive model)	1	xxxx	After Restart	Stop Setting	-

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H02	00	Control Mode Selection	0: Speed Mode; 1: Position Mode (Default); 2: Torque Mode; 3: Speed Mode↔ Torque Mode; 4: Position Mode↔Speed Mode; 5: Position Mode↔ Torque Mode; 6: Position Mode↔Speed Mode↔ Torque Mode	1	1	Immediately	Stop Setting	-
H02	02	Rotation Direction Selection	0: Take CCW direction as the forward direction (A leading B); 1: Take CW direction as the forward direction (Reverse mode, A is delayed)	1	0	After Restart	Stop Setting	PST
H02	31	System Parameter Initialization	0: No Operation; 1: Restore to factory setting value (except group H0/1); 2: Clear fault record	1	0	After Restart	Stop Setting	-
H05	07	Electronic Gear Ratio 1 (Numerator)	1-1073741824	1	4	Immediately	Stop Setting	P
H05	09	Electronic Gear Ratio 1 (Denominator)	1-1073741824	1	1	Immediately	Stop Setting	P
H05	15	Reference Pulse Mode	0: Direction + pulse, positive logic (default value); 1: Direction + pulse, negative logic; 2: Phase A + Phase B Orthogonal pulses, 4 multiple frequency; 3: CW+CCW	1	0	After Restart	Stop Setting	P
H08	00	Speed-loop Gain	1.0Hz-2000.0Hz	0.1Hz	400.0Hz	Immediately	Running Setting	PS
H08	01	Speed-loop Integration Time Parameters	0.15ms-512.00ms	0.01ms	20.00ms	Immediately	Running Setting	PS

Function Code		Name	Setting Range	Min. Unit	Factory Setting	When Enabled	Data Type	Related Mode
H08	02	Position-loop Gain	1.0Hz-2000.0Hz	0.1Hz	20.0Hz	Immediately	Running Setting	P
H08	15	Load Rotating Inertia Ratio	1.00-200.00	0.01	1.00	Immediately	Stop Setting	PST
H0d	02	Moment of inertia of Identification Function	0: No Operation; 1: Enable moment of inertia of identification	1	0	Immediately	Stop Setting	-

12.5 Motor SN Reference Table

Motor Type	Rated Volt	Servo Motor Model ISM□□-□□□□□□□-*****		Motor SN (H00-00)
ISMH	220V	H1 (Low inertia, small capacity)	ISMH1-20B30CB-U1*	00003
			ISMH1-40B30CB-U1*	00004
			ISMH1-75B30CB-U1*	00006
		H2 (Low inertia, medium capacity)	ISMH2-10C30CB-U1*	00150
			ISMH2-15C30CB-U1*	00151
		H3 (Medium inertia, medium capacity)	ISMH3-85B15CB-U1*	00261
			ISMH3-13C15CB-U1*	00262
			ISMH3-87B10CB-U1*	00272
			ISMH3-12C10CB-U1*	00273
		H4 (medium inertia, small capacity)	ISMH4-40B30CB-U1*	00600
	380V	H2 (Low inertia, medium capacity)	ISMH2-10C30CD-U1*	00100
			ISMH2-15C30CD-U1*	00101
			ISMH2-20C30CD-U1*	00102
			ISMH2-25C30CD-U1*	00103
			ISMH2-30C30CD-U1*	00104
			ISMH2-40C30CD-U1*	00105
			ISMH2-50C30CD-U1*	00106
		H3 (Medium inertia, medium capacity)	ISMH3-85B15CD-U1*	00211
			ISMH3-13C15CD-U1*	00212
			ISMH3-18C15CD-U1*	00213
			ISMH3-29C15CD-U1*	00214
			ISMH3-44C15CD-U1*	00215
			ISMH3-55C15CD-U1*	00216
			ISMH3-75C15CD-U1*	00217
			ISMH3-87B10CD-U1*	00222
			ISMH3-12C10CD-U1*	00223
ISMV	380V	V3 (Medium inertia, medium capacity)	ISMV3-29C15CD-U1*	00514
			ISMV3-44C15CD-U1*	00515
			ISMV3-55C15CD-U1*	00516
			ISMV3-75C15CD-U1*	00517

12.6 Common Servo Configuration Specifications

Please make sure to configure the appropriate cable.

ISMH: Maximum speed is greater than rated speed, and the motor has short-time over-speed capacity.

220V:

Rated Speed	Max. Speed	Capacity	Servomotor Model ISM□□-□□□□□□□-*****		Servodrive Model: IS500*□□□□I	
					Single-phase AC220V	3-phase AC220V
3000rpm	6000rpm	200W	H1 (Low inertia, small capacity)	20B30CB	S1R6	
		400W		40B30CB	S2R8	
		750W		75B30CB	S5R5	
		1000W	H2 (Low inertia, medium capacity)	10C30CB		S7R6
	5000rpm	1500W		15C30CB		S012
1500rpm	3000rpm	850W	H3 (Medium inertia, medium capacity)	85B15CB		S7R6
		1300W		13C15CB		S012
1000rpm	2000rpm	870W		87B10CB		S7R6
		1200W		12C10CB		S012
3000rpm	6000rpm	400W	H4 (Medium inertia, small capacity)	40B30CB	S2R8	

380V

Rated Speed	Max. Speed	Capacity	Servomotor Model ISM□□-□□□□□□□-*****		Servodrive Model IS500*□□□□I
					3-phase AC380V
3000rpm	6000rpm	1000W	H2 (Low inertia, medium capacity)	10C30CD	T5R4
	5000rpm	1500W		15C30CD	T5R4
		2000W		20C30CD	T8R4
		2500W		25C30CD	T8R4
		3000W		30C30CD	T012
		4000W		40C30CD	T017
		5000W		50C30CD	T017

Rated Speed	Max. Speed	Capacity	Servomotor Model ISM□□-□□□□□□□-*****		Servodrive Model IS500*□□□□I
					3-phase AC380V
1500rpm	3000rpm	850W	H3 (Medium inertia, medium capacity)	85B15CD	T3R5
		1300W		13C15CD	T5R4
		1800W		18C15CD	T8R4
		2900W		29C15CD	T012
		4400W		44C15CD	T017
		5500W		55C15CD	T021
		7500W		75C15CD	T026
1000rpm	2000rpm	870W		87B10CD	T3R5
		1200W		12C10CD	T5R4

ISMV: Maximum speed equals rated speed, and the motor does not have the short-time over-speed capacity

380V

Rated Speed	Max. Speed	Capacity	Servomotor Model ISM□□-□□□□□□□-*****		Servodrive Model IS500*□□□□I
					3-phase AC380V
1500rpm	1500rpm	2900W	V3 (Medium inertia, medium capacity)	29C15CD	T8R4
		4400W		44C15CD	T012
		5500W		55C15CD	T017
		7500W		75C15CD	T021

Warranty Agreement

The warranty period of the product is 18 months (refer to the barcode on the equipment body). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instruction, Our Company will be responsible for free maintenance.

Within the warranty period, maintenance will be charged for the damages caused by the following reasons:

a. The damage caused by improper use or repair/modification without prior permission;

b. The damage caused by fire, flood, abnormal voltage, other disasters and second disaster;

c. The hardware damage caused by dropping or transportation upon the procurement.

d. The damage caused by the improper operation;

e. The damage or failure caused by the trouble out of the equipment (e.g. external device)

If there is any failure or damage to the product, please correctly fill out the Product Warranty Card in detail.

The maintenance fee is charged according to the newly adjusted Maintenance Price List by our company.

In general, the warranty card will not be re-issued. Please keep the card and present it to the maintenance personnel when asking for maintenance.

If there is any problem during the service, please contact the agent of our company or our company directly.

This agreement shall be interpreted by Shenzhen Inovance Technology Co., Ltd.

Shenzhen Inovance Technology Co., Ltd.

Service Department

Address: Block E, Hongwei Industry Park, Liuxian Road, Baocheng No. 70 Zone, Bao'an District, Shenzhen

Service Hotline: 400-777-1260 P.C.: 518101

Website: www.inovance.cn

Inovance Product Warranty Card

<table>
<tr><td rowspan="3">Customer information</td><td colspan="2">Add. of unit:</td></tr>
<tr><td>Name of unit:

P.C.:</td><td>Contact person:</td></tr>
<tr><td></td><td>Tel.:</td></tr>
<tr><td rowspan="3">Product information</td><td colspan="2">Product model:</td></tr>
<tr><td colspan="2">Body barcode (Attach here):</td></tr>
<tr><td colspan="2">Name of agent:</td></tr>
<tr><td>Failure information</td><td colspan="2">(Maintenance time and content):

Maintenance personnel:</td></tr>
</table>