Foreword

Dear Customer,

First of all, thank you for purchasing the ESS200P series servo drive developed and manufactured by Shenzhen Encom Electric Technologies Co., Ltd!

Shenzhen Encom Electric Technologies Co., Ltd. was established in 2004. Since 2012, it has become a national high-tech enterprise. After nearly 15 years of technical accumulation and honing, our products have undergone various complicated and harsh industrial environments. We have developed EDS series, EN series, EAS series and ESS series, industrial electric drive inverters, AC servo drives, synchronous servo drives. These products have been widely used in many applications, and have won the recognition, trust and praise of our customers.

The ESS200P series servo drive uses advanced control technology to achieve high-performance position control, speed control and torque control. It is a feature-rich and powerful servo drive product. The ESS200P has functions such as inertia identification, gain switching, notch filtering and vibration suppression. It can meet the application needs of machine tools, textiles, packaging, semiconductors, printing and other industries with various types of easy-to-use motors.
This series of servo products, combined with the inverter products and PLC automation products of the company, can provide integrated solutions for the customers engaged in equipment manufacturing and automation engineering, which is of great value for reducing system cost and improving system reliability. .

This manual providesinformation on installation wiring, parameter settings, troubleshooting and countermeasures, routine maintenance, and related precautions. In order to ensure the correct installation and operation of the drive and servo motor, please read this manual carefully before installation, and keep it in hand and hand it over to the end user of this servo system.

If there are any difficulties or special requirements for the use of this series of servo drives and servo motors, please contact our local offices or distributors, or contact our technical engineering department directly, we will be happy to help you.

As the company is committed to the continuous improvement of the performance of servo drive products, the contents of this manual are subject to change without notice.

1 Safety information and use precautions

To ensure the safety of person and device, be sure to read this chapter carefully before using the Servo Drive.

1.1 Safety mark

There are three safety marks used in the manual as follow:

Symbol	Symbol description
	It may lead to death, serious injury or heavy property loss if operate not as requested.
	Precautions when operation, it may lead to body injured or device broken if operate not as requested.
 **Note**	Pay extra cautions during using.

1.2 Safety precautions

(1) Forbid to use it in such environments like damp, aggressive gas, inflammable gas or near the combustible materials, otherwise it may cause fire.
(2) Forbid to stretch into the inner of the driver, otherwise will get burned or an electric shock.
(3) Must assemble over-current protection device, leakage protection device, non-fused breaker, over-heat protect device, emergency-stop device to avoid electric shock, injured or fire.
(4) Emergency power-off system must be installed so that when emergency occurs, the operation can be quickly stopped in real time and the power supply can be blocked to avoid injury or electric shock, fire, error, damage and so on.
(5) Before moving the drive, installing wiring or checking the drive, the power must be cut off and left for a period of time according to the product label to avoid electric shock.
(6) Before moving the drive, installing wiring or checking the drive, the power must be cut off first. The operation should be carried out after confirming there is no risk of electric shock, so as to avoid electric shock.
(7) Wiring operation must be carried out by professional electrical technicians to avoid electric shock.
(8) Servo motor, servo driver and external brake resistor must be installed on non-flammable objects such as metal to avoid fire.
(9) After the power is disconnected for more than 5 minutes, the voltage between + and - is confirmed to be below the safe voltage with the multimeter after the power indicator is off, and then the driver can be disassembled and assembled, otherwise it will be electrocuted due to the residual voltage.
(10) Please be sure to connect electromagnetic contactor and non-fusing circuit breaker between the power supply and the main circuit of the servo driver (For single phase driver is L1, L2 and three phase driver is L1, L2 and L3). Otherwise, when the driver fails, the high current cannot be cut off to cause fire.
(11) In the drive and servo motor, don't mix with oil, grease, screws, metal, and other combustible or conductive foreign matter, otherwise may lead to fire.

(1) Strictly prohibited to pull, squeeze, intentionally damage or apply gravity on cable to avoid electric shock, malfunction or damage.
(2) Do not touch the motor shaft when the motor is running to avoid injury.
(3) The temperature of servo motor, servo driver and external braking resistor will be rise when they work, please don't touch them to avoid injury.
(4) Motor and encoder lines must be properly connected to avoid injury or failure or damage.
(5) During Jog operation, please follow the steps required in this manual.

1.3 Assemble precautions

(1) Make sure the stability of fixture and assembling of the product to avoid fire or personal accident occurs when earthquake.
(2) Forbid to change, dismantle and repair the driver privately, it may lead to injured or breakdown.
(3) Strictly forbidden to block the suction port and the exhaust port and ensure that no foreign objects enter inside, otherwise it may cause internal components aging which lead to failure and damage.
(4) Please ensure that the drive is kept at a specified distance from the inner surface of the cabinet and other machines when installing the drive, otherwise it will cause malfunction and damage.

(1) Please not pull the cable conductor heavily, otherwise will cause it breakdown.
(2) Please follow the specified assemble method and direction, assemble the wires rightly and safely to avoid injured or electric shock.
(3) The ambient temperature around the motor and servo driver should not over the allowable value to avoid failure.
(4) Forbid to use external pressure to drive the motor to avoid it damaged.
(5) Servo driver and motor should be grounding to avoid get electric shock.
(6) Please don't hold the cable conductor or motor shaft to carry to avoid injured.
(7) Forbid heavy shock on the motor shaft to avoid breakdown.
(8) Strong shock on the product is strictly prohibited to avoid breakdown.
(9) Strictly forbid to connect 3PH power source to the output terminal U, V, W of the servo drive to avoid injured or cause fire.
(10) Please connect the output U, V, W of the servo drive and the U, V, W of the servo motor directly. Don't install electromagnetic contactor between them to avoid abnormal operation and malfunction.
(11) Please not let the power cable and signal cable through the same pipe or bundle them together. When wiring, the power cable and signal cable should be separated by more than 30cm.
(12) Please check and operate after confirming that the CHARGE indicator is off.
(13) Please not power on and off frequently, when need to be switched the power source on and off repeatedly, please less than 1 times per minute.
(14) Please don't connect 220V servo drive to 380V power source; otherwise it will lead to breakdown.

1.4 Precautions when using

(1) When error occurs, troubleshoot it first and make sure it's safe before clearing it and restarting it to avoid injury.
(2) Follow the rated voltage to use the driver to avoid electric shock, injured or fire.
(3) Follow the product instruction and rated output parameter to assemble it correctly to avoid injured or causing breakdown.
(4) Please use the motor and drive in accordance with the recommended combination to avoid fire.
(5) Don't significantly adjust or change the gain of the driver, mechanical operation, operation must be stable to avoid injury.
(6) Please don't turn on and off the main power of the driver frequently to avoid electric shock, injury, error or damage.
(7) Strictly prohibited to stand above the drive or stack sundries, otherwise will cause electric shock, injured, error or damage.
(8) Strictly prohibited to stack sundries in front of the cooling hole to avoid electrical shock or fire.

1.5 Running precautions

(1) When use the servo drive on vertical axis, please set safety device to avoid falling during warning, over-travel situation etc. Moreover, please set it stop and lock the servo driver when over-travel happening to avoid work-piece falls on abnormal cases.
(2) When power is restored after a power outage, the driver may restart suddenly, please keep away from the machine. Corresponding mechanical design must be carried out for the restart to ensure personal safety and avoid injury.
(3) To avoid accident occurs, please run the servo motor without load to avoid injury during Jog run.

(1) When use braking motor, please make sure the braking device is release during operation, otherwise it will damage the servo motor.
(2) To avoid injured, please don't touch the motor when the motor is running.
(3) When Jog run, please fix motor and ensure the actions are normal when separated from machine systems. Thereafter assemble it on mechanical system to avoid injured.
(4) When error occurs, troubleshoot it first and make sure it's safe before clearing it and starting again to avoid injury.

1.6 Definition of motor rotation direction

Forward direction and reverse direction definite as show in Fig.1-1:

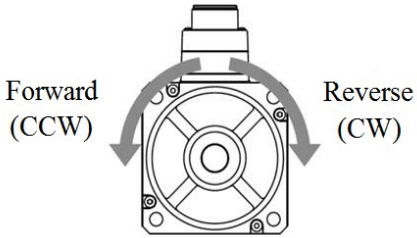


Fig.1-1

1.7 Scrap disposal precautions

When scrap servo driver and its spare parts, please note:

(1) The whole servo driver: scrap the servo driver as industrial scrap.

(2) Electrolytic capacitor: the electrolytic capacitor in the driver may explode when burning.

(3) Plastics: plastics and rubber parts will give harmful and poisonous gas, please be well protected when burning it.

2 Product inspection and type details

2.1 Incoming inspection

(1) Check if there is any damage during transportation and servo drive itself has damage or fall-off parts

(2) Check if the items on the packing list are all ready.

(3) Please confirm nameplate data of the servo drive is consistent with your order requirements.

Our products are guaranteed by strict quality system in manufacturing, packaging, transportation, etc. If there is some kind of omission or error, please contact our company or local agent, we will solve it as soon as possible.

2.2 Nameplate and type details

2.2.1 Servo drive nameplate and type explanation

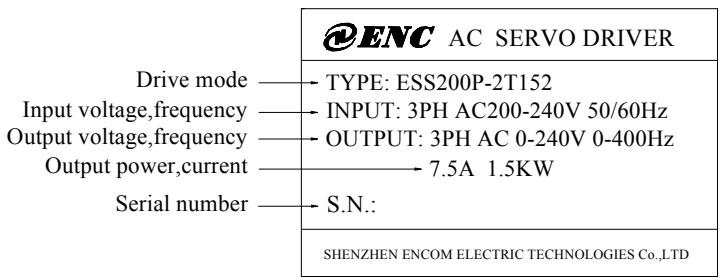


Fig. 2-1 Servo drive nameplate details

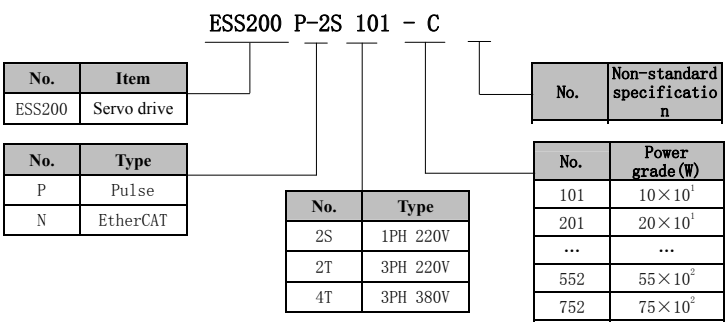


Fig. 2-2 Servo drive type details

2.2.2 Servo motor nameplate and type details

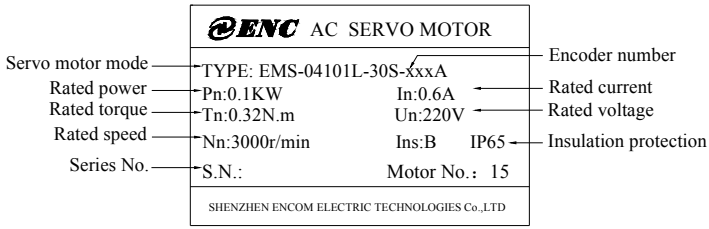


Fig 2-3 Servo motor nameplate details

Note

According to motor nameplate，should set encoder number into**[F00.21]** after power on，and motor number into **[F00.03]**，or the motor can't work well.

EMS - 06 401 L - 30 S - 7 C 1 A

Code	Name
EMS	ESS200 series universal servo motor

Code	Bass No.
04	40mm
06	60mm
08	80mm
09	90mm
11	110mm
13	130mm
15	150mm
18	180mm

Code	Power(W)
101	10×10^1
201	20×10^1
…	…
552	55×10^2
752	75×10^2

Code	Inertia
L	Low
M	Middle
H	High

Code	Rated speed
01	100 rpm
10	1000 rpm
15	1500 rpm
20	2000 rpm
25	2500 rpm
30	3000 rpm

Code	Voltage
S	220V
T	380V

Code	Encoder type
0	2500 line incremental
1	2500 line saver
5	17-bit bus absolute
6	20-bit bus absolute
7	23-bit bus absolute

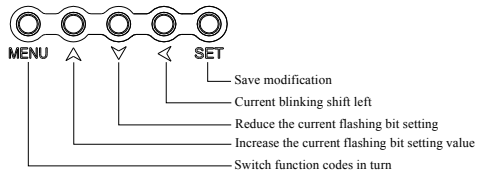
Code	Optional
1	Oil seal without brake
2	Oil-free seal without
3	Oil seal with
4	Oil-free seal with
5	Oil seal with permanent
6	Oil-free seal with

Code	Mark
A	General
B	nonstandard

Code	Shaft connection
A	Axis
B	Solid with key
C	Solid keyed with threaded
D	Solid with threaded hole

Fig 2-4 Servo motor types details

2. 3 Servo drive construction

Item	Function
LED	5-digit 8-segment LED digital tube for displaying servo running status and parameter setting
Key operator	
Charge **Bus voltage indicator**	Used to indicate that the bus capacitance is in a charged state. When the indicator is on, the internal capacitor may still have charge even if the main circuit power is turned off. Therefore, do not touch the power terminal when the light is on to avoid electric shock.
L1C、L2C **Control loop power input terminal**	Refer to the nameplate rated voltage level input control loop power supply
L1、L2、L3 **Main circuit power input terminal**	Refer to the nameplate rated voltage level and input the main loop power supply.
-1、-2	It is used for external reactor access, and is short-circuited by default. It is also used together with the (+) terminal for multiple servo common DC buses.
(+)、(-) **Servo bus terminal**	DC bus terminal for multiple servo common DC bus
(+)、RB、B **External brake resistor connection terminal**	By default, short wires are connected between RB and B. When the external braking resistor is connected, remove the short wiring to open the circuit between RB and B, and connect the external braking resistor before (+) and B.
U、V、W **Servo motor connection terminal**	Connect servo motor U, V, W phase
Ground terminal	Connect to the power supply and motor ground terminal for grounding
X6 encoder connection terminal	Connected to the motor encoder terminal
X5 control terminal	Command input signal and other ports for input and output signals
X3、X4 communication terminal	Internal parallel connection to RS485 communication command device

2. 4 Servo drive basic specification and function

Item				Terminal function and specification
Basic Specification	Control mode			Vector control
	Control way			① Position control；② Speed control；③ Torque control ④ Position/speed control；⑤ Position/torque control； ⑥ Speed/ torque control
	Gain adjust mode			Manual mode, one-button parameter auto-tuning mode
	Filter function			1.Command pulse inertial filter, FIR filter; 2.Adaptive low frequency resonance filter; 3.4 sets of notch filters, 2 of which are adaptive notch filters
	Inertia self-learning function			①Off-line；②On-line
	Motor parameter self-learning function			Motor parameter self-learning, encoder information self-learning
	Support encoder			2500 line incremental encoder(9 lines, 15 lines)； 17bit, 20bit, 23bit incremental encoder； 17bit, 20bit, 23bit absolute encoder；
	Batch parameters upload download			Support external accessories for batch parameter upload and download
Position control mode	Performance	Speed feed forward compensation		0～100.0%（Set resolution ratio 0.1%）
		Torque forward compensation		0～200.0%（Set resolution ratio 0.1%）
		Position accuracy		±1 motor encoder pulse
	Input signal	Pulse instructions	Input pulse form	Contains three Instruction form: "direction + pulse", "A, B phase orthogonal pulse", "CW / CCW pulse"
			Input form	①Differential input；②Open collector
			Input pulse frequency	①Differential input: High speed up to 4Mpps, pulse width not less than 0.125μs. Low speed up to 500Kpps, pulse width cannot be lower than 1μs ② Open collector: up to 200Kpps, pulse width cannot be lower than 2.5μs
		Built-in collector open circuit power		+24V（Built-in 2.4kΩ resistor）
		Multi-segment position command selection		Configure 4 DIs to achieve the 1st to 16th position selection
Speed/torque control mode	Performance	Speed control range		1：5000
		Speed calibration rate		Load rating change（0～100%），max±0.01%
				Power±10%，max change ±0.01%
				Environment temperature（0～50℃），max±0.01%
		Speed loop pulse width		1000Hz
		Torque control accuracy		±5%
	Input signal	Speed command input	Command voltage	DC±10V，12 bits
				Input voltage：max±12V
			Input impedance	About 9kΩ
			Circuit	About 47μs

			time parameters	
		Torque command input	Command voltage	DC±10V，12 bits
				Input voltage：Max±12V
			Input impedance	About 9kΩ
			Circuit time parameters	About 47μs
		Multi-speed command	Speed selection	Configure 4 DIs to make CMD1, CMD2, CMD3, and CMD4 functions, and realize the 1st to 16th speed selection.
Input output signal	Analog input	Two channel analog input （AI1，AI2）		DC±10V，12 bits precision，input resistance value is about 9kΩ
	Analog output	Two channel analog output（AO1，AO2）		DC±10V
	Digit input signal	Signal allocated can be changed		8-channel DI (where DI8 high-speed DI input) Multiple DI functions: Servo enable, alarm reset, gain switching, forward over travel switch, reverse over travel switch, positive external torque limit, negative external torque limit, Origin switch, Original position reset enable, interrupt fixed length disable, position deviation clear , internal pulse command prohibition and other functions.
	Digit output signal	Signal allocated can be changed		5-channel DO Multiple DO functions: Servo ready, motor rotation, zero speed signal, speed consistency, positioning completion, positioning approach, torque limit, speed limit, brake output, warning output, fault output, interrupt fixed length completion, original position homing completion, electrical original position homing Completion, torque arrival, speed arrival, etc.
	Position output function	Output form		Phase A, Phase B: Differential Output Phase Z: differential output or open collector output
		Frequency dividing ratio		Arbitrary sub-frequency（max 240Khz）
Other function	Over travel prevention function			Stop immediately when the forward and reverse over travel switches are active
	Electronic gear ratio			0.1048576≤B/A≤419430.4
	LED indication function			Main power supply CHARGE, 5-digit LED display
	Communication function	RS485		When use MODBUS，can up to 247stand
		RS232		Support PC host computer debugging, monitoring, parameter setting, etc.
	Other	Original position reset, full-closed, gain adjustment, alarm recording, JOG operation, 16-segment position control, 16-segment multi-speed control.		
Protection function	Over current, overvoltage, under voltage, short to ground, input phase loss, overheating, driver overload, motor overload, speeding, encoder failure, excessive positional deviation, etc.			
Environment	Operating temperature			-10℃～+40℃（The ambient temperature should be derated in the range of 40 ° C ~ 50 ° C, the average load rate cannot be higher than 80%）
	Storage temperature			-40℃～+70℃
	work humidity /storage humidity			Less than 90%RH（no condensation）

	Vibration-proof strength	Less than 4.9m/s^2
	Impact strength	Less than 19.6m/s^2
	Pollution grade	2 grade
	Altitude	Lower than 1000 meters
Structure	Protection grade	IP20
	Cooling mode	Forced air cooling or natural cooling
	Installation mode	Wall hanging

Note

Note 1: Please install the servo drive at the specified ambient temperature. When placed in a power cabinet, the temperature inside the cabinet should not exceed the specified value.
Note 2: The rate of change of speed is defined by:

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

In fact, due to voltage changes and temperature changes, the amplifier deviation is caused, resulting in a change in the calculated resistance value. Therefore, the effect is manifested by the change in the rotational speed. The change in the rotational speed is expressed by the ratio of the rated rotational speed, and is the rate of change of the speed caused by the voltage change and the temperature change, respectively.
Note 3: Forward rotation refers to counterclockwise rotation when the motor is viewed from the load.
Note 4: The built-in open collector power supply is not electrically insulated from the control circuit in the servo drive.
Note 5: The bus protocol is the Dumochuan protocol or the Fre_Dat-B protocol of Changchun Yuheng.

2.5 Motor system mating specification

Motor capacity	Rated speed	Max speed	Rated torque	Servo motor mode	Base No.	Difference	Motor No.	Servo drive mode		
								1 phase 220V	3 phase 220V	Case type
100W	3000	6000	0.32	EMS-04101L-30S-xxxA	40	Small capacity, small inertia	15	2S101	/	A
200W	3000	6000	0.64	EMS-06201L-30S-xxxA	60	Small capacity, small inertia	16	2S201	/	A
	3000	6000	0.64	EMS-06201M-30S-xxxA	60	Small capacity, medium inertia	0			
400W	3000	6000	1.27	EMS-06401L-30S-xxxA	60	Small capacity, small inertia	17	2S401	/	A
	3000	6000	1.27	EMS-06401M-30S-xxxA	60	Small capacity, medium inertia	1			
	3000	5000	1.27	EMS-08401H-30S-xxxA	80	Small capacity, big inertia	2			
730W	3000	2500	3.50	EMS-08731H-20S-xxxA	80	Small capacity, big inertia	3	2S751	/	B
750W	3000	4000	2.40	EMS-08751L-30S-xxxA	80	Small capacity, small inertia	4			

	3000	4000	2.40	EMS-09751H-30S-xxxA	90	Small capacity, big inertia	21			
1000W	2500	3500	4.00	EMS-08102L-25S-xxxA	80	Small capacity, small inertia	6	/	2T102	B
	2500	3000	4.00	EMS-13102M-25S-xxxA	130	Small capacity, medium inertia	7			
	1000	1500	10.00	EMS-13102H-10S-xxxA	130	Small capacity, big inertia	23			
1200W	3000	4000	4.00	EMS-08122L-30S-xxxA	80	Medium capacity, medium inertia	8			
1500W	3000	3200	5.00	EMS-11152M-30S-xxxA	110	Medium capacity, medium inertia	24	/	2T152	B
	2500	3000	6.00	EMS-13152M-25S-xxxA	130	Medium capacity, medium inertia	25			
	1500	2000	10.00	EMS-13152H-15S-xxxA	130	Medium capacity, large inertia	26			
1800W	3000	3500	6.00	EMS-11182L-30S-xxxA	110	Medium capacity, small inertia	27	/	2T202	C
2000W	2500	3000	7.70	EMS-13202M-25S-xxxA	130	Medium capacity, medium inertia	28			
2600W	2500	3000	10.00	EMS-13262M-25S-xxxA	130	Medium capacity, medium inertia	29			
2900W	1000	1500	27.00	EMS-18292H-10S-xxxA	180	Medium capacity, large inertia	31	/	2T302	C
3000W	2000	3000	15.00	EMS-15302M-20S-xxxA	150	Medium capacity, medium inertia	30			
	1500	2000	19.00	EMS-18302H-15S-xxxA	180	Medium capacity, large inertia	14			

Motor capacity	**Rated speed**	**Max speed**	**Rated torque**	**Servo motor mode**	**Base No.**	**Difference**	**Motor No.**	**Servo drive mode**	
								1 phase 220V	**Case type**
1000W	2500	3000	4.00	EMS-13102M-25T-xxxA	130	Medium capacity, medium inertia	44	4T102	B
	1000	1500	10.00	EMS-13102H-10T-xxxA	130	Medium capacity, large inertia	32		
1200W	3000	4000	4.00	EMS-13122L-30T-xxxA	130	Medium capacity, small inertia	33	4T152	B
1500W	2500	3000	6.00	EMS-13152M-25T-xxxA	130	Medium capacity, medium inertia	46		
	1500	2000	10.00	EMS-13152M-15T-xxxA	130	Medium capacity,	34		

						medium inertia			
2000W	2500	3000	7.70	EMS-13202M-25T-xxxA	130	Medium capacity, medium inertia	47	4T202	B
2300W	1500	2000	15.00	EMS-13232H-15T-xxxA	130	Medium capacity, large inertia	35		
2600W	2500	3000	10.00	EMS-13262M-25T-xxxA	130	Medium capacity, medium inertia	36	4T302	C
2700W	1500	2000	17.20	EMS-18272H-15T-xxxA	180	Medium capacity, large inertia	48		
3000W	1500	2000	19.00	EMS-18302H-15T-xxxA	180	Medium capacity, large inertia	49		
3800W	2500	3000	15.00	EMS-13382L-25T-xxxA	130	Medium capacity, small inertia	38	4T442	C
4300W	1500	2000	27.00	EMS-18432M-15T-xxxA	180	Medium capacity, medium inertia	39		
4500W	2000	2500	21.00	EMS-18452M-20T-xxxA	180	Medium capacity, medium inertia	50		
5500W	1500	2000	35.00	EMS-18552M-15T-xxxA	180	Medium capacity, medium inertia	51	4T552	C
7500W	1500	2000	48.00	EMS-18752M-15T-xxxA	180	Medium capacity, medium inertia	52	4T752	D

2.6 Cable mode

2.6.1 Servo motor main circuit cable

Motor mode	Servo motor main circuit cables		
	L=3.0m	L=5.0m	L=10.0m
EMS-04101L-30S-xxxA EMS-06201L-30S-xxxA EMS-06201M-30S-xxxA EMS-06401L-30S-xxxA EMS-06401M-30S-xxxA EMS-08401H-30S-xxxA	EN-D201-3	EN-D201-5	EN-D201-10
EMS-08731H-20S-xxxA EMS-08751L-30S-xxxA EMS-09751H-30S-xxxA EMS-08102L-25S-xxxA EMS-08122L-30S-xxxA	EN-D202-3	EN-D202-5	EN-D202-10

EMS-13102M-25S-xxxA EMS-13102H-10S-xxxA EMS-11152M-30S-xxxA EMS-13152M-25S-xxxA EMS-13152H-15S-xxxA EMS-11182L-30S-xxxA EMS-13202M-25S-xxxA EMS-13102M-25T-xxxA EMS-13102H-10T-xxxA EMS-13122L-30T-xxxA EMS-13152M-25T-xxxA EMS-13152M-15T-xxxA EMS-13202M-25T-xxxA EMS-13232H-15T-xxxA EMS-13262M-25T-xxxA	EN-D211-3	EN-D211-5	EN-D211-10
EMS-13262M-25S-xxxA EMS-15302M-20S-xxxA EMS-18302H-15S-xxxA EMS-13382L-25T-xxxA	EN-D212-3	EN-D212-5	EN-D212-10
EMS-18272H-15T-xxxA EMS-18302H-15T-xxxA	EN-D223-3	EN-D223-5	EN-D223-10
EMS-18292H-10S-xxxA EMS-18432M-15T-xxxA EMS-18452M-20T-xxxA EMS-18552M-15T-xxxA	EN-D221-3	EN-D221-5	EN-D221-10
EMS-18752M-15T-xxxA	EN-D222-3	EN-D222-5	EN-D222-10

2.6.2 17 bit、20 bit and 23 bit encoder cable

Base No.	Servo motor main encoder cables		
	L=3.0m	L=5.0m	L=10.0m
Base not more than 90	EN-M601-3	EN-M601-5	EN-M601-10
Base not more than 110	EN-M611-3	EN-M611-5	EN-M611-10

2.6.3 2500 line encoder cable

Base No.	Servo motor encoder cables		
	L=3.0m	L=5.0m	L=10.0m
Base not more than 90	EN-M602-3	EN-M602-5	EN-M602-10
Base not more than 110	EN-M612-3	EN-M612-5	EN-M612-10

2.6.4 Spare parts of communication cable

Cable type	Description	Mark
EN-M701	Servo drive PC communication cable	
EN-M702	Keyboard parameter copy cable	

EN-M401	Servo drive multi-stage parallel communication cable	
EN-M404	Servo drive communication terminal matching resistor plug	
EN-M403	Servo drive Modbus communication cable	
EN-M402	Servo drive CAN communication cable	

2.7 Braking resistor correspond specification

Servo drive mode		Built-in braking resistor specifications		Minimum allowable resistance value (Ω)	Capacitor absorbs maximum braking energy (J)
		Resistance value (Ω)	Power (W)		
Single phase 220V	ESS200P-2S101	-	-	60	5
	ESS200P-2S201	-	-	60	10
	ESS200P-2S401	-	-	60	18
	ESS200P-2S751	30	60	30	25
Three phase 220V	ESS200P-2T102		80	30	26
	ESS200P-2T152		80	20	18
	ESS200P-2T202	15	120	15	26
	ESS200P-2T302				39
Three phase 380V	ESS200P-4T102	60	60	60	26
	ESS200P-4T152				39
	ESS200P-4T202	60	80	40	53
	ESS200P-4T302			30	79
	ESS200P-4T442	30	120	30	116
	ESS200P-4T552				145
	ESS200P-4T752	-	-	30	198

Note

(1) There are no built-in braking resistors for the 2S101, 2S201, 2S401 and 4T752 models. If you need to use, please configure the external braking resistor yourself;
(2) Please select the external braking resistor according to the actual working conditions. For the specific braking resistor power selection, please contact our technical support.

3 The installation and wiring of Servo Drive

3.1 Installation of Servo Drive

3.1.1 Installation environment

(1) Please install Servo Drive indoor place with good ventilation and temperature requirements within - 10 ℃ to 40 ℃.When temperature over 40 ℃, external forced cooling or de-rating use needed. Preheat treatment needed when temperature below -10℃;
(2) Forbid to install in the place of direct sunlight, dust, floating fiber and metal powder.
(3) Strictly prohibited to install in places with corrosive and explosive gases;
(4) Humidity should less than 95%RH and without condensation;
(5) Vibration less than 5.9 m/s² (0.6g);
(6) Please keep away from electromagnetic interference source and other electronic equipment sensitive to electromagnetic interference;
(7) Pollution degree of installation site: PD2;

3.1.2 Installation Precautions

（1）Installation Method

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

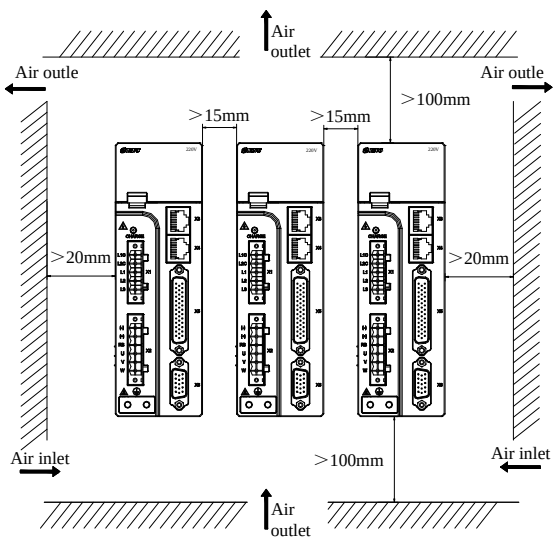


Fig.3-1 Servo Drive installation diagram

When installing, please make the front of the servo drive (the actual installation face of the operator) toward the operator and make it vertical to the wall.

（2）Cooling

As shown in Fig.3-1, Please keep sufficient clearances around the servo drive to ensure cooling by cooling fans or natural convection. Install cooling fans above the servo drive to avoid excessive temperature rise and maintain even temperature inside the control cabinet.

（3）Installation Side by Side

When installing servo drives side by side, please keep at least 15 mm between two servo drives (if installation space is limited, please leaving no space) and Leave more than 100mm space on each side of the longitudinal.

（4）Grounding

Be sure to ground the grounding terminal, otherwise there may be a risk of electric shock or malfunction due to interference.

（5）Requirements of cable direction

Please mount the drive with cable outlet facing downwards as show in Fig.3-2 to avoid liquid flow into the drive across cable when some liquid attached to the cable.

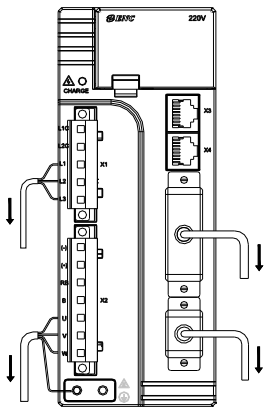


Fig.3-2 Servo Drive cable direction diagram

3.2 Servo Motor installation

3.2.1 Installation Location

（1）Please do not use this product in the vicinity of environment with corrosive or inflammable gases or combustible goods, such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gas, acid, soda and salt;

（2）Use the servo motor with oil sealing when the motor is to be used in a place with grinding fluid, oil spray, iron powder or cuttings;

（3）Keep the servo motor away from heat sources such as furnaces;

（4）Do not use the servo motor in an enclosed environment. Working in the enclosed environment will lead to high temperature of the servo motor and shorten its service life.

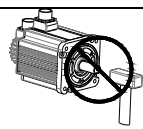
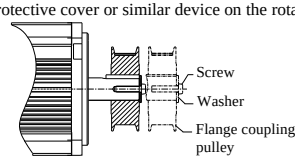
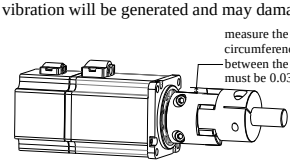
3.2.2 Environment Conditions

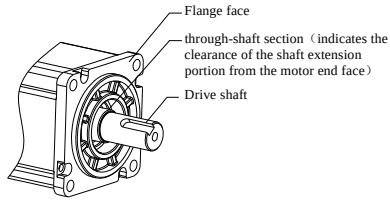
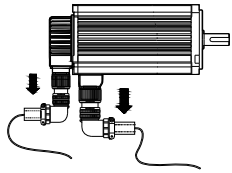
Table3-1 Installation Environment

Item	Description
Use ambient temperature	0～40℃（non-freezing）
Use environment humidity	20%～90%RH（no condensation）
Storage temperature	-20℃～60℃（Peak temperature ensurance: 80℃ for 72 hours)
Storage humidity	20%～90%RH（no condensation）
Vibration	Below 49m/s^2
Impact	Below 490m/s^2
Protection level	IP65（IP67need to be customized ）
Altitude	<1000m,de-rated using when the altitude is above 1000 m

3.2.3 Installation Precautions

Table 3-2 Installation Precautions

Item	Description
Rust-proof treatment	Wipe up the antirust agent at the motor shaft extension before installing the servo motor, and then take rust-proof treatment.
Encoder Precautions	Do not strike the shaft extension during installation, otherwise the internal encoder will damage.  (1) Use the screw hole at the shaft extension when mounting a pulley to the servo motor shaft with key slots. To fit the pulley, insert a double-end screw into the screw hole of the shaft, put a washer against the coupling end, and then use a nut to push the pulley in.。 (2) For servo motor shafts with key slots, use screw holes on the shaft end to install. For the servo motor shaft without key slots, please use friction coupling or the like. (3)When removing the pulley, use a pulley remover to protect the shaft from suffering severe impact from load. (4) To ensure safety, install a protective cover or similar device on the rotary area such as the pulley mounted on the shaft. 
Alignment	Use the coupling for mechanical connection and align the axis of the servo motor with the axis of the equipment. When installing the servo motor, make sure that alignment accuracy satisfy the requirement as described in the following figure. If the axes are not properly aligned, vibration will be generated and may damage the bearings and encoder. 

Installation direction	The servo motor can be installed horizontally or vertically.
Oil and moisture countermeasure	(1) Do not submerge the motor/cable to water or oil; (2) Confirm the IP level of the servo motor when using it in a place with water drops (except for the through-shaft section).  For applications with some liquids, please mount the motor with cable outlet facing downwards as show in the following figure to avoid liquid flow to the servo motor across cable.  (3) In the environment where the through-shaft section is exposed to oil drops, please use a servo motor with oil sealing; The using conditions of the servo motor with oil sealing: ①Make sure that the oil level is lower than the oil sealing lip during using; ②Prevent oil accumulation on the oil sealing lip when the motor is installed vertically upward.
Stress status of cables	Do not bend or apply tension to the cables, especially the signal cables whose core wire is 0.2 mm or 0.3 mm which is very thick. So do not pull the cables tightly during wiring.
The treatment of connectors	About connectors, please observe the following precautions: (1) When connecting the connectors, make sure that there is no waste or sheet metal inside the connectors. (2) Connect the connectors to the power cable side of the servo mot or first, and make sure that the grounding cable of the power cables is reliably connected. If the connectors are first connected to the encoder cable side, the encoder may become faulty due to the potential differences between PE terminals. (3) Make sure the pins are correctly arranged during wiring. (4) The connectors are made up of resins. Do not strike the connectors to prevent them from being damaged. (5) Hold the servo motor body during transportation when the cables are well connected, instead of catching the cables. Otherwise, the connectors may be damaged or the cables may be broken. (6) If bent cables are used, please note that do not attach stress on the connectors during wiring. Otherwise it may lead to connectors broken.

3.3 Servo system wiring diagram

The servo drive is directly connected to the industrial power supply and is not isolated by a power supply such as a transformer. To prevent cross-electric shock accidents in the servo system, use a fuse or wiring breaker on the input power supply. Since the drive does not have a built-in grounding protection circuit, in order to make a safer system, please use an earth leakage circuit breaker that is both overloaded and short-circuit protected, or a dedicated earth leakage circuit breaker that is equipped with a ground wire protection.

It is strictly forbidden to use the electromagnetic contactor for motor operation and stop operation. Since the motor is a large inductive component, the instantaneous high voltage generated may break through the contactor. Please pay attention to the power supply capacity when external control power supply or 24Vdc power supply. Especially when powering several drives or multi-way brakes at the same time, insufficient power supply capacity will result in insufficient supply current and failure of the drive or brake. The brake power supply is a 24V DC voltage source. The power needs to refer to the motor model and meet the brake power requirements.

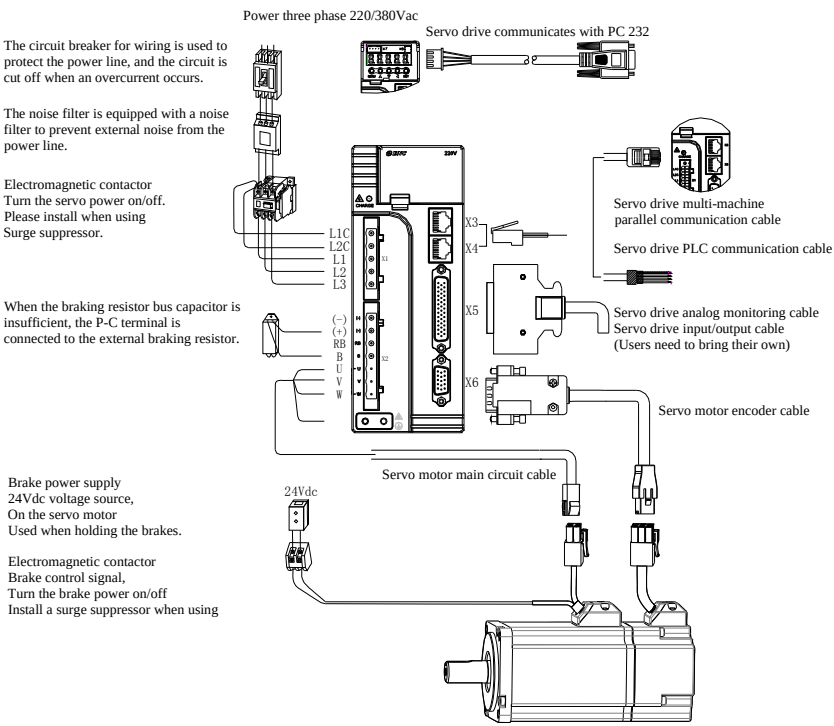


Fig.3-3 Servo system wiring

Note

(1) When using external braking resistance,please refer to Fig.3-3 to connect external braking resistance after remove the short wiring between RB and Bof the the servo drivers.
(2) Fig.3-3 is the wiring diagram for 3PH 220V/380V Servo Drive. If choose single phase 220V Servo Drive, please connect any two phases in the main terminals of L1, L2 and L3.

4 Servo Drive and Servo motor connection description

4.1 Servo drive terminals and pins description

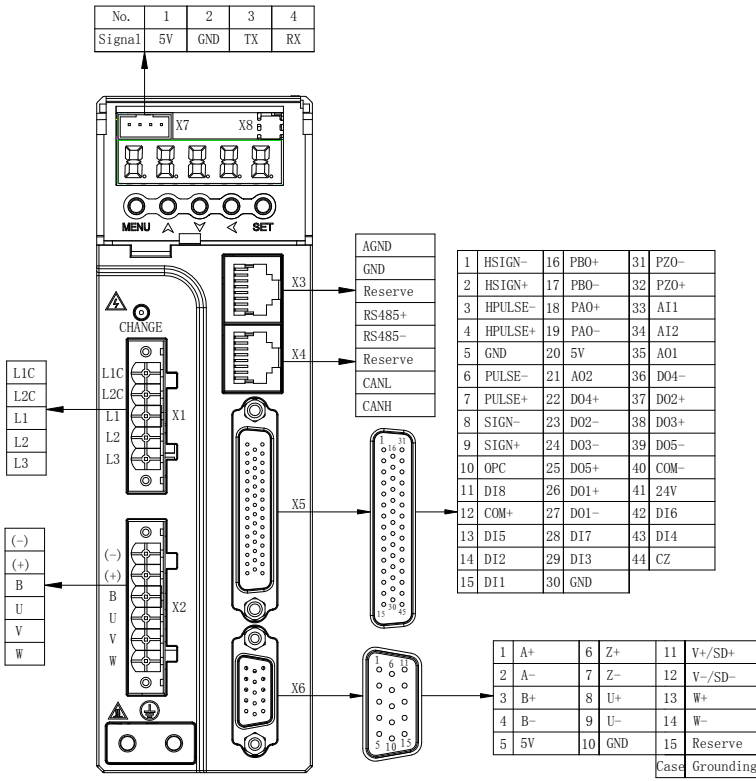


Fig.4-1 Servo Drive terminal pin profile

4.2 Wiring of Servo Drive Main Circuit

4.2.1 Main Circuit Terminals description

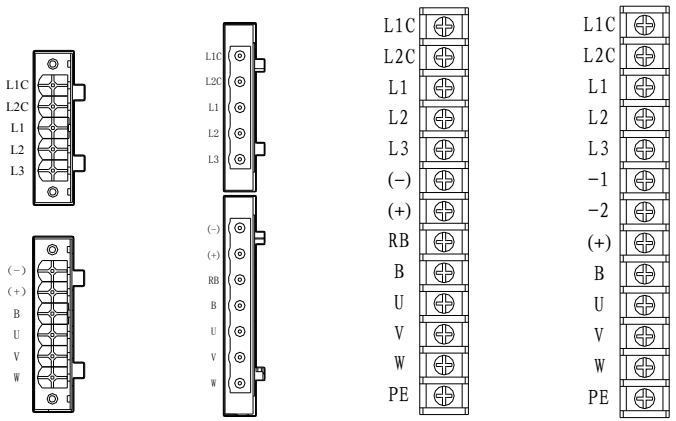


Fig.4-2 Servo Drive terminal block arrangement

Table 4-1 Names and functions of main circuit terminals of Servo Drive

Terminal Symbol	Terminal Name	Terminal Function	
L1、L2、L3	Main circuit power input terminals	1PH 220V:100W～750W	Main circuit single phase 220V power input. Can be connect to any two of L1、L2、L3.
		3PH 220V:1000W～3000W	Main circuit three phase 220V power input, Connect to L1、L2、L3.
		3PH 380V:1000W～7500W	Main circuit three phase 380V power input, Connect to L1、L2、L3.
L1C、L2C	Control power input terminals	Control circuit power input, Please refer to the rated voltage on the nameplate.	
RB、B、(+)	Terminals for connecting external braking resistor	1PH 220V:100W～400W	Connect an external regenerative resistor between (+) and B if the braking capacity is insufficient.
		1PH 220V:750W; 3PH 220V:1000W～3000W 3PH 380V:1000W～7500W	Terminal RB and B are shorted by default. When the braking capacity is insufficient, please make the circuit between RB and B open(remove the jumper between RB and B), and connect an external braking resistor between RB and B.
(+)、(-)	Common DC bus terminal	The common DC bus terminal can be connected together when multiple servo drives are used in parallel.	

U、V、W	Servo motor Connection terminals	Servo motor connection terminals connect to the U, V and W of servo motor.
-1、-2	Terminals for connecting external reactor	Terminal -1 and -2 are shorted by default. Please remove the shorting stub and connect external reactor between -1 and -2 when need to suppress high power harmonics.
⏚	Ground	Respectively connect to the ground terminal of the power supply and the servo motor.

4.2.2 Wiring of braking resistor

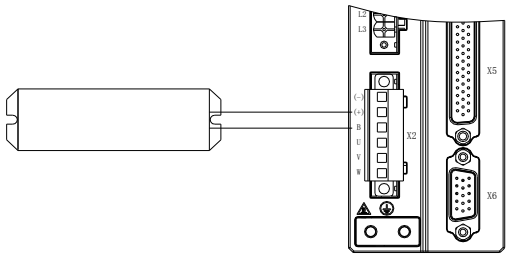


Fig.4-3 External braking resistor connection diagram

Precautions for braking resistor wiring：

（1）Please remove the short connection between (+) and (-) when using the external braking resistor. Otherwise it will lead the braking tube damage due to over-current;

（2）Do not connect the external brake resistance directly to the bus terminal (+), (-), or it may cause explosion or fire;

（3）Do not select any resistor lower than the minimum resistance value, Otherwise, Er.103 will alarm or damage the Servo Drive;

（4）Ensure that the parameters related to the braking resistor **[F01.16]**,**[F01.17]** and **[F01.18]** are accurately set before using the servo drive；

（5）Install the external braking resistor on incombustible objects like metal.

Note

Please refer to section "2.7Specification of brake resistor" for selection and usage of brake resistor.

4.2.3 Recommended Models and Specifications of Main Circuit Cables

Table 4-2 Servo Drive Current specification

Servo Drive case and model		Rated Output Current (A)	Max. Output current (A)	Recommended Cable
A Type	ESS200P-2S101	1.1	3.3	18AWG
	ESS200P-2S201	1.5	4.5	18AWG
	ESS200P-2S401	2.7	8.1	18AWG
B Type	ESS200P-2S751	3.9	11.7	16AWG

	ESS200P-2T102	5.2	15.6	16AWG
	ESS200P-2T152	7.5	22.5	16AWG
	ESS200P-4T102	2.8	8.4	16AWG
	ESS200P-4T152	4.0	12	16AWG
	ESS200P-4T202	5.5	16.5	16AWG
	ESS200P-2T202	9.5	28.5	16AWG
	ESS200P-2T302	13.0	39	13AWG
C Type	ESS200P-4T302	7.5	22.5	16AWG
	ESS200P-4T442	10	30	13AWG
	ESS200P-4T552	12	36	13AWG
D Type	ESS200P-4T752	21	63	10AWG

4.2.4 Example of power supply wiring

(1) Single phase 220V power supply models：ESS200P-2S101、ESS200P-2S201、ESS200P-2S401、 ESS200P-2S751

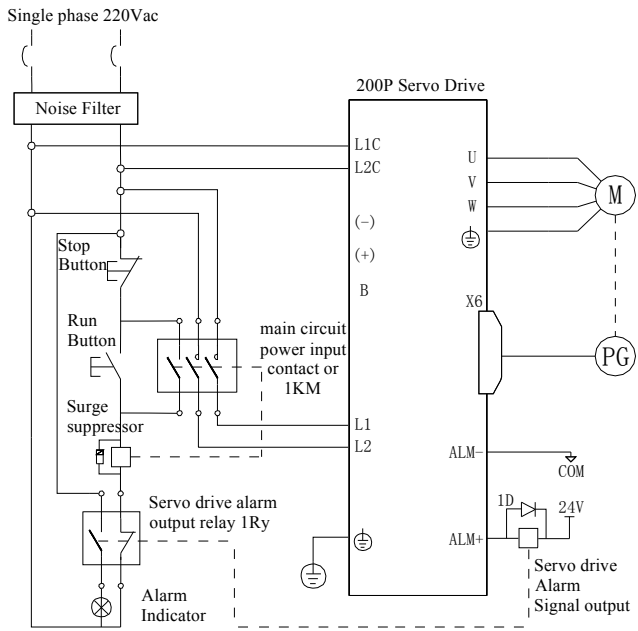


Fig.4-4 Single phase 220V Main Circuit wiring

(2) Three phase 220V power supply models：ESS200P-2T102、ESS200P-2T152、ESS200P-2T202 and ESS200P-2T302

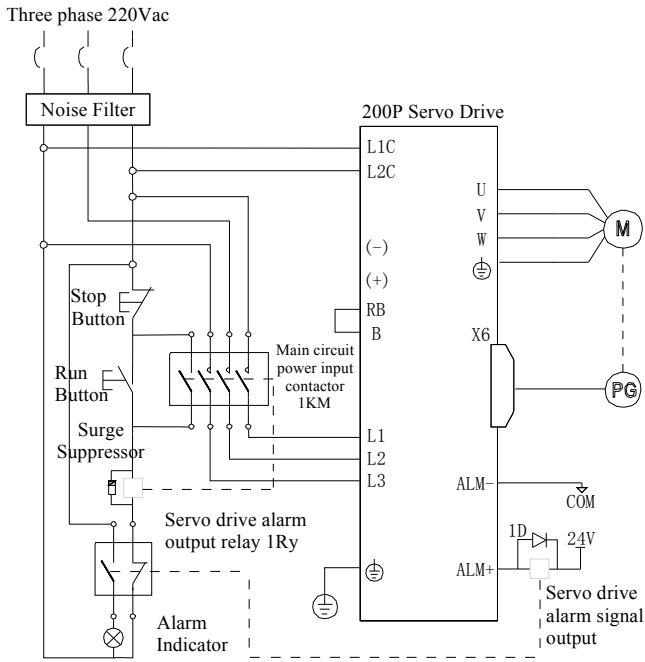


Fig.4-5 Three phase 220V Main Circuit wiring

Note

(1) 1KM: electromagnetic contactor, 1Ry: relay; 1D: flywheel diode.
(2) DO set as alarm output(ALM+/-);When the servo drive gives alarm, the power supply would be cut off automatically and the alarm indicator will light.

(3) Three phase 380V power supply models:ESS200P-4T102、ESS200P-4T152、ESS200P-4T202、ESS200P-4T302、ESS200P-4T442、ESS200P-4T552、ESS200P-4T752

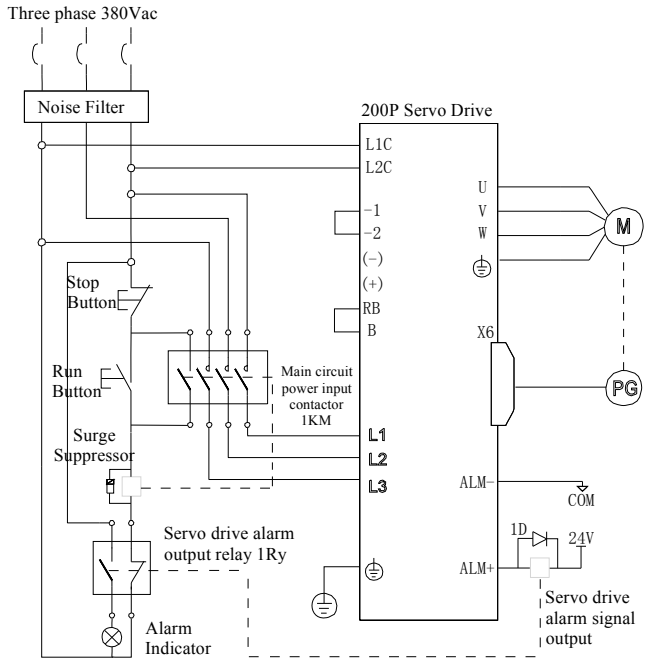


Fig.4-6 Three phase 380V Main Circuit wiring

Note

Only D type case has -1 and -2 terminal.

4.2.5 Precautions for Main Circuit Wiring

（1）Do not connect the power supply cables to the output terminals U, V and W. Otherwise it will lead to the servo drive damage.

（2） When using built-in braking resistor, RB and B must be shorted (they have been connected with a short wire before delivery).

-1 and -2 are shorted connection by default. When need to be restrict higher harmonic from the power, please remove the shorten wire and connect a DC reactor between -1 and -2.

（3）When placing cable bundle in a pipe, Please consider the allowable current reduction rate due to poor heat dissipation conditions.

When the temperature in the cabinet is higher than the temperature limit of the cable, please

choose cable with a higher temperature limit, and PTFE wire is suggested. Please pay attention to the thermal protection of the cable when the surrounding is low-temperature environment. The surface of the cable is prone to hardening and breaking under the low-temperature environment.

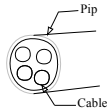
（4）The bending radius of the cable should be more than 10 times of the outer diameter of the cable to prevent the inner core of the cable from breaking due to long-term bending.

（5）Select and use cables of rated voltage above 600VAC and rated temperature above 75°C.Under the 30°C ambient temperature and normal cooling conditions, the permissible current density of the cables shall not exceed 8 A/mm2 when the total current is below 50 A. When the total current is larger than 50A, the current density should not exceed 5A/mm^2. For high ambient temperature and cables are bunched situations, the permissible current should be adjusted properly. The permissible current density (A/mm2) is calculated as follows:

Conductor allowable current density = 8×Current reduction coefficient of conductor ×Current compensation coefficient

$$Allowable\ current\ density = \sqrt{(Max.allowable\ temperature\ of\ \ cable - ambient\ temperature)/30}$$

Table 4-3 Current reduction coefficient of conductor



Number of Cables in the Same Duct	Current Reduction Coefficient
≤3	0.7
4	0.63
5～6	0.56
7～15	0.49

（6）Do not connect the braking resistor between DC BUS terminals + and - . Otherwise it may lead to fire.

Do not cross or bundle the power cables and signal cables together from the same pipe. They should be separated by more than 30cm to avoid interference.

（7）High voltage may still remain in the servo drive when the power supply is cut off. Do not touch the power terminals within 5 minutes after power-off.

（8）Do not frequently turn ON and OFF the power supply. If the power supply needs to be turned on or off repeatedly, make sure that the time interval is at least one minute. The servo drive parts contain capacitor, high charging current will flows for 0.2 seconds when the power supply is turned OFF. Frequently turning ON and OFF the power supply will deteriorate performance of the main circuit components inside the servo drive.

（9）Use a grounding cable with the same cross-sectional area as the power cable. If the cross-sectional area of the power cable is less than 1.6 mm2, please use 2.0 mm2 grounding cable.

（10）Ground the servo drive reliably.

（11）Do not power on the servo drive when any screw of the terminal block or any cable are loose. Otherwise fire may occur easily.

4.3Wiring of Power Cables between Servo Drive and Servo Motor

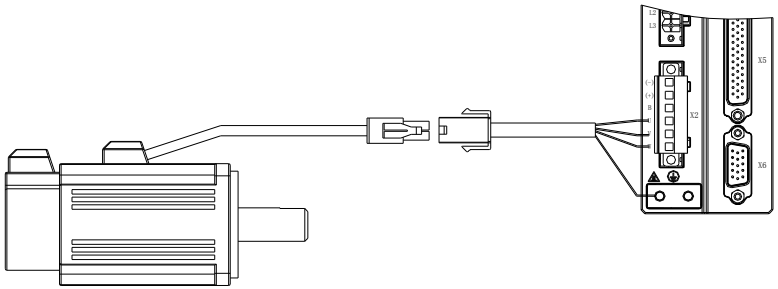
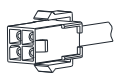
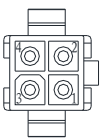
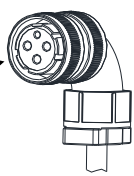
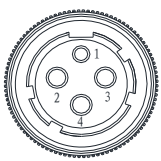
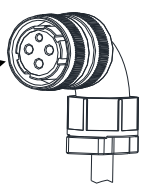
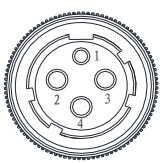


Fig 4-7 Example of servo drive output and servo motor connection

Table 4-4 Connectors of power cables on servo motor side

<table>
<tr><th>Connector Appearance</th><th>Terminal pin distribution</th><th>Base No.</th></tr>
<tr><td>See from this side
  </td><td> 
<table><tr><th>Pin No.</th><th>Signal name</th></tr><tr><td>1</td><td>U</td></tr><tr><td>2</td><td>V</td></tr><tr><td>3</td><td>W</td></tr><tr><td>4</td><td>PE</td></tr></table>
Plastic case：AMP 1-172159-9；Terminal：170362-1</td><td>40
60
80
90</td></tr>
<tr><td>See from this side
  </td><td> 
<table><tr><th>Pin No.</th><th>Signal name</th></tr><tr><td>1</td><td>PE</td></tr><tr><td>2</td><td>U</td></tr><tr><td>3</td><td>V</td></tr><tr><td>4</td><td>W</td></tr></table>
Model：YD28K4TSJ</td><td>110
130
150</td></tr>
<tr><td>See from this side
  </td><td> 
<table><tr><th>Pin No.</th><th>Signal name</th></tr><tr><td>1</td><td>PE</td></tr><tr><td>2</td><td>U</td></tr><tr><td>3</td><td>V</td></tr><tr><td>4</td><td>W</td></tr></table>
Model：YD32K4TSJ</td><td>180</td></tr>
</table>

4.4 Wiring of Servo Drive and Servo Motor Encoder Cables

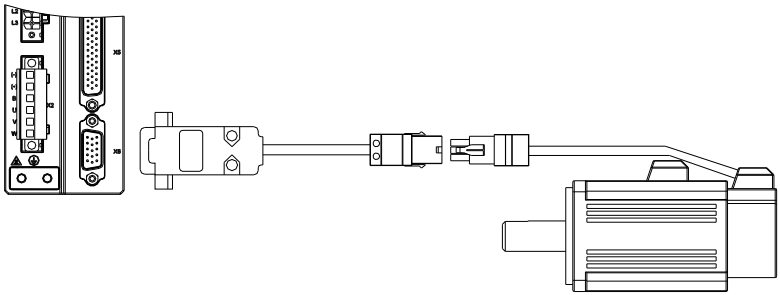


Fig.4-8 Example of connecting encoder signal cables

Table 4-5 Bus absolute encoder cable connector

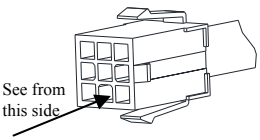
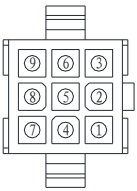
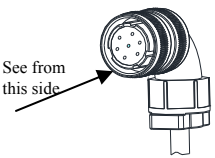
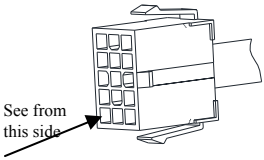
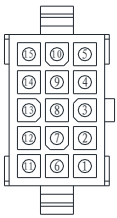
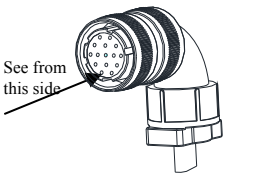
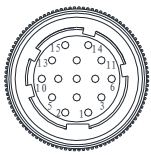
<table>
<tr><th>Connector Appearance</th><th>Terminal pin distribution</th><th>Base No.</th></tr>
<tr><td> 
See from this side</td><td> 
Plastic case：AMP 1-72161-9；Terminal：170361-1
<table><tr><th>Pin No.</th><th>Signal name</th></tr><tr><td>1</td><td>PE</td></tr><tr><td>2</td><td>E-</td></tr><tr><td>3</td><td>E+</td></tr><tr><td>4</td><td>SD-</td></tr><tr><td>5</td><td>0V</td></tr><tr><td>6</td><td>SD+</td></tr><tr><td>7</td><td>5V</td></tr></table></td><td>40
60
80
90</td></tr>
<tr><td> 
See from this side</td><td> 
Model：YD28K7TSJ
<table><tr><th>Pin No.</th><th>Signal name</th></tr><tr><td>1</td><td>PE</td></tr><tr><td>2</td><td>E-</td></tr><tr><td>3</td><td>E+</td></tr><tr><td>4</td><td>SD-</td></tr><tr><td>5</td><td>0V</td></tr><tr><td>6</td><td>SD+</td></tr><tr><td>7</td><td>5V</td></tr></table></td><td>110
130
150
180</td></tr>
</table>

Table 4-6 Incremental photoelectric encoder cable connectors

<table>
<tr><th>Connector Appearance</th><th>Terminal pin distribution</th><th>Base No.</th></tr>
<tr><td> 
</td><td> 

<table>
<tr><th>Pin No.</th><th>Signal name</th><th>Pin No.</th><th>Signal name</th></tr>
<tr><td>1</td><td>PE</td><td>9</td><td>A+</td></tr>
<tr><td>2</td><td>5V</td><td>10</td><td>V+</td></tr>
<tr><td>3</td><td>0V</td><td>11</td><td>W+</td></tr>
<tr><td>4</td><td>B+</td><td>12</td><td>V-</td></tr>
<tr><td>5</td><td>Z-</td><td>13</td><td>A-</td></tr>
<tr><td>6</td><td>U+</td><td>14</td><td>B-</td></tr>
<tr><td>7</td><td>Z+</td><td>15</td><td>W-</td></tr>
<tr><td>8</td><td>U-</td><td></td><td></td></tr>
</table>
Plastic case：AMP 1-172163-9；Terminal：17D361-1</td><td>40
60
80
90</td></tr>
<tr><td> 
</td><td> 

<table>
<tr><th>Pin No.</th><th>Signal name</th><th>Pin No.</th><th>Signal name</th></tr>
<tr><td>1</td><td>PE</td><td>9</td><td>Z-</td></tr>
<tr><td>2</td><td>5V</td><td>10</td><td>U+</td></tr>
<tr><td>3</td><td>0V</td><td>11</td><td>V+</td></tr>
<tr><td>4</td><td>A+</td><td>12</td><td>W+</td></tr>
<tr><td>5</td><td>B+</td><td>13</td><td>U-</td></tr>
<tr><td>6</td><td>Z+</td><td>14</td><td>V-</td></tr>
<tr><td>7</td><td>A-</td><td>15</td><td>W-</td></tr>
<tr><td>8</td><td>B-</td><td></td><td></td></tr>
</table>
Model：YD28K15TSJ</td><td>110
130
150
180</td></tr>
</table>

Precautions for cable wiring:

（1）Ground the servo drive and shielded layer of the servo motor reliably. Otherwise the servo drive will report a false alarm.

（2）Do not connect cables to the reserved pins.

（3）Please consider voltage drop caused by the cable resistance and signal attenuation caused by the distributed capacitance when determine the encoder cable length. Twisted-pair cable of size 26AWG or above (as per UL2464standard) and with a length within 10 m are recommended. For longer cable requirement, the cable diameter should be appropriately increased, as shown in the following table:

Table 4-7 Recommended cable

Wire diameter size	Ω/km	Allowed Cable Length (m)
26AWG(0.13mm^2)	143	10.0
25AWG(0.15mm^2)	89.4	16.0
24AWG(0.21mm^2)	79.6	18.0
23AWG(0.26mm^2)	68.5	20.9
22AWG(0.32mm^2)	54.3	26.4

4.4.1 Wiring of Absolute Encoder

（1）Installation of the Battery Box:

Battery box accessories model：ESS-C100，including：

Plastic box:1 PC

Battery：1 PC（3.6V，1800mAh）

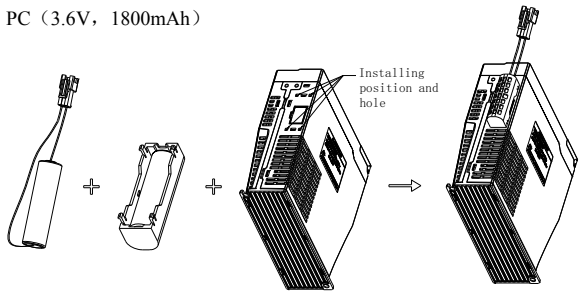


Fig.4-9 Installation example diagram of the Battery Box for the Absolute Encoder（A Type case）

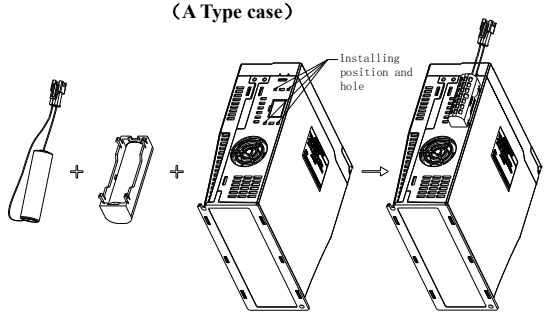


Fig.4-10 Installation example diagram of the Battery Box for the Absolute Encoder（B Type case）

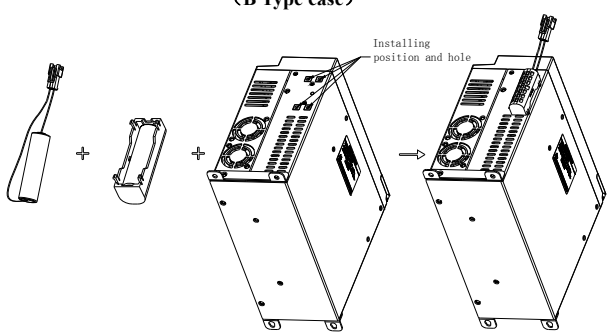


Fig.4-11 Installation example diagram of the Battery Box for the Absolute Encoder（C Type case）

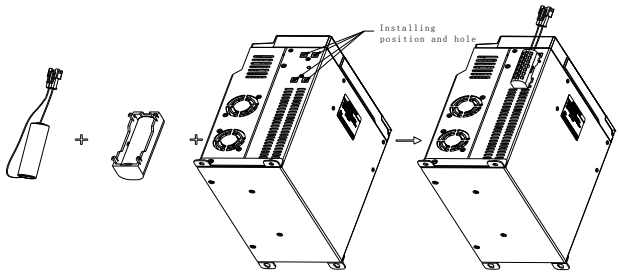


Fig.4-12 Installation example diagram of the Battery Box for the Absolute Encoder (D Type case)

(2) Removing the battery box

The battery may have leakage after a long-time use, so please replace it every two years. Remove the battery box in steps which reverse to the above steps .When closing the battery box cover, prevent the connector cables from being pinched. Avoid clamping the connector cable while closing the battery box cover:

If the battery is used incorrectly, it may result in battery leakage which corrodes the components or causes battery explosion. Please observe the following precautions:

(1) Place the battery with correct +, - polarity.

(2) Leaving a battery that has been used for a long time or is no longer useful inside the device can cause battery leakage. It not only corrodes surrounding components but also give rise to the danger of short circuit due to its electrical conductivity. If so, please replace the battery periodically (recommended period: every 2 years).

(3) Forbid to disassemble the battery as the electrolyte from flying out which resulting in the risk of personal safety accidents.

(4) Forbid to put the battery into fire. Putting the battery into fire or heating it can create a risk of explosion.

(5) Forbid to make the battery short circuit and strip the battery tube. If connect the + and – terminal of the battery by metal and so on, it may cause a high current to flow which not only weakening the battery power but also probably causing explosion of the battery due to severe heating.

(6) Forbid to charge the battery.

(7) Dispose the replaced battery according to local regulations.

（3）Battery Selection

Please refer to the following table to select an appropriate battery:

Table 4-9 Battery description for absolute encoder

Battery Spec.	Item and Unit	Rated value			Condition
		Min.	Typical	Max.	
Output: 3.6V 1800mAh	External battery voltage(V)	3.2	3.6	5	In standby mode(Note 2)
	Circuit fault voltage(V)	2.5	2.7	2.9	In standby mode
	Battery alarm voltage(V)	2.85	3	3.15	
	Circuit consumption current(μA)	-	2	-	Normal operation (Note 1)
		-	10	-	In standby mode，axis static
		-	80	-	In standby mode，axis rotating
	Battery using Temperature(℃)	0	-	40	Same temperature requirements as motor ambient temperature
	Battery storage temperature (℃)	-20	-	60	

The above data is measured under the 20°C ambient temperature.

Note

Note 1: During normal operation, the absolute encoder supports one-turn or multi-turn data counting and transmitting / receiving. After connecting the absolute encoder properly, turn on the power to the servo drive, the encoder will enters normal operation state and transmits/receives data after a delay of about 2s. When the encoder switches from standby state to normal operation state (power turned on), it needs the motor speed not exceed 10 RPM. Otherwise, the servo drive will give error and you need to power on the servo drive again.

Note 2: Standby mode: The servo drive without power and the external battery is used for multi-turn data counting. In this case, data transmitting/receiving is in stop state.

（4）Theoretical battery life

Assume that:

Normal operation time of servo drive during each day: T1，Motor rotating time after power-off of servo drive: T2，Motor rotating stop time after power-off: T3 (Unit: hour)

Example:

Table 4-10 Theoretical battery life of absolute encoder

Item	Time Arrangement 1	Time Arrangement 2
Days in one year with different operating conditions（Days）	313	52
T1（H）	8	0
T2（H）	0.1	0
T3（H）	15.9	24

Yearly consumption＝（8H×2uA＋0.1H×80uA＋15.9H×10uA）× 313 ＋（0H×2uA＋0H×80uA ＋24H×10uA）×52≈70mAH
Theoretical battery life＝Battery capacity/ Yearly consumption=2600mAH/70mAH=37.1 Years

（5）Wiring of absolute encoder battery box and signal wires

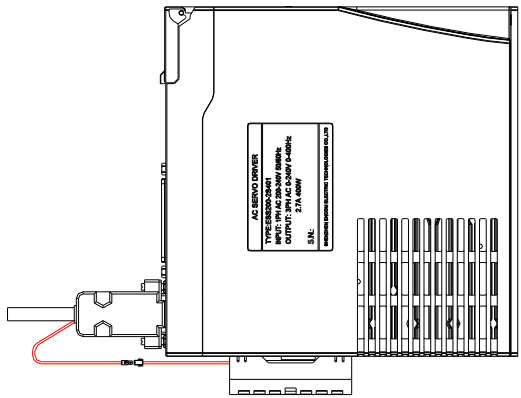
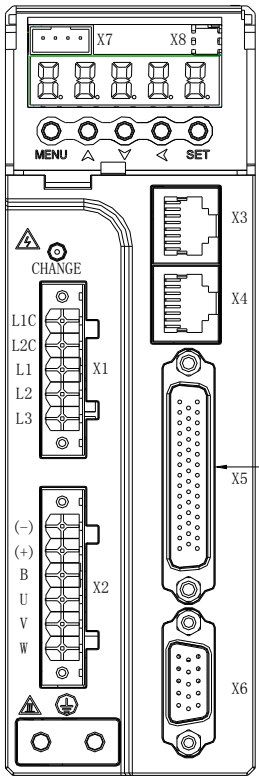


Fig.4-13 Wiring of absolute encoder battery box and signal wires diagram

Note

(1) Store the battery box in required ambient temperature and ensure the battery is in reliable contact and has sufficient capacity. Otherwise, position information loss may occur in the encoder.
(2) About the battery positive and negative connection, please refer to the mark on wires.

4.5 Wiring of control signal terminal X5 in Servo Drive



1	HSIGN-	16	PB0+	31	PZ0-
2	HSIGN+	17	PB0-	32	PZ0+
3	HPULSE-	18	PA0+	33	AI1
4	HPULSE+	19	PA0-	34	AI2
5	GND	20	5V	35	AO1
6	PULSE-	21	AO2	36	DO4-
7	PULSE+	22	DO4+	37	DO2+
8	SIGN-	23	DO2-	38	DO3+
9	SIGN+	24	DO3-	39	DO5-
10	OPC	25	DO5+	40	COM-
11	DI8	26	DO1+	41	24V
12	COM+	27	DO1-	42	DI6
13	DI5	28	DI7	43	DI4
14	DI2	29	DI3	44	CZ
15	DI1	30	GND		

Fig.4-14 Pin layout of control circuit terminal connector of servo drive

Note

(1) X5 terminal is three rows of GHK DB44 terminal.
(2) 24AWG to 26AWG cables are recommended.

4.5.1 Position Command Input Signals

Table 4-10 Position command signal description

Signal		Pin No.	Function	
Position command	PULSE+ PULSE- SIGN+ SIGN-	7 6 9 8	Low-speed pulse command input mode： ①Differential drive mode ②OC mode	Pulse input format: Direction + Pulse Phase A , B orthogonality pulse CW/CCW pulse
	HPULSE+ HPULSE-	4 3	High-speed command pulse input	
	HSIGN+ HSIGN-	2 1	High-speed command pulse input	
	OPC	10	External power input terminal of pulse command	
	GND	30	Ground of signal	

The command pulse and direction output circuit on the host device side can be selected in differential drive output and OC output. The maximum input frequency and Min. pulse width as showing in the following table:

Table 4-11Correspondence between pulse input frequency and pulse width

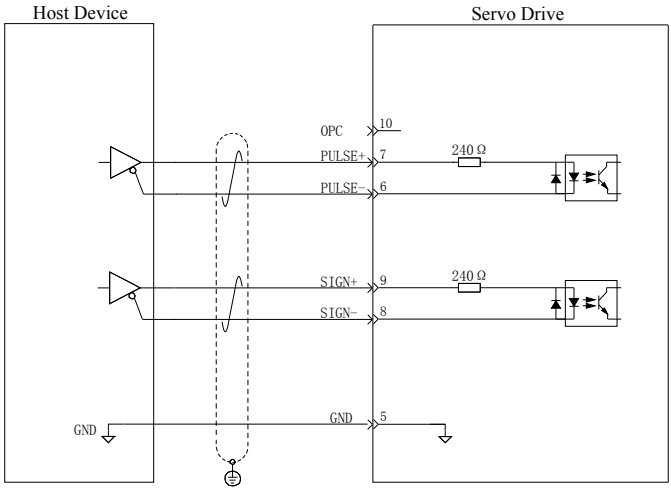
Pulse mode		Max. Frequency(pps)	Min. Pulse Width (us)
Low speed	Differential	500k	1
	OC	200k	2.5
High-speed differential		4M	0.125

Note

If the output pulse width of the host device is smaller than the Min. value, it will lead to pulse receiving error in the servo drive.

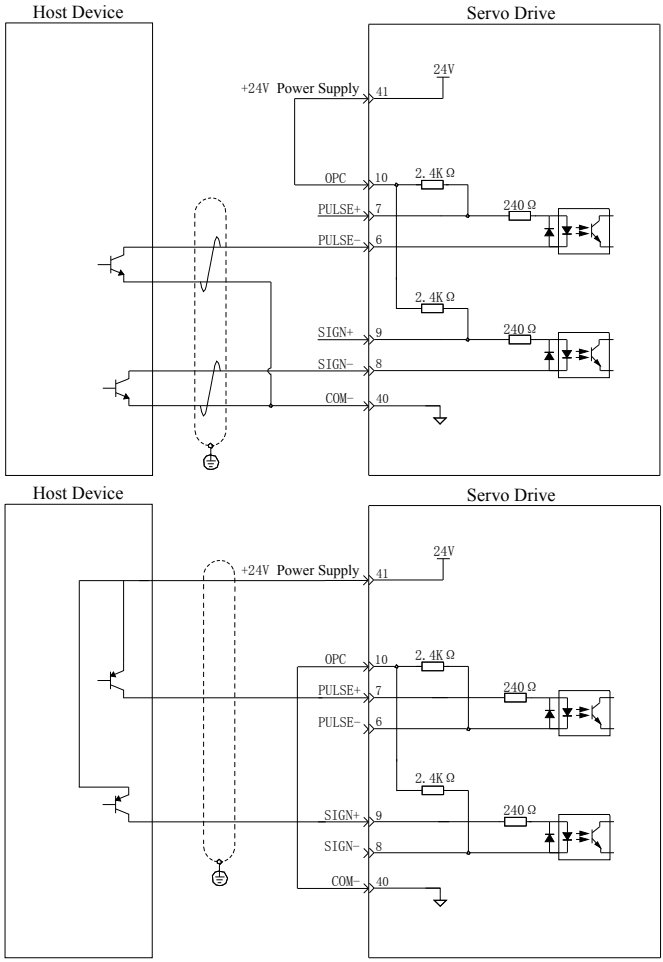
4.5.1.1 Low-speed pulse command input

(1) Differential drive mode

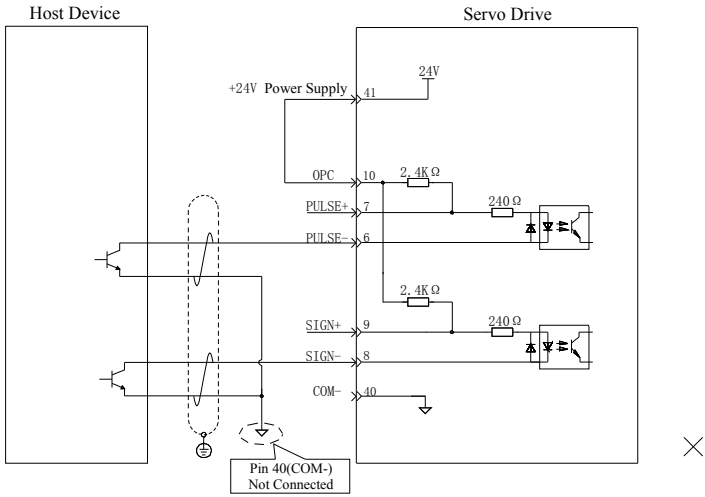


(2) OC mode

①When using the internal 24 V power supply of the servo drive：

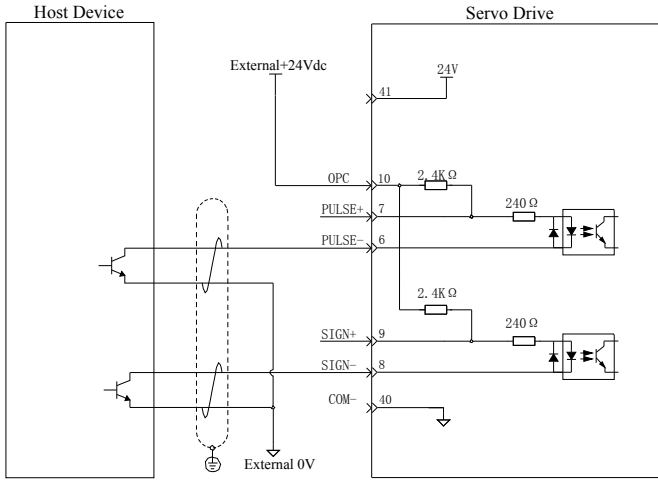


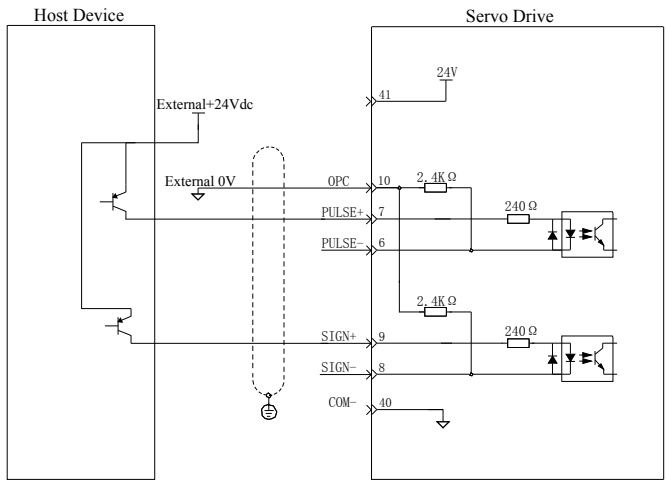
Wrong wiring: Pin 40(COM-) is not connected, which cannot form a closed-loop circuit.



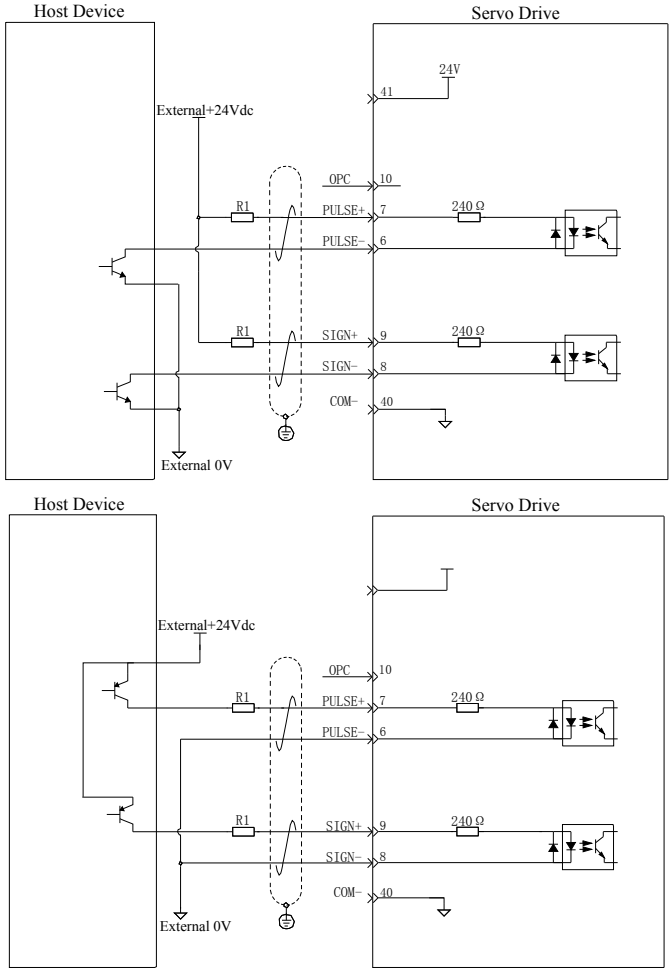
② When using external power supply:

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





Solution 2: Using external resistor



The selection of R1 according to the following formula:

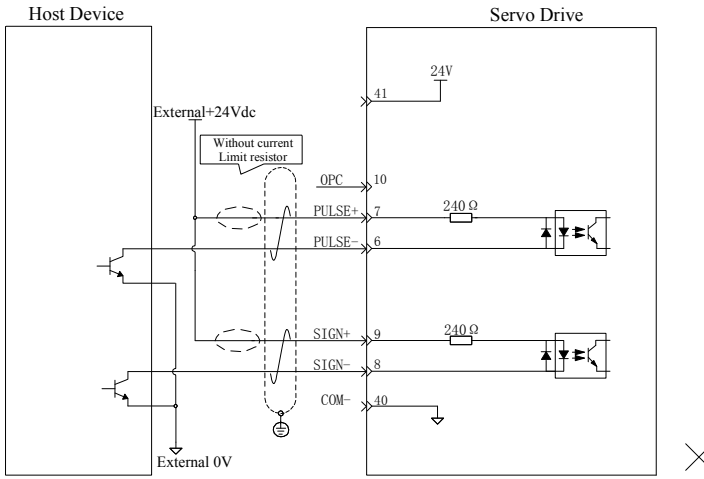
$$\frac{V_{CC}-1.5}{R1+240}=10mA$$

Table 4-12Recommended R1 resistance

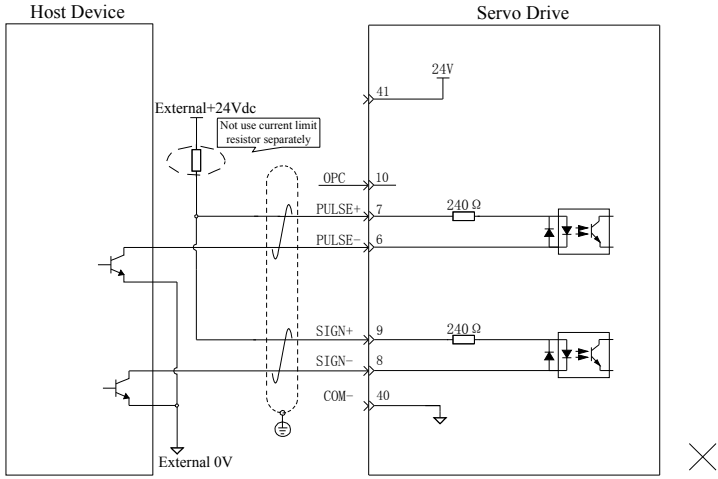
Vcc voltage	R1 resistance	The power of R1
24V	2.4KΩ	0.5W
12V	1.5KΩ	0.5W

Examples of wrong wiring:

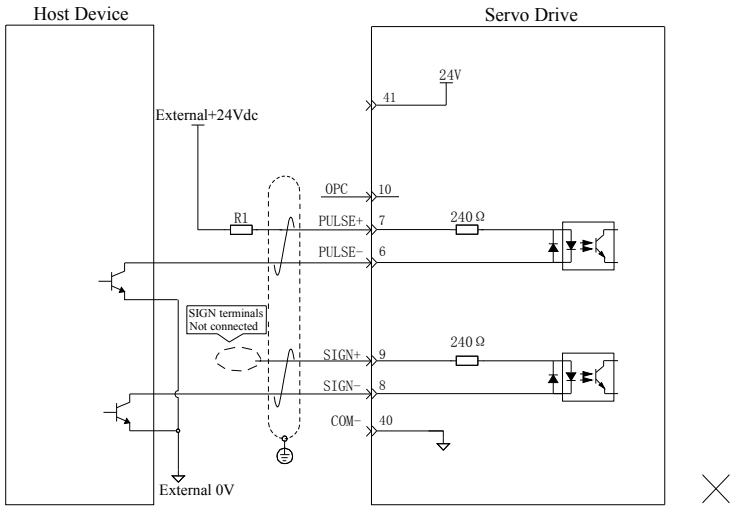
Wrong wiring 1: Not connect the current-limiting resistance resulting in burnout of terminals.



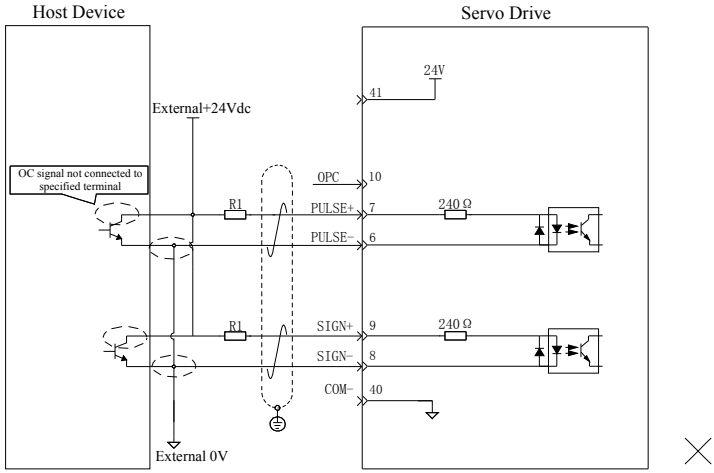
Wrong wiring 2: Multiple terminals share same current-limiting resistance, resulting in pulse receiving error.



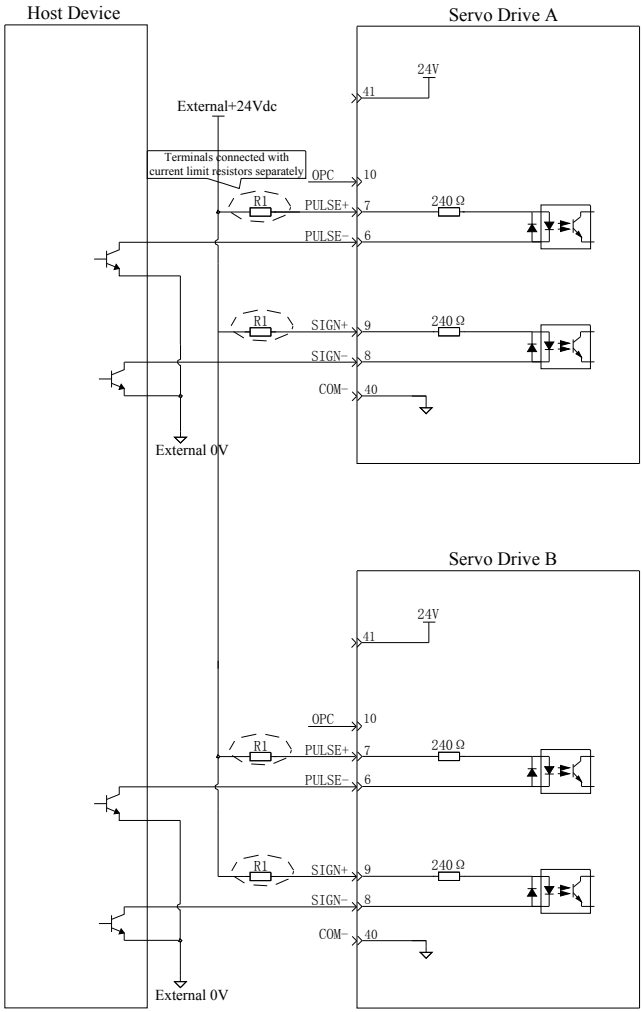
Wrong wiring 3:SIGN terminal not connected，resulting two terminals to failure to receive pulses.

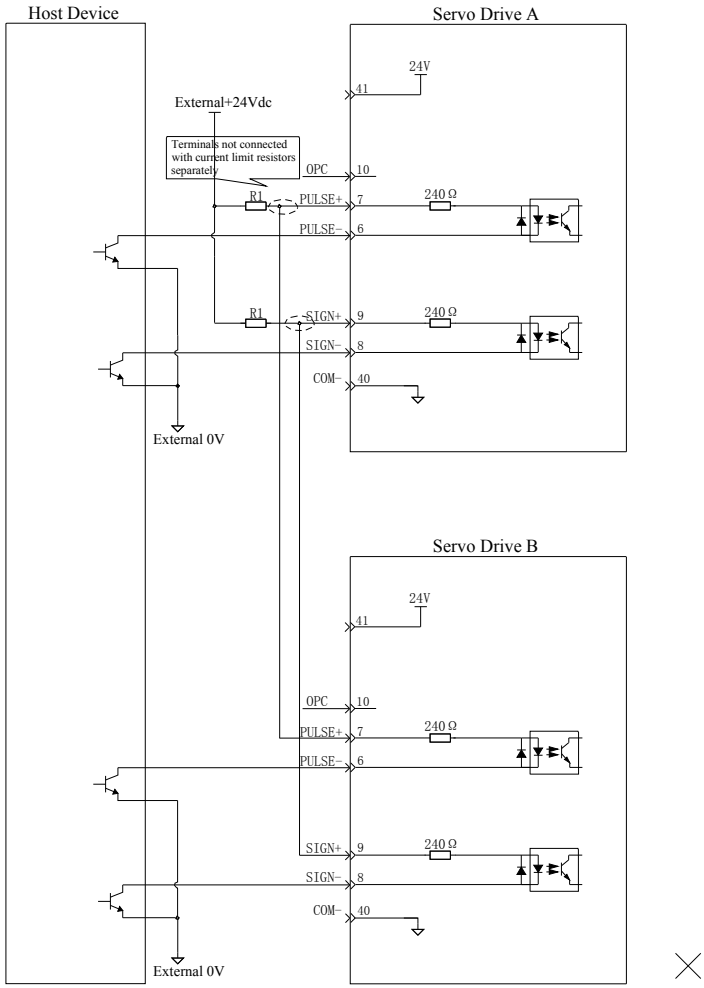


Wrong wiring 4: Wrong terminals connected results in burnout of terminals.



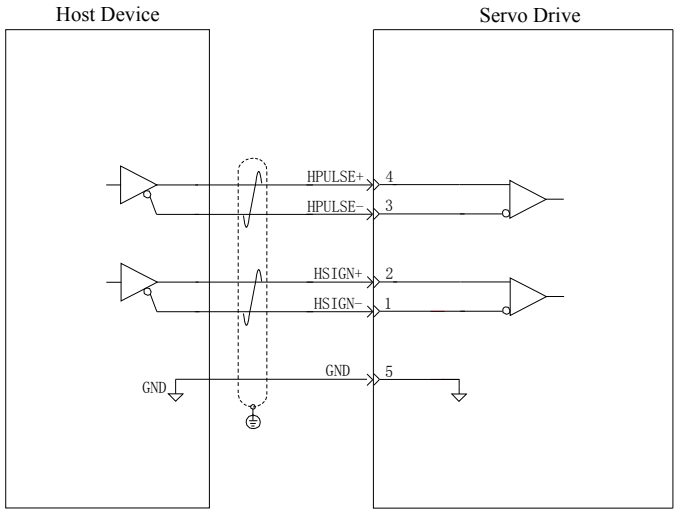
Wrong wiring 5: Multiple terminals share the same current-limiting resistance, resulting in pulse receiving error.




Host Device
Servo Drive A
24V
41
External+24Vdc
Terminals not connected with current limit resistors separately
OPC
10
R1
PULSE+
7
240 Ω
PULSE−
6
R1
SIGN+
9
240 Ω
SIGN−
8
COM−
40
External 0V
Servo Drive B
24V
41
OPC
10
PULSE+
7
240 Ω
PULSE−
6
SIGN+
9
240 Ω
SIGN−
8
COM−
40
External 0V

4.5.1.2 High-speed pulse command input

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



Note

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

(1) Pulse loss occurs when inputting reference pulses.
(2) The direction is reverse when inputting reference direction.
(3) Be sure to connect the ground of the host device 5V and the servo drive together to reduce noise interference
(4) Please ensure the wire for HPULSE+ and HPULSE-, HSIGH+ and HSIGN- are twisted-pair.

4.5.2 AI signals

Table 4-13 AI signal description

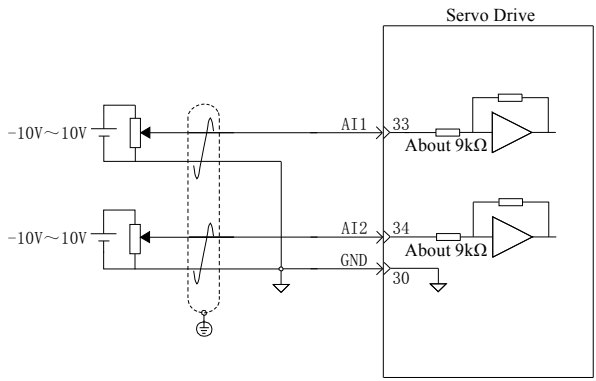
Signal	Default function	Pin No.	Function Description
Analog input	AI2	34	Ordinary analog input signal with 12 bit resolution
	AI1	33	Input voltage: Max.±12V
	GND	30	Analog signal input ground

The analog signal input terminals for speed and torque are AI1 and AI2 with 12 bit resolution. The corresponding voltage values set via group F02.

(1) The range of voltage input:-10V～+10V，12 bit resolution;

(2) Max. voltage：±12V；

(3) Input resistance: About 9kΩ



4.5.3 DI/DO signals

Table 4-14 DI/DO signal description

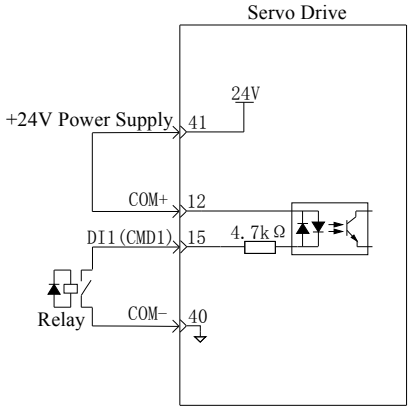
Signal		Default function	Pin No.	Function description
General	DI1	S-ON	15	Servo on
	DI2	P-OT	14	Positive limit switch
	DI3	N-OT	29	Negative limit switch
	DI4	INHIBIT	43	Pulse input inhibited
	DI5	ALM-RST	13	Alarm reset
	DI6	ZCLAMP	42	Zero speed clamp
	DI7	HomingStart	28	Homing Start
	DI8	-	11	-
	+24V		41	Internal 24Vpower supply, voltage range:20～28V，maximum output current:200mA
	COM-		40	
	COM+		12	Power input(12V～24V)
	DO1+	S-RDY+	26	Servo ready
	DO1-	S-RDY-	27	
	DO2+	COIN+	37	Position reached
	DO2-	COIN-	23	
	DO3+	ZERO+	38	Zero speed
	DO3-	ZERO-	24	
	DO4+	ALM+	22	Fault output
	DO4-	ALM-	36	
	DO5+	HomeAttain+	25	Homing completed
	DO5-	HomeAttain-	39	

4.5.3.1 DI circuit

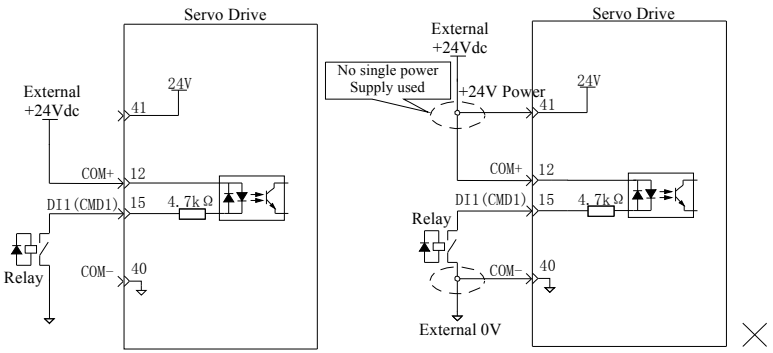
DI1 to DI8 circuits are the same. The following takes DI1 circuit as an example.

(1) The host device provides relay output signal:

① Using the internal 24Vpower supply of servo drive:

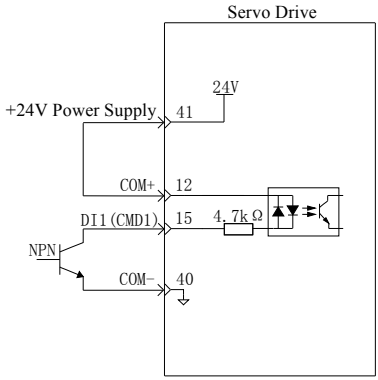


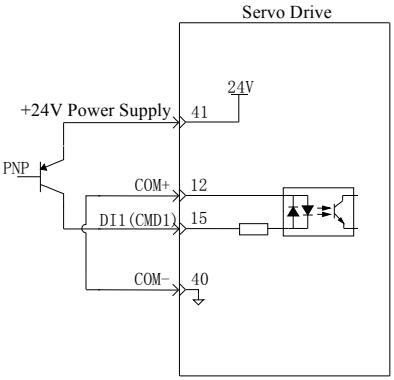
②Using external power supply:



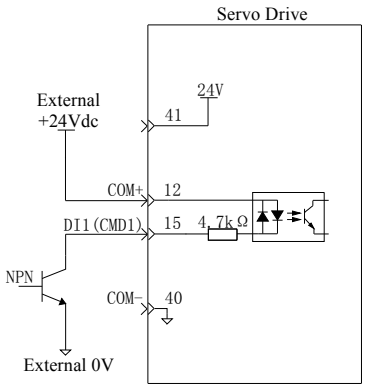
(2) The host device provides OC output signal:

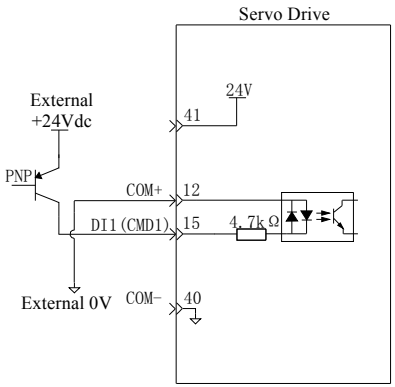
① Using the internal 24Vpower supply of servo drive:





② Using external power supply:





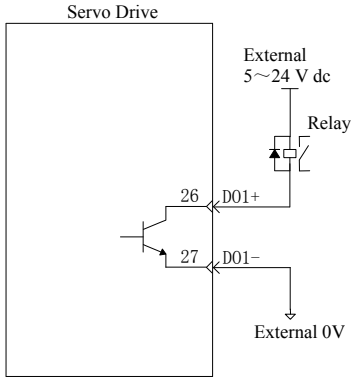
Note

Mixing the using of PNP and NPN inputs is not supported.

4.5.3.2 DO Circuit

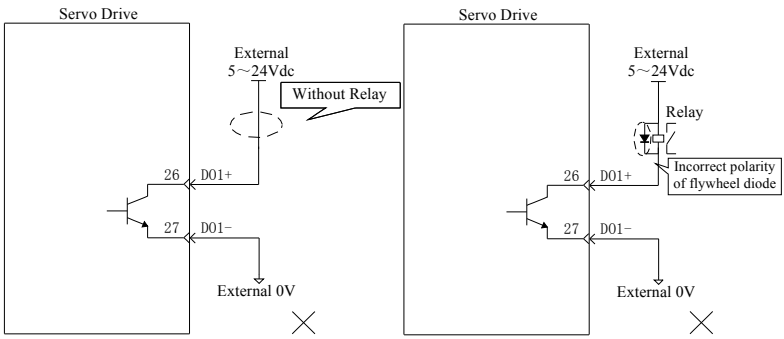
DO1 to DO5 circuits are the same. The following takes DO1 circuit as an example.

(1) The host device uses relay input:

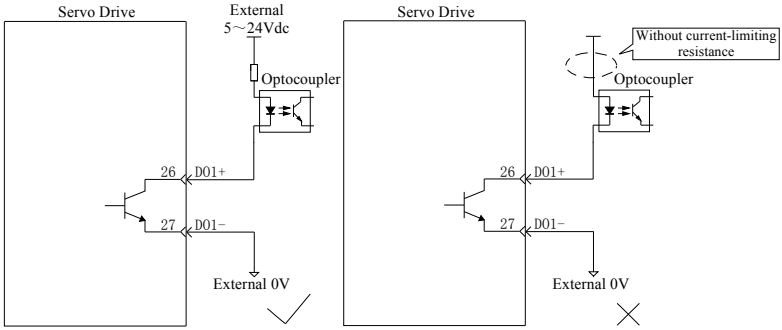


Note

When the host device uses relay input, a flywheel diode must be installed; Otherwise, DO terminals may be damaged.



(2) When the host device uses optocoupler input:



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

①Max. Voltage:DC30V

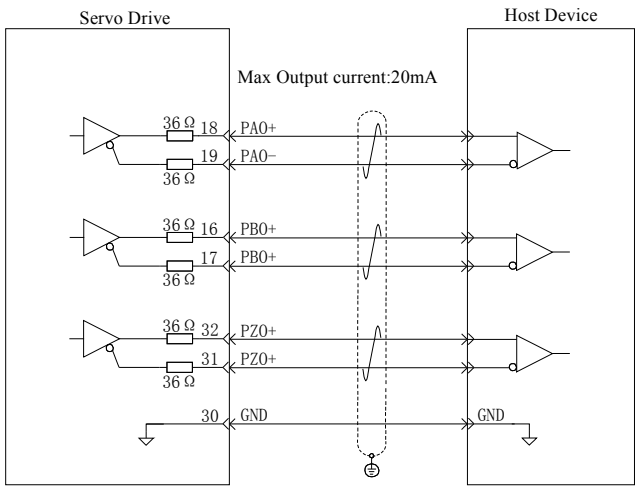
②Max. Current:DC50mA

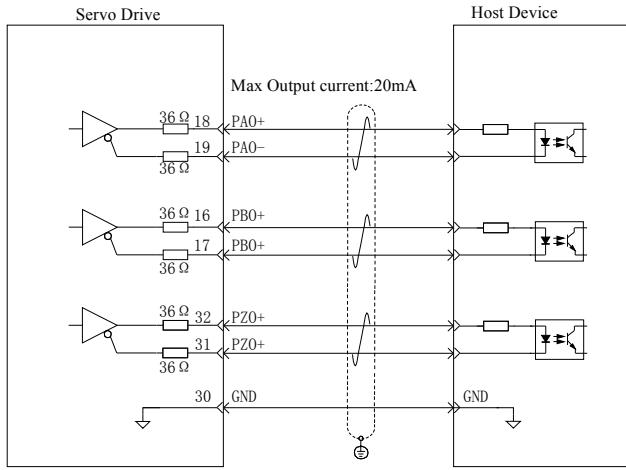
4.5.4 Encoder Frequency-Division Output Signal

Table 4-15 Encoder frequency-division output signal specifications

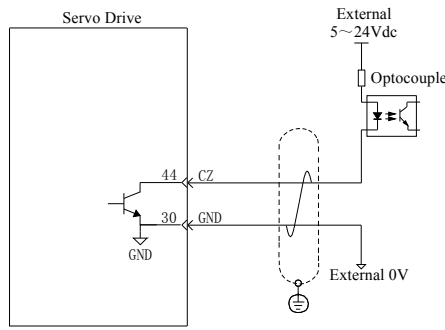
Signal	Default Function	Pin No.	Function description	
General	PAO+ PAO-	18 19	Phase A output signal	Phase A and B quadrature pulseoutput signal
	PBO+ PBO-	16 17	Phase B output signal	
	PZO+ PZO-	32 31	Phase Z output signal	Home pulse output signal
	CZ	44	Phase Z output signal	Home pulse OC output signal
	GND	30	Home pulse OC output signal ground	
	+5V	20	5 V internal power supply with max. output current 200mA	
	GND	5		
	PE	Case	Shield	

The encoder frequency-division output circuit outputs OC signals via the differential drive. Generally, feedback signals are provided for the host device when forming closed-loop position control system. A differential or optocoupler circuit shall be used in the host device toreceive feedback signals. The maximum output current is 20mA.





The encoder phase Z output circuit outputs OC signals. Generally, feedback signals are provided for the host device when forming closed-loop position control system. An optocoupler circuit, relay circuit, or bus receiver circuit shall be used in the host controller to receivefeedback signals.



Note

Be sure to connect the 5V ground of the host device to the GND of the drive and use shielded twisted-pair wires to reduce noise interference.

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

(1) Max. Voltage: DC30V

(2) Max. Current: DC50mA

4.5.5 Wiring for motor brake

The brake is a mechanism that prevents the servo motor shaft from moving when the servo driver is in a non-running state and keeps the motor in a locked position so that the moving part of the machine does not move because of gravity or external force.

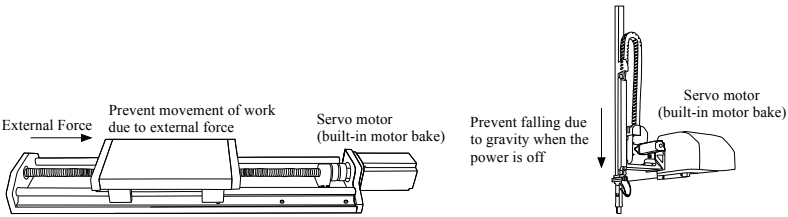


Fig.4-15 Brake application diagram

Note

(1) The brake mechanism built into the servo motor is a non-power-operated fixed special mechanism, which cannot be used for braking purposes, only used for keeping the servo motor in a stopped state.
(2) Except for permanent magnet brake, the brake coil has no polarity.
(3) The servo open signal(S-ON) must be off after the servo motor stops.
(4) When the motor with the brake built-in is running, the brake may make a sound which does not affect any functionality.
(5) When brake coils are energized (the brake is released), magnetic flux leakage may occur at the shaft end. Thus, pay special attention when using magnetic sensors around the servo motor.

4.5.5.1 Brake wiring

The connector of the motor brake has no polarity. Customers needs to prepare 24 V external power supply. The standard wiring of the brake signal (BK) and motor brake power supply as show in Fig. 4-17：

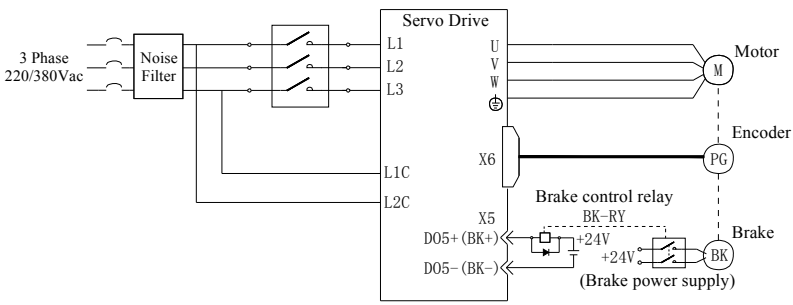


Fig.4-16 The Wiring diagram of Motor Brake

Precautions for motor brake wiring:

(1) The cable length of the motor brake shall take the voltage drop caused by the cable resistance into full consideration, and the input voltage shall be at least 21.6V to ensure the working of brake. The brake specifications of our servo motors as show in following table:

Table 4-16 Brake specifications

Servo motor module	Rated torque (Nm)	Supplied Voltage(V) ±10%	Supplied Current Range(A)	Release Time (ms)	Applying Time(ms)
40 base	1	24	0.23～0.27	20	8
60 base	2	24	0.40～0.50	30	10
80、90 base	4	24	0.52～0.86	55	63
110 and 130-10N below motor	8	24	0.68～0.85	72	87
130-10N and above motor	16	24	0.85～1.33	95	110
180-35N below motor	30	24	0.85～1.80	115	130
180-35N and above motor	50	24	1.47～1.70	120	135

(2) The brake shall not share the power supply with other devices. Otherwise, the brake may malfunction due to voltage or current drop resulted from working of other devices.

(3) Cables of 0.5 mm2 and above are recommended.

4.5.5.2 Brake software setting

For servo motors with brakes, one DO terminal of the servo drive must be configured as function 9 (FunOUT.9: BK, brake output), and the DO logic valid logic is determined, and **[F01.06]** needs to be set to 1 , enable the brake control.

Code	Item	Function name	Function
FunOUT.9	BK	Brake output	Invalid: the brake power is turned on, the brake is actuated, and the motor is in the position lock state; Valid: the brake power supply is disconnected, the brake is released, and the motor can be rotated;
F01.06	Whether the loose brake control is effective	Whether the loose brake control is effective	0: invalid 1: valid

4.5.5.3 Servo drive state brake timing

(1) Brake timing when the servo motor is at rest

Note

(1) After the brake output set as ON from OFF, please do not input position/speed/torque instruction within [F01.07] time, otherwise the instruction will be lost or run wrong.
(2) When apply to a vertical shaft, the dead weight or external force on the moving part of the machine may cause slight movement of the machine. When the servo motor is at rest, the servo enable is OFF and the output of the locking brake immediately turns OFF. However, in the time of [F01.08], the motor is still in the energized state to prevent the moving parts from moving due to the dead weight or external force.

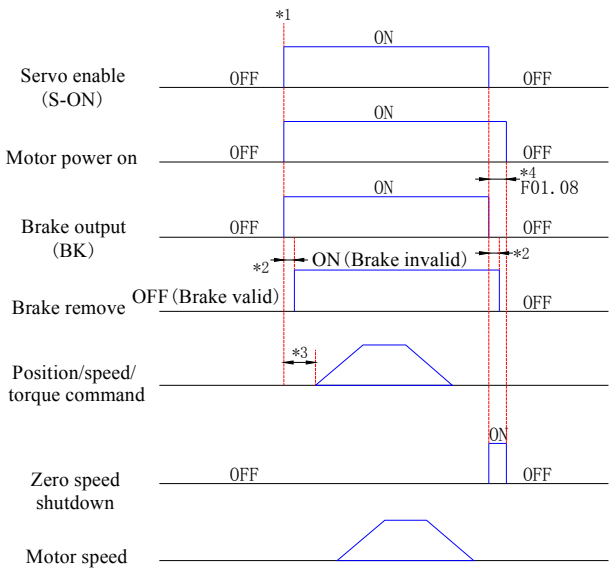


Fig.4-17 Brake timing diagram when the servo motor is at rest

Note

*1: When the servo enable is ON, the brake output is turned ON and the motor enters the power-on state.
*2: Refer to the motor specifications for the delay time of the brake release unit operation. Please refer to Table 4-16 for details.
*3: When the brake output is turned on to the input instruction, please wait for **[F01.07]** or longer.
*4: When the servo motor is stationary (motor speed is lower than **[F01.09]**), when the servo is turned OFF, the brake output is turned OFF at the same time. The brake output can be set OFF by setup [F01.08],. The motor enters a non-energized state.

Code	Item	Setting range	Unit	Function	Setting mode	Effective mode	Factory default
F01.07	Brake output ON to command receiving delay	0～1000	ms	Setting a delay time for the servo driver to start receiving the input command from the brake output (BK) ON; F01.08 has no effect when the brake output (BK) is not assigned.	Stop setting	Effective immediately	250
F01.08	Brake output OFF to motor no power delay	1～1000	ms	Set the delay time for the motor to enter the non-energized state and the brake output (BK) OFF. When F01.06=0, F01.08 has no effect.	Run setting	Effective immediately	150

(2) Brake timing when the servo motor rotates

When the servo enable is turned from ON to OFF, if the current motor speed is greater than or equal to 20 rpm, the drive operates in the rotary brake timing.

Note

(1) When the servo enable is turned from OFF to ON, do not input the position/speed/torque command during [F01.07] time, otherwise it will cause loss or operation error;
(2) When the servo motor rotates, the servo enable is turned OFF, and the servo motor enters the zero speed stop state, but the brake output needs to be decelerated until [F01.09] is set to OFF;
(3) After the brake output changes from ON to OFF, the motor is still energized for a certain period of time to prevent the mechanical movement from moving due to its own weight or external force.

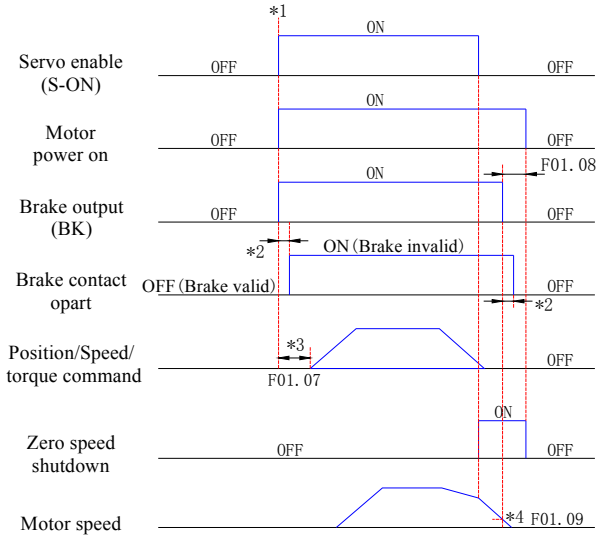


Fig.4-18 Brake timing diagram when the servo motor rotates

Note

(1) When the servo enable is ON, the brake output is turned ON and the motor enters the energized state;
(2) Refer to the motor specifications for the delay time of the brake contact operation. For details, see "2.3.3 Servo motor specifications 6" Electrical specifications of the brake motor";
(3) When the brake output is turned ON to the input command, please wait for **[F01.07]** or longer;
(4) When the servo motor is turned off and the servo is turned OFF, **[F01.09]** and **[F01.08]** can be used to set the delay of the brake output OFF after the servo enable is turned OFF, and then delay after the brake output is turned OFF. When **[F01.08]**, the motor enters the non-energized state.

Code	Item	Setting range	Unit	Function	Setting mode	Effective mode	Factory default
F01.09	Rotating state, the speed threshold when the brake output is OFF	0～3000	rpm	Set the motor speed threshold when the brake output (BK) is turned OFF when the motor is in the rotation state; F01.09 has no effect when the brake output (BK) is not assigned.	Run setting	Effective immediately	30

4.6 Wiring of communication signals X3, X4, and X7

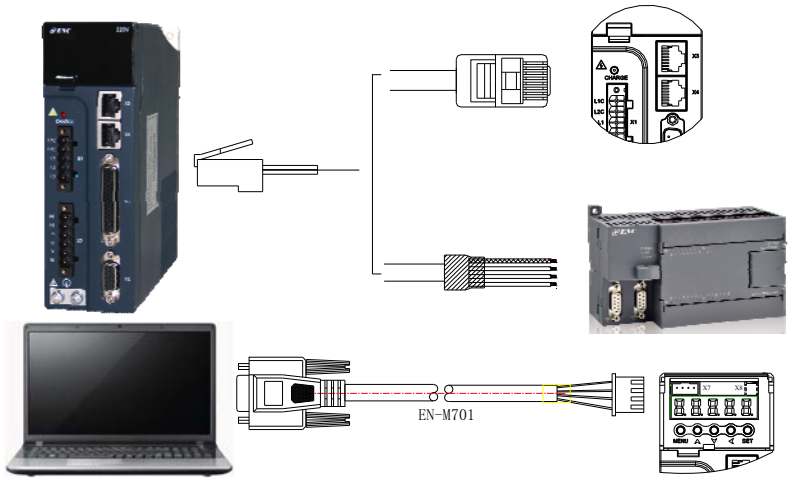


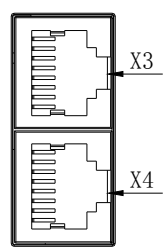
Fig.4-19 Communication wiring diagram

Communication signal connectors (X3, X4) are two universal communication signal terminal connectors connected in parallel. Do not connect wires to the reserved terminals. X7 is used to connect to the 232 communication terminal of PC.

4.6.1 Communication signal connectors

The X3/X4 terminals of the servo drive are used for communication connection between the servo drive and PC, PLC, and other servo drives. The terminal pin of X3/X4 is defined as follows:

Table 4-17Pins definition of communication signal connectors

Pin No.	Pin	Description	Terminal pin layout
1	AGND	-	
2	GND	-	
3	Reserved	-	
4	RS485+	RS485 communication port	
5	RS485-		
6	Reserved	-	
7	CANL	CAN communication port	
8	CANH		
Case	PE	Shield	

4.6.2 CAN Communication Connection

(1) CAN Communication Connection with PLC

The connection cableEN-M402 between the servo drive and PLC under CAN communication as following shows:

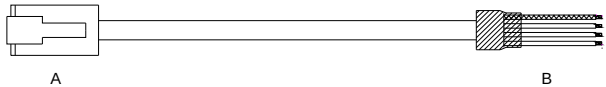


Fig.4-20 Appearance of communication cable between servo drive and PLC

Table 4-18 Pin definition of communication cable between servo drive and PLC

RJ45 on Servo Drive side (A)			PLC side (B)		
Communication type	**Signal**	**Pin No.**	**Communication type**	**Signal**	**Pin No.**
CAN	CANH	8	CAN	CANH	Depends on PLC module
	CANL	7		CANL	
	AGND	1		CGND	
-	PE (Shield)	Case	-	PE (Shield)	Case

(2) CAN Communication Connection for Multi-drive in parallel connection

The connection cable for multiple servo drives connected in parallel under CAN communication as following shows:

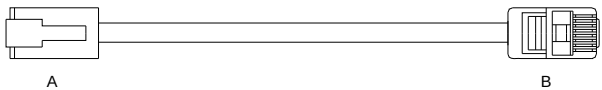


Fig.4-21 Appearance of communication cable for parallel connection of multiple servo drives

Table 4-19 Pin connection relation of communication cable for parallel connection

RJ45 on Servo Drive side (A)			RJ45 on Servo Drive side (B)		
Communication type	**Signal**	**Pin No.**	**Communication type**	**Signal**	**Pin No.**
CAN	CANH	8	CAN	CANH	8
	CANL	7		CANL	7
	AGND	1		AGND	1
-	PE（Shield）	Case	-	PE（Shield）	Case

(3) Precautions for Grounding wiring of CAN Communication

When adopt CAN Communication, please note the connection between the GND of host device and the GND of servo drive as shown in the following figure:

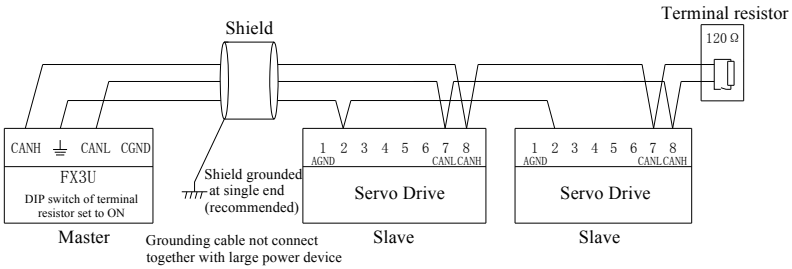


Fig.4-22 Correct CAN communication connection

Note

(1) PLC built-in terminal resistor for CAN communication, please set the related DIP switch on;
(2) The shield be grounded at single end is recommended;
(3) Do not connect the CGND of host device to the AGND of the servo drive.

4.6.3 RS485 Communication Connection

(1) Communication connection with PLC RS485

When adopt RS485 communication, the connection cableEN-M403 between the servo drive and PLC as following shows:

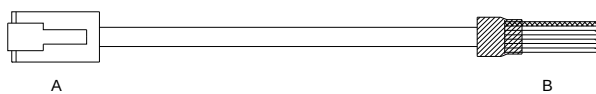


Fig.4-23 Appearance of communication cable between servo drive and PLC

Table 4-20 Pin connection relations of communication cable between servo drive and PLC

RJ45 on Servo Drive side (A)			PLC side (B)		
Communication type	**Signal**	**Pin No.**	**Communication type**	**Signal**	**Pin No.**
RS485	RS485+	4	RS485	RS485+	Depends on PLC module
	RS485-	5		RS485-	
	GND	2		GND	
-	PE (Shield)	Case	-	PE (Shield)	Case

(2) RS485 Communication Connection for Multi-drive in parallel connection

The connection cable for multiple servo drives connected in parallel under RS485 communication as following shows:

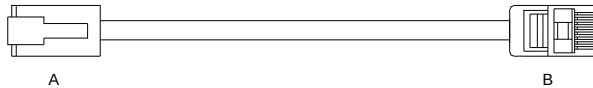


Fig.4-24 Appearance of communication cable for parallel connection of multiple servo drives

Table 4-21 Pin connection relation of communication cable for parallel connection

RJ45 on Servo Drive side (A)			RJ45 on Servo Drive side (B)		
Communication type	**Pin No.**	**Communication type**	**Communication type**	**Signal**	**Pin No.**
RS485	RS485+	4	RS485	RS485+	4
	RS485-	5		RS485-	5
	GND	2		GND	2
-	PE (Shield)	Case	-	PE (Shield)	Case

(3) Precautions for Grounding wiring of RS485 Communication

When adopt RS485 Communication, please note the connection between the GND of host device and the GND of servo drive as shown in the following figure:

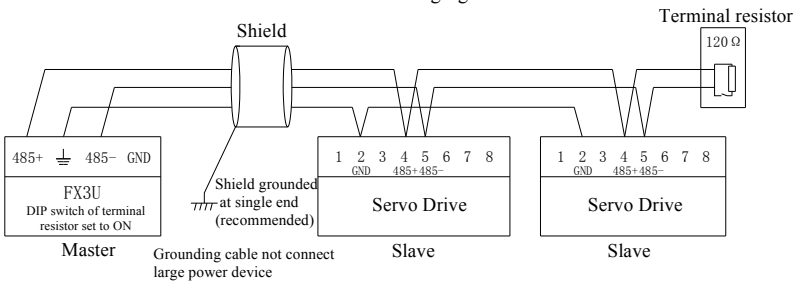


Fig.4-25Correct RS485 communication connection

Note

(1) PLC built-in terminal resistor for 485 communication, please set the related DIP switch on;

(2) The shield be grounded at single end is recommended;

(3) Do not connect the GND of host device to the GND of the servo drive, otherwise it will damage the device and lead to the communication abnormal.

4.6.4 Communication Connection with PC (RS232)

Users can connect the servo drive and PC through PC communication cable. The common communication port RS232 is recommended. As following shows:

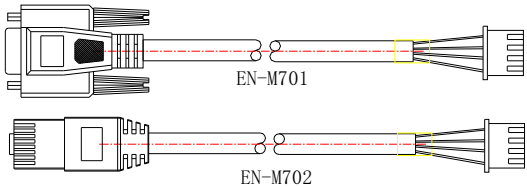


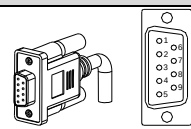
Fig.4-26 PC communication cable appearance

Table 4-22 Pin connection relation between PC communication cable and the servo drive

Servo Drive side (A)		PC side (B)	
Signal	**Pin No.**	**Signal**	**Pin No.**
RS232-TXD	3	PC-RXD	2
RS232-RXD	4	PC-TXD	3
GND	2	GND	5
PE (Shield)	Case	PE (Shield)	Case

The definition of DB9 terminal on PC side as show in following table:

Table 4-23 Pin definition of DB9 terminal on PC side (B side in above table)

Pin No.	Name	Description	Pin layout
2	PC-RXD	PC receiving end	
3	PC-TXD	PC sending end	
5	GND	Grounding	
Case	PE	Shield	

If host device not equipped with serial port and just only USB port available, you can use a serial-to-USB cable to converse it.

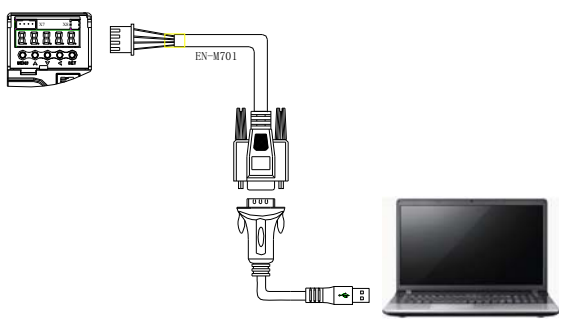


Fig.4-27 Communication Serial-to-USB conversion diagram

4.7 Wiring of Analog Monitoring Signal (X5)

The terminal layout of analog monitoring signal terminal connector (X5):

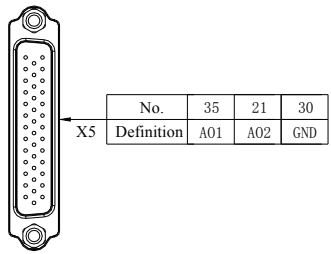


Fig.4-28 Analog monitoring signal terminal connector

Corresponding interface circuit:

(1) Analog output:-10V～+10V

(2) Max. Output:1mA

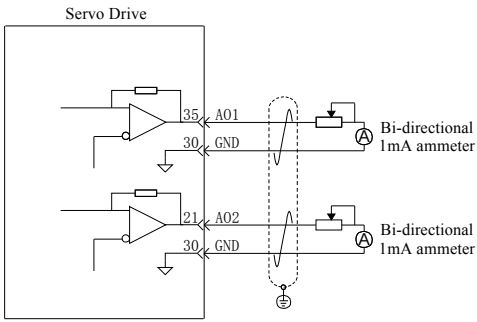


Table 4-24 Monitored objects of analog signal

Pin No.	Monitored objects
AO1	00:Motor speed,01:Motor reference,02:Torque reference,03:Position deviation(Command unit), 04:Position deviation(Encoder unit),05:Position deviation,06:Positioningcompleted reference, 07:Speed feed-forward, 08:AI1 voltage,09:AI2 voltage,10:Output current 1,11:Output current 2, 12:Output voltage,13:DC Bus voltage,14:Communication reference,15:Feedback torque.
AO2	

Note

After the control power turned OFF, the analog monitoring output terminal may output around 5 V voltage and lasts for Max. 50ms.It will output 10V and lasts around 250ms when turn on the servo drive. Please take full consideration when using.

4.8 Anti-interference Measures for Electrical Wiring

Take following measures to suppress interference:

(1)The length of reference input cable less than 3 m, and the length of encoder cable less than10 m.

(2)Use thick wires as much as possible for grounding wiring（above 2.0mm²）

① D class (or higher class) grounding is recommended (grounding resistance isbelow 100 Ω).

② Use single point grounding for servo drive system.

(3)Use noise filter to prevent radio frequency interference. Please install noise filters at the input side of the power supply in civil environment or environment with strong interference noise.

(4)To prevent malfunction due to electromagnetic interference the following treatment methods can be adopted:

① Install surge suppressors on the coils of relay, solenoid and electromagnetic contactor.

②When wiring, please separate the strong power line from the weak power line and keep the interval above 30cm. Do not put them in the same pipe or bundle them together.

③Do not share power supply with welding machine or EDM equipment, etc. Please install noise filter on the input side of the power supply line when there is a high frequency generator nearby.

4.8.1 EMI Inhibition switch

When using servo drive, if the field environment interferes is serious, please turn on EMI switch SW1;(:Earth grounding, :Suspending)

Turn the switch and the black square indicates the position of switch. It's recommended to place the EMI switch on the grounding position only if the interference in the field environment is relatively high and the ⏚ terminal must be connected to the Earth reliably.

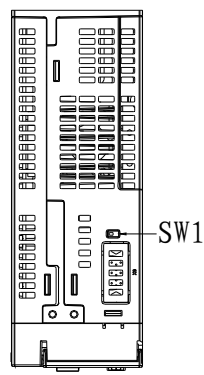


Fig.4-29 Servo drive anti-inference diagram

4.8.2 Anti-interference wiring example and grounding treatment

The main circuit of servo drive adopts high-speed switching element. Switching noisefrom these elements may affect normal operation of the servo drive due to improperwiring or grounding. Thus, the servo drive must be properly wired and grounded. Please add noisefilter if necessary.

(1) Example of Anti-interference wiring

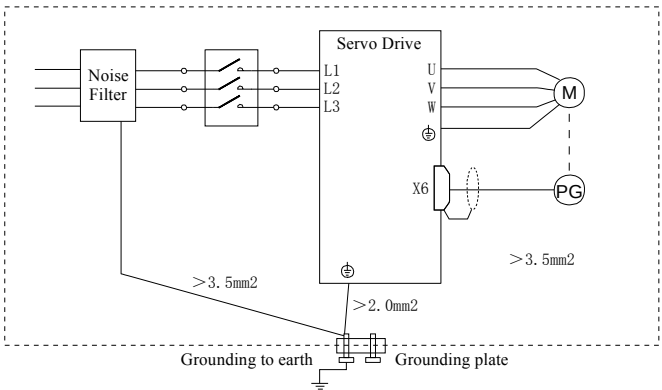


Fig.4-30 Anti-inference wiring diagram

Note

(1) Please use 3.5mm² or above cable for grounding the cabinet case (Braided wires recommended).
(2) Please observe the precautious in“4.8.3 Using methods of noise filter” when using noise filter.

(2) Grounding treatments

To avoid electromagnetic interference problems, please follow the following method for grounding:

① Grounding the servo motor case: Please connect grounding terminal of the servo motor to the PE terminal of the servo drive together and grounding the PE terminal reliably to reduce potential EMI problems.

② Grounding the shield of the encoder cable: Grounding both side of the shield of the motor encoder cable.

4.8.3 Using methods of noise filter

To prevent interference from power cables and reduce impact of the servo drive to othersensitive devices, please install noise filter on the input side of the power supply according tothe input current. In addition, please install noise filter on the power supply line of peripheraldevices if necessary. When installing and wiring the noise filter, please observe the following precautions to avoid weakening the actual effect of the filter.

(1) Please separate the noise filter input and output wiring, do not put them in the same pipe or bundle them together.

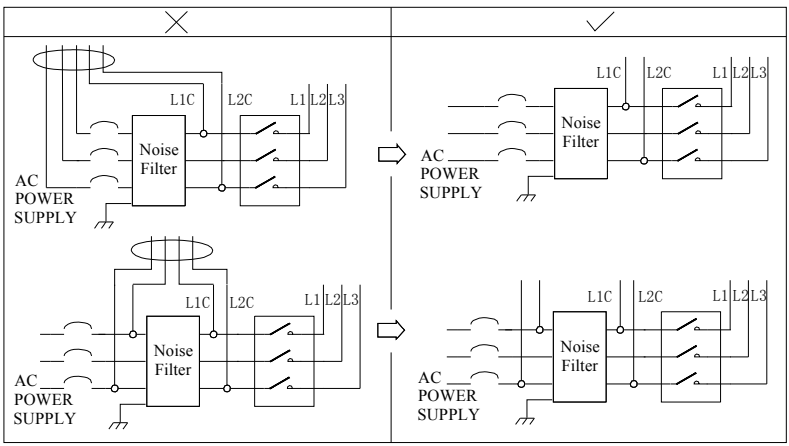


Fig.4-31 Separate wiring of noise filter input and output diagram

(2) Separate the grounding wire of noise filter from its output power supply wires.

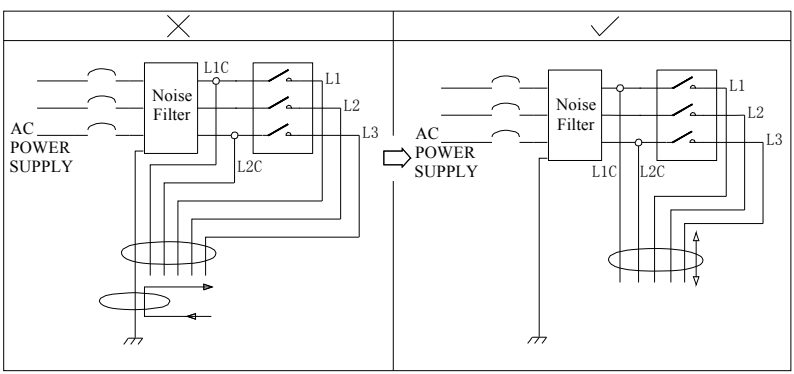


Fig.4-32 Noise filter grounding wires and output power supply wires separated diagram

(3) Use separate grounding cable as short and thick as possible for the noise filter. Do not use same grounding cable with other devices.

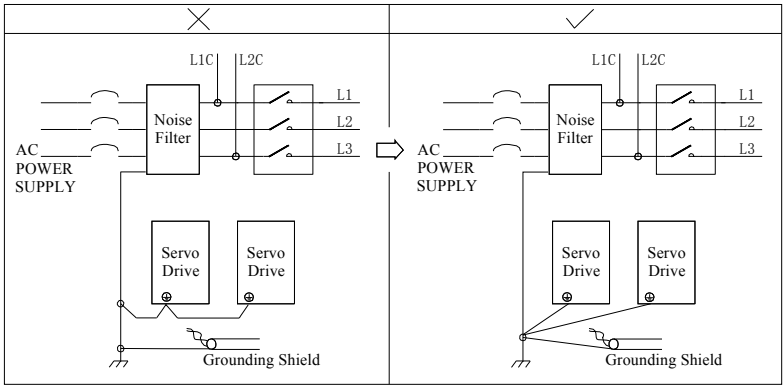


Fig.4-33 Single point grounding diagram

(4) Grounding the noise filter that inside the cabinet.

When the noise filter and the servo driver are installed in a control cabinet, it is recommended to fix the filter and the servo driver on the same metal plate. Ensure the contact part is in good conductive condition, and ground the metal plate properly.

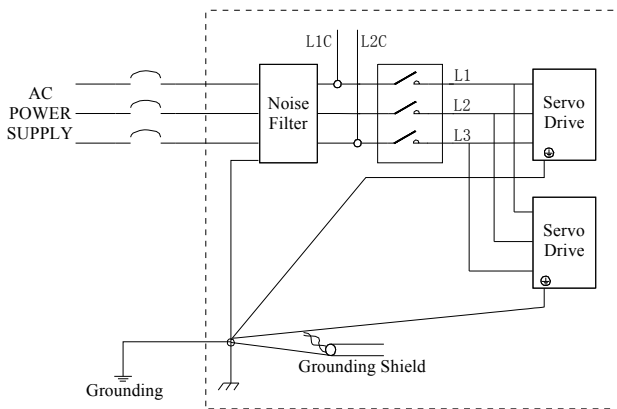


Fig.4-34 Noise filter grounding diagram

4.9 Precautions of Using Cables

(1) Do not bend or apply stress to cables. Please note that the core wire of signal cable just 0.2 or 0.3mm in diameter which is easy to break.

(2) Please use flexible cables for the applications that need move cables. Ordinary cables are easily damaged after being bent for a long time. Cables configured together with low power servo motors cannot be moved.

(3) When using cable protection chain, please observe the followings:

①The bending radius of the cable must be at least 10 times of its outer the diameter;

②Do not fix or bundle the cables inside cable protection chain. They just can be bundled and fixed at two unmovable ends of cable protection chain;

③Cables should not be wound or warped;

④The space efficient in the cable protection chain must be about 60%;

⑤Do not mix cables with large difference in size to avoid thick cables crushes thin cables. If thick and thin cables really need to be used together, place spacer plate between them.

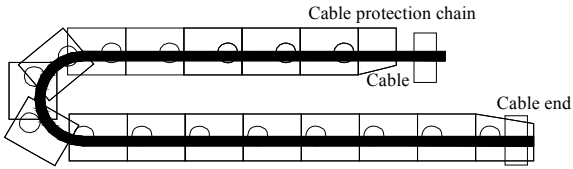


Fig.4-35 Cable protection chain diagram

5 Running mode and adjust method

According to the command mode and operation characteristics of the servo drive, it can be divided into three operation modes, namely, the position control operation mode, the speed control operation mode, and the torque control operation mode.

Position control operation mode Generally, the displacement of the movement is determined by the number of pulses, and the pulse frequency of the external input determines the magnitude of the rotation speed. Since the position mode can be strictly controlled for speed and position, it is generally applied to a positioning device. It is the most control mode for servo applications, mainly used for robots, placement machines, engraving and milling, CNC machine tools, etc.

Speed control operation mode It is controlled by analog input or digital reference, communication given control rotation speed, mainly used in some constant speed applications. For analog engraving and milling machine applications, the host computer uses position control and the servo drive uses speed control mode.

Torque control operation mode The set torque is changed by changing the analog setting in real time or changing the corresponding address value by communication. It is mainly used in winding and unwinding devices where the stress of materials is strictly required. For example, some tension control devices such as winding devices or fiber-optic devices, the torque setting should be changed at any time according to the change of the winding radius to ensure the force on the material does not change as the winding radius changes.

5.1 Position control operation mode instruction

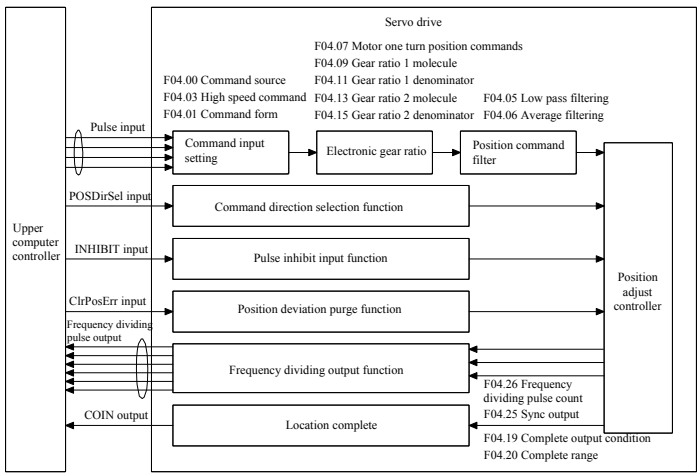


Fig.5-1 Position control operation mode diagram

The position control operation mode is a common working mode of the servo drive. The main steps are as follows:：

（1）Connect the power supply of the servo main circuit and control circuit correctly, as well as the motor power line and encoder line. The servo panel displays “xxxx0” after power-on, indicating that the servo power supply is correctly wired and the motor encoder is wired correctly.

（2）Perform servo JOG test run by pressing the button to confirm whether the motor can run normally.。

（3）Refer to Figure 5-2 for wiring instructions to connect the pulse direction input and pulse command input in the X5 terminal and the necessary DI/DO signals, such as servo enable, positioning completion signal, etc.。

（4）Make settings related to the position mode. Set the DI/DO used according to the actual situation. Refer to [F02/F03 Group] for the function code. In addition, if necessary, you need to set the functions such as return-to-origin and crossover output. For details, please refer to the detailed product manual.

（5）The servo is enabled, and the position command is issued by the upper computer to control the rotation of the servo motor. First, let the motor rotate at a low speed, and confirm whether the rotation direction and the electronic gear ratio are normal, and then adjust the gain. Please refer to the figure “5-18 General Debug Flow Chart”.

5.1.1 Position control operation mode wiring

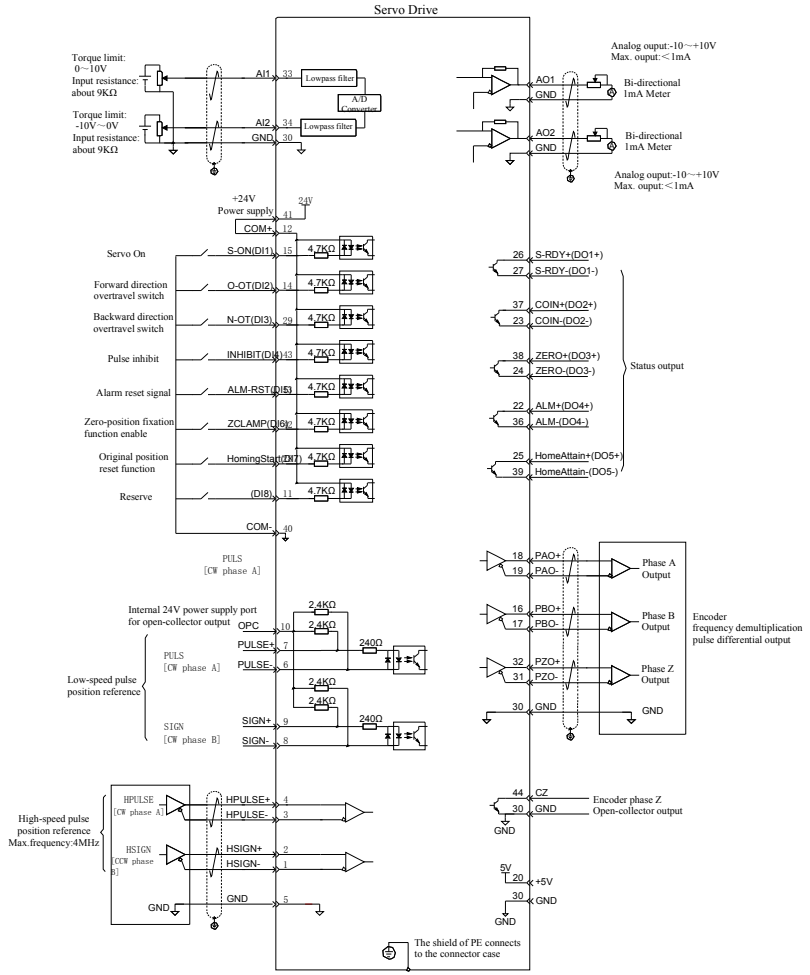


Fig 5-2 Position mode wiring diagram

Note

(1) "∫" means twisted-pair.

(2) Signal cables and power cables must be routed separately, at least 30cm apart..

(3) When the signal cable needs to be refilled due to insufficient length, the shielding layer must be reliably connected to ensure reliable shielding and grounding.

(4) +5V is referenced to GND, and +24V is referenced to COM-. Do not exceed the maximum allowable current, otherwise the driver will not work properly.

5.1.2 Position control operation mode relate function code setting

Parameter setting in position control mode, including mode selection, command pulse form, electronic gear ratio, DI/DO, etc.

（1）Position command input setting

① Position command source

Set the function code [F04.00]=0, the position command is derived from the pulse command, and other values can be set according to the actual situation.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.00	Position command source	0：pulse command 1：step amplitude 2：Multi-position command	-	0	Effective immediately	Stop setting	P

② Pulse command source

Set function code **[F04.03]**, specified pulse command source from low speed pulse or high speed pulse

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.03	Pulse command input terminal selection	0：Low speed 1：high speed	-	0	Power again	Stop setting	P

③ Position command direction switch

By setting DI function FunIN.27，Set the function code [F04.00]=0, the position command is derived from the pulse command, and other values can be set according to the actual situation.

Code	Name	Function name	Description	Mark
FunIN.27	POSDirSel	Position command direction setting	Invalid：forward Valid：Negative	The logic selection of the corresponding terminal is recommended to be set to: Level active.

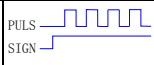
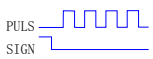
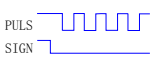
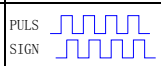
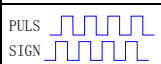
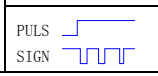
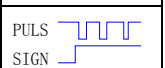
④ Pulse command Configuration choice.

Set the function code [F04.01], select the form of external pulse command, including "pulse +direction (positive and negative logic)", "orthogonal pulse", "CW + CCW".

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.01	Pulse command form	0：Pulse+ direction 1：A phase+ B phase quadrature pulse, 4 times frequency：CW+CCW	-	0	Power again	Stop setting	P

The principle of three pulse command form is like below table.

Table 5-1 Pulse command form principle

Pulse command form	Positive logic		Negative logic	
	Forward	Reverse	Forward	Reverse
Direction+ pulse				
Orthogonal pulse（A phase+ B phase）				
CW+CCW				
				

⑤ Pulse inhibiting input

By set DI function FunIN.13，to inhibit pulse command input。

Code	Name	Function name	Description	Mark
FunIN.13	INHIBIT	Position command inhibit	Valid: disable command pulse input; Invalid: Allows command pulse input.	It turned out to be a pulse inhibit function. Now upgraded to position command prohibition, with internal and external position commands. The logic selection of the corresponding terminal must be set to: Level active.

(2) Electric gear ratio setting

Set the electronic gear ratio according to the actual situation of the machine and the host computer。

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.09	Electronic gear ratio 1（molecule）	1～1073741824	1	1048576	Effective immediately	Run setting	P
F04.11	Electronic gear ratio 1（denominator）	1～1073741824	1	10000	Effective immediately	Run setting	P
F04.13	Electronic gear ratio 2（molecule）	1～1073741824	1	1048576	Effective immediately	Run setting	P
F04.15	Electronic gear ratio 2（denominator）	1～1073741824	1	10000	Effective immediately	Run setting	P

The principle of the electronic gear ratio is shown in the figure below.：

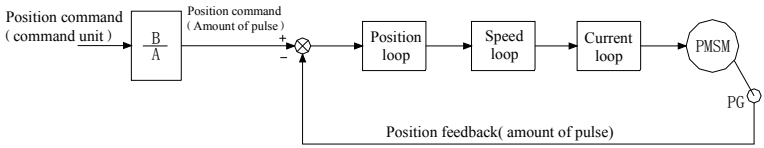


Fig. 5-3 Electronic gear ratio function principle diagram

When [F04.07] = 0, the motor and the load are connected through the reduction gear, assuming that the reduction ratio of the motor shaft to the load machine side is n/m (the motor shaft rotates m turns, the load shaft rotates n turns), and the electronic gear ratio Calculated as follows：

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{F04.09}{F04.11} = \frac{\text{Encoder resolution}}{\text{The amount of displacement of the load shaft for one revolution (command unit)}} \times \frac{m}{n}$$

The drive supports up to 2 sets of electronic gear ratios, which can be selected using the gear ratio switching function (FunIN.24).

When [F04.07]≠0:

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Encoder resolution}}{F04.07}$$

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.07	Number of position commands per motor revolution	0～8388608	P/r	0	Power again	Stop setting	P

At this time, the gear ratio is independent of [F04.09], [F04.11], [F04.13], [F04.15], and the gear ratio switching function is invalid.

（3）Position command filter setting

The position command smoothing function is to filter the input position command to make the rotation of the servo motor smoother. This function is effective in the following situations:

1 The upper device output pulse command has not undergone acceleration/deceleration processing, and the acceleration/deceleration rate is large;

2 The command pulse frequency is too low;

3 The electronic gear ratio is more than 10 times.

Note：This function has no effect on the amount of displacement (the total number of position commands).

The settings related to the position command smoothing function are as follows.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.05	First-order low-pass filtering time constant	0.0～1000.0	ms	0	Effective immediately	Stop setting	P

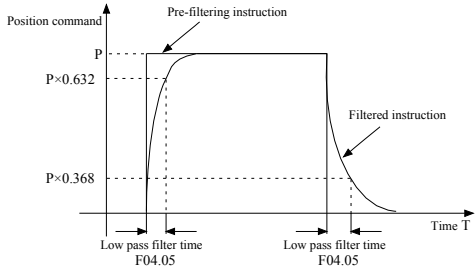


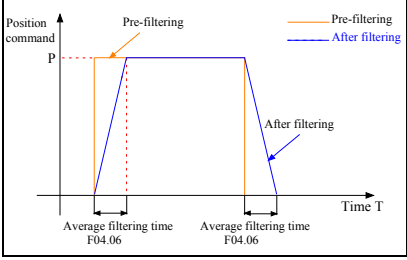
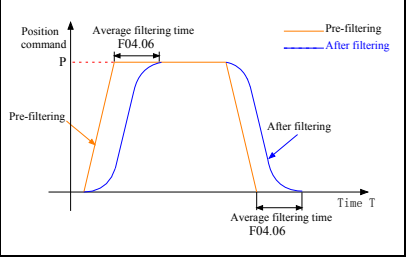
Fig.5-4 First-order filtering example diagram

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.06	Average filter time constant	0.0～128.0	ms	0	Effective immediately	Stop setting	P

Note

When [F04.06]=0，The average filter is invalid.

Table 5-2 Comparison of the filtering effect of the averaging filter on two different position commands

Rectangular position command	Trapezoidal position command
	

（4）Position deviation clear function

By setting the DI function FunIN.34, you can use DI to control whether the position deviation is cleared.。

Code	Name	Function name	Description	Mark
FunIN.34	ClrPosErr	Position deviation clear	Valid: the position deviation is cleared; Invalid: The position deviation is not cleared.	The logical choice of the corresponding terminal, The recommended setting is: Edge is valid. This DI function is recommended to be configured on the DI8 or DI9 terminals.

（5）Crossover output function

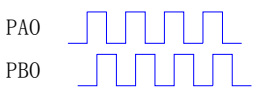
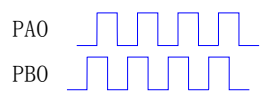
The servo pulse output source is selected by [F04.25], and the pulse command synchronous output function is generally used for synchronous control applications.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.25	Servo pulse output source selection	0: encoder crossover output 1: Pulse command synchronous output 2: Frequency division and synchronous output are prohibited	-	0	Power on again	Stop setting	P

By setting [F04.26], the servo driver divides the number of pulses fed back by the encoder according to the set value and outputs it through the crossover output port. The set value of [F04.26] corresponds to the number of pulses output per revolution of PAO/PBO (4 times before multiplier).

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.26	Encoder frequency division pulse number	35～40000	P/r	500	Power on again	Stop setting	-

Table 5-3 Output phase form

Forward (A ahead B)	Reverse (B ahead A)
	

Note

Output pulse feedback phase shape can be adjusted by [F04.28].

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F04.28	Output pulse phase	0: The CCW direction is the forward direction(A ahead B) 1: Take the CW direction as the forward direction (reverse mode, A lag B)	-	0	Power on again	Stop setting	PST

5.2 Speed control operation mode instructions

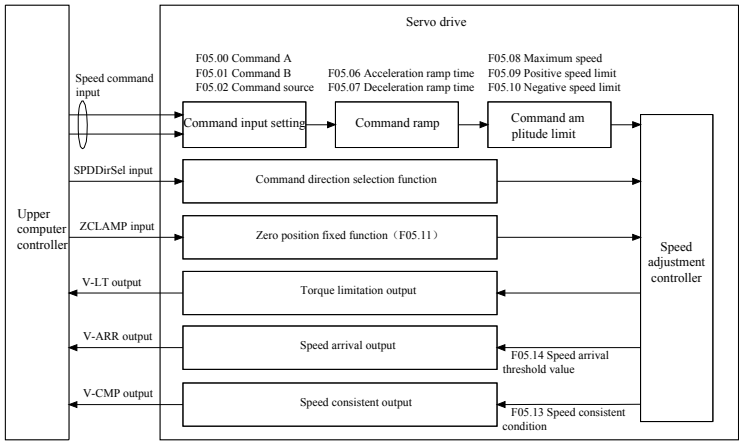


Fig.5-5 Speed control operation mode diagram

The main steps of the speed control operation mode are as follows:

(1) Connect the power supply of the servo main circuit and control circuit correctly, as well as the motor power line and encoder line. After power-on, the servo panel displays “xxxx0”, indicating that the servo power supply is correctly wired and the motor encoder is wired correctly.

(2) Perform servo JOG test run by pressing the button to confirm whether the motor can run normally.

(3) Refer to Figure 5-6 for wiring instructions to connect the necessary DI/DO signals and analog speed commands in the X5 terminal.

(4) Make settings related to the speed mode.

(5) To enable the servo, first make the motor rotate at a low speed, determine whether the motor's rotation direction is normal, and then adjust the gain. Please refer to “Figure 5-18 General Debug Flow Chart”.

5.2.1 Speed control operation mode wiring

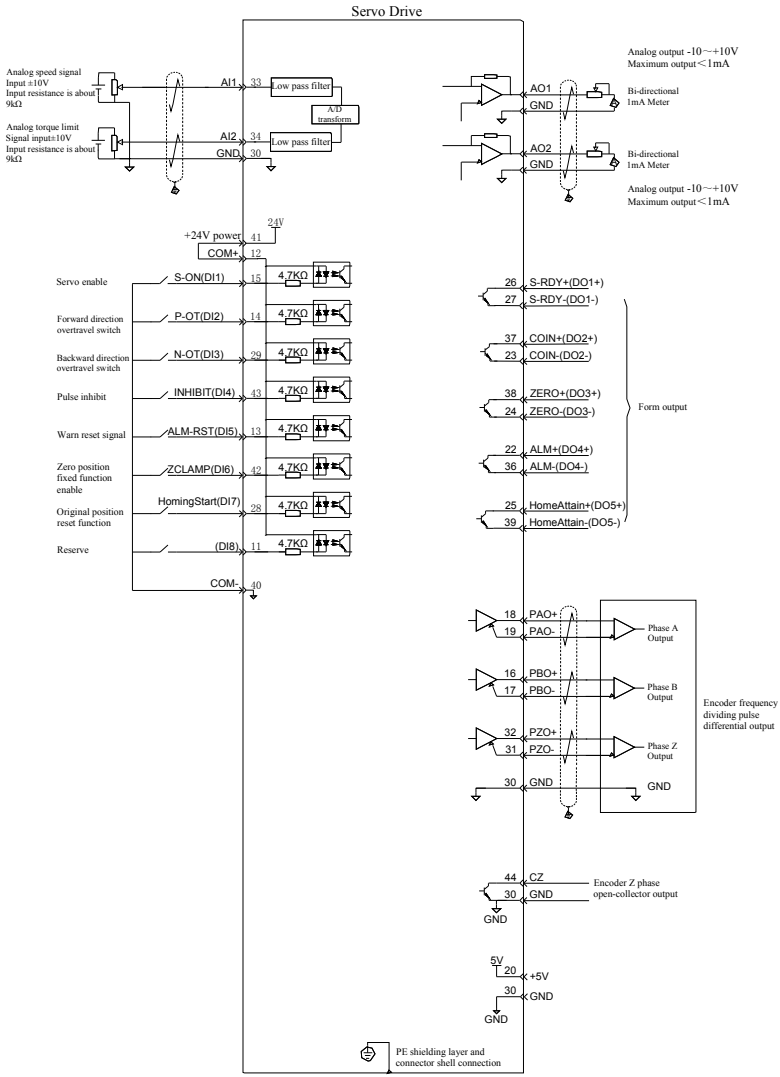


Fig. 5-6 Speed mode wiring diagram

Note

(1) " ∫ " indicates a twisted pair.
(2) The signal cable and the power cable must be separated and routed at least 30cm apart.
(3) When the signal cable is not enough length to continue the cable, the shield must be reliably connected to ensure reliable shielding and grounding.
(4) +5V is referenced to GND, +24V is referenced to COM-. Do not exceed the maximum allowable current, otherwise the driver will not work properly.

5.2.2 Speed control operation mode related function code setting

（1）Speed command input setting

① Speed command source

In speed control mode, there are two sets of speed commands: source A and source B.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F05.00	Main speed command A source	0：digit preset（F05.04） 1：AI1 2：AI2 3：Communication preset	-	0	Effective immediately	Stop setting	S
F05.01	Auxiliary speed command B source	0：digit preset（F05.04） 1：AI1 2：AI2 3：Multi-speed command 4：Communication preset	-	1	Effective immediately	Stop setting	S
F05.04	Speed command keyboard setting value	-6000～6000	rpm	200	Effective immediately	Run setting	S
F05.05	Jog speed setting value	0～6000	rpm	100	Effective immediately	Run setting	S

In：

a) Digital setting, is keyboard setting, means that the set speed value is stored by function code [F05.04] and used as the speed command.

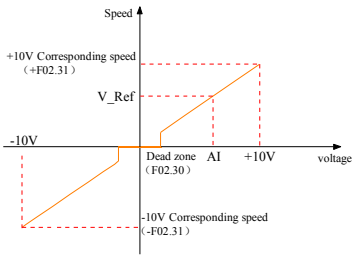
b) Analog speed command source refers to the conversion of an externally input analog voltage signal into a command signal that controls the speed of the motor. Take AI2 as an example to explain the analog setting speed command method.

Table 5-4 Analog setting speed command operation example

Process	Content	Mark
1	Set the command source to be the source of AI2 in the speed command A.F05.00=2，F05.02=0	Set the speed command source under speed control.
2	Adjust AI2 related parameters: (1) Offset setting (set by F02.29) (2) Dead zone setting (set by F02.30)	The AI2 samples are adjusted by offset and deadband settings.
3	F02.31 sets the corresponding speed command	Specify the forward maximum speed value

	value of 10V	corresponding to +10V Specify the negative maximum speed value corresponding to -10V

When there is interference in the AI2 input signal, the AI2 low-pass filter parameter [F02.28] can be set to perform filtering processing.



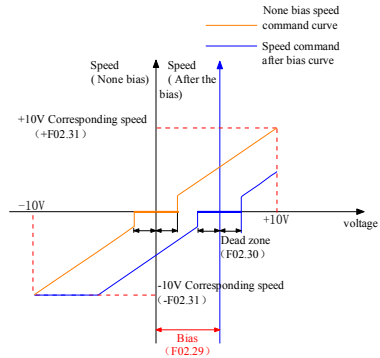


Fig. 5-7 Unbiased AI2 schematic **Fig. 5-8 Schematic diagram of AI2 after offset**

The given speed command value can be viewed with [F10.01].

a) Multi-speed command means that the user selects 16 sets of speed commands and related control parameters stored in the internal register by external DI or internally specified mode.

b) Jog speed command means that the user sets the jog running function (FunIN.18, FunIN.19) by configuring two external DI or PC control software, and uses the speed value stored by function code [F05.05] as the point. Dynamic running speed, DI state selects the speed command direction.

② Speed command direction switching

By setting the function code FunIN.26, you can use DI to control the direction switching of the speed command to meet the need to switch direction.

Code	Name	Function name	Description	Mark
FunIN.26	SPDDirSel	Speed command direction setting	Invalid: positive direction; Effective: the opposite direction.	The logical choice of the corresponding terminal, Recommended setting is: level effective

③ Speed command selection

The speed control mode has the following five speed command acquisition modes, which are set by function code [F05.02].

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F05.02	Speed command selection	0: Primary speed command A source 1: Auxiliary speed command B source 2: A+B	-	0	Effect immediately	Stop setting	S

		3: A-B 4: A/B switching					

When the speed command selects "A/B switching", that is, the function code [F05.02]=4, a separate function definition is required for the DI terminal. It is determined by this input terminal that the current A command input is valid or the B command input is valid.

Code	Name	Function name	Description	Mark
FunIN.4	CMD-SEL	Main and auxiliary operation command switching	Invalid: the current running command is A; Valid: The current running command is B.	The logical choice of the corresponding terminal, Recommended setting is: level effective

（2）Instruction ramp function setting

The ramp function control function is to convert the variable speed command into a smoother constant acceleration/deceleration speed command, that is, to set the acceleration/deceleration time to achieve the purpose of controlling acceleration and deceleration. In the speed control mode, if the given speed command changes too much, the motor will jump or vibrate. If the acceleration and deceleration time of the soft start is increased, the smooth start of the motor can be realized to avoid the above situation. Mechanical parts are damaged.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F05.06	Speed command acceleration ramp time constant	0～65535	ms	0	Effect immediately	Operation setting	S
F05.07	Speed command deceleration ramp time constant	0～65535	ms	0	Effect immediately	Operation setting	S

The ramp function control converts the step speed command into a smoother constant acceleration/deceleration speed command for smooth speed control (including internal set speed control).

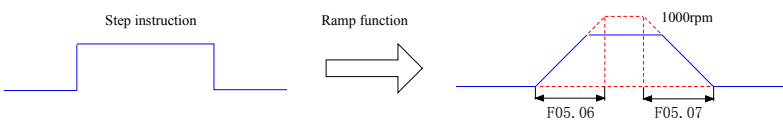


Fig.5-9 Ramp function definition diagram

[F05.06]: Time required to accelerate the speed command from zero speed to 1000 rpm.
[F05.07]: Time required for the speed command to decelerate from 1000 rpm to zero speed.
The actual acceleration and deceleration time is calculated as follows:
Actual acceleration time = (speed command / 1000) × speed command acceleration ramp time
Actual deceleration time = (speed command / 1000) × speed command deceleration ramp time

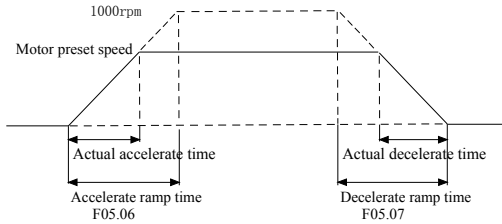


Fig.5-10 Acceleration/deceleration time

(3) Speed command limit setting

In speed control mode, the servo drive can limit the size of the speed command. Speed command limits include:

① [F05.08] Set the amplitude limit of the speed command. The speed commands in the positive and negative directions cannot exceed this value. Otherwise, it will be limited to output at this value.

② [F05.09] Set the forward speed limit. If the positive direction speed command exceeds the set value, it will be limited to output at this value.

③ [F05.10] Set the negative speed limit. If the negative direction speed command exceeds the set value, it will be limited to output at this value.

④ The maximum motor speed is the default limit. When matching different motors, this parameter will change with the motor parameters.

The function codes [F05.08], [F05.09] and [F05.10] are limited to the minimum limit point when the speed is limited, as shown in Figure 5-11, due to the [F05.10] setting. Greater than [F05.08], the actual forward speed limit is [F05.09] and the reverse speed limit is [F05.08].

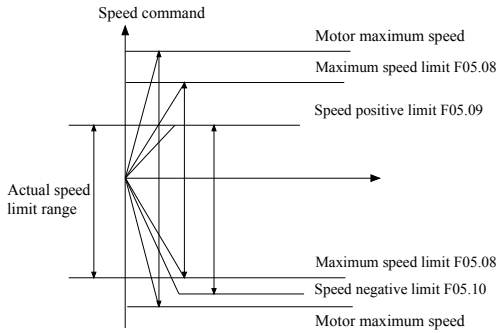


Fig.5-11 Speed command limit diagram

Note：The default maximum limit for the maximum motor speed.

The actual motor speed limit interval is:

|The amplitude of the forward speed command | ≤ min{Motor maximum speed, F05.08, F05.09}

|Amplitude of negative speed command | ≤ min{Motor maximum speed, F05.08, F05.10}

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F05.08	Maximum speed threshold	0～6000	rpm	4500	Effect immediately	Run setting	S
F05.09	Forward speed threshold	0～6000	rpm	4500	Effect immediately	Run setting	S
F05.10	Reverse speed threshold	0～6000	rpm	4500	Effect immediately	Run setting	S

（4）Zero position fixed function

In the speed control mode, if ZCLAMP is valid and the amplitude of the speed command is less than or equal to the speed value set by [F05.11], the servo motor enters the control of the zero fixed state. If the oscillation occurs at this time, the position loop can be adjusted. Gain. When the amplitude of the speed command is greater than the speed value set by [F05.11], the servo motor exits the control of the zero fixed state.

DI function selection:

Code	Name	Function name	Description	Mark
FunIN.12	ZCLAMP	Zero fixed enable	Valid: Enable zero fixed function Invalid: disable zero fixed function	The logical choice of the corresponding terminal, The recommended setting is: Level is valid.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F05.11	Zero fixed speed threshold	0rpm～6000rpm	rpm	10	Effective immediately	Run setting	S

5.3 Torque control operation mode instructions

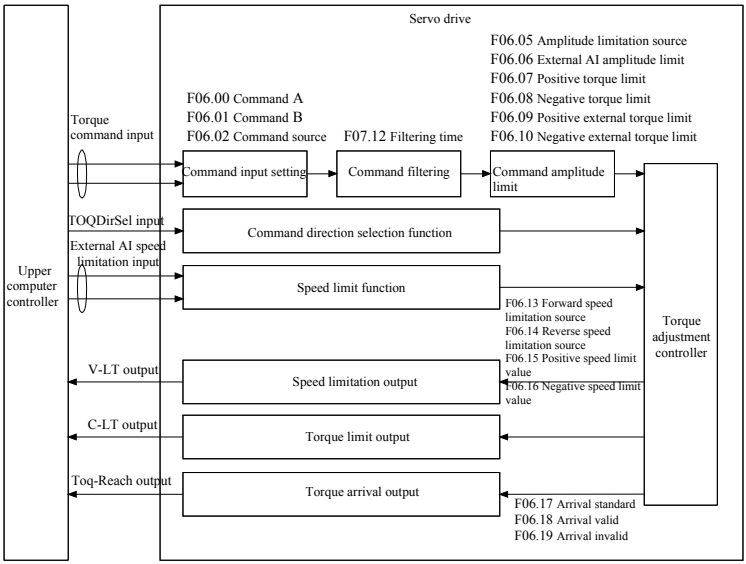


Fig.5-12 Torque control mode diagram

The main steps of the torque control operation mode are as follows:

(1) Connect the power supply of the servo main circuit and control circuit correctly, as well as the motor power line and encoder line. After power-on, the servo panel displays “xxxx0”, indicating that the servo power supply is correctly wired and the motor encoder is wired correctly.

(2) Perform a servo JOG test run by pressing the button to confirm that the motor can operate normally.

(3) Refer to Figure 5-13 for wiring to connect the necessary DI/DO and torque command source and speed limit signals in the X5 terminal.

(4) Make the relevant settings for the torque mode.

(5) Enable the servo, set a lower speed limit value, and apply a forward or reverse torque command to the servo to confirm whether the motor rotates in the correct direction and whether the speed is correctly limited. If it is normal, it can be used.

5.3.1 Torque control operation mode wiring

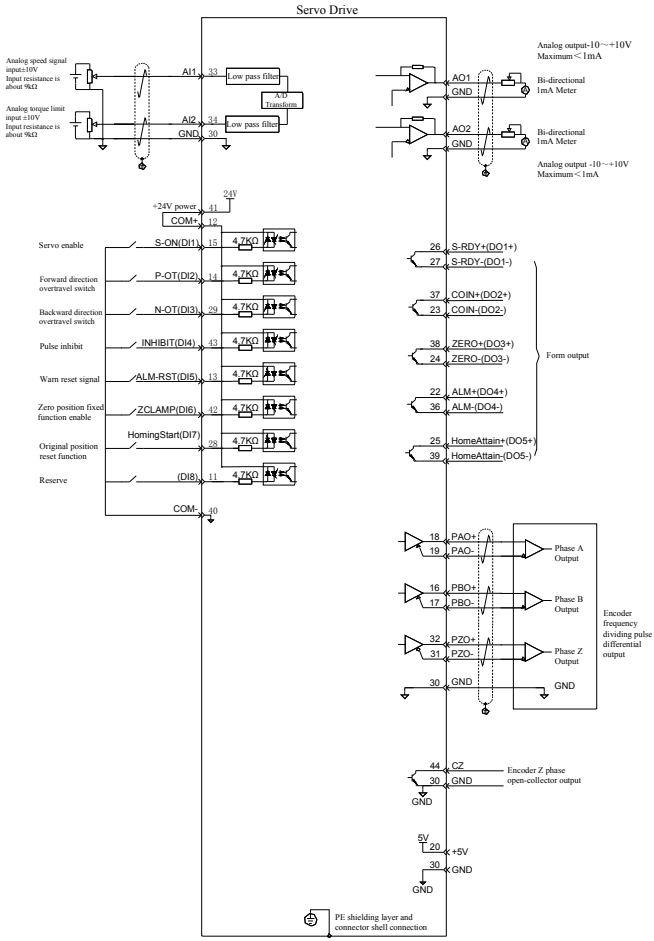


Fig. 5-13 torque mode wiring diagram

Note

(1) “ ∫ ” indicates a twisted pair.

(2) The signal cable and the power cable must be separated and routed at least 30cm apart.

(3) When the signal cable is not enough length to continue the cable, the shield must be reliably connected to ensure reliable shielding and grounding.

(4) +5V is referenced to GND, +24V is referenced to COM-. Do not exceed the maximum allowable current, otherwise the driver will not work properly.

5.3.2 Torque control operation mode related function code setting

（1）Torque command input setting

a) Torque command source

In torque control mode, there are two sets of torque commands: source A and source B. It can be set in the following two ways:

1. Digital setting, ie keyboard setting. Refers to the torque value stored in function code [F06.04] as a percentage of the rated torque as the torque command.

2. Analog command source refers to the conversion of an externally input analog voltage signal into a torque command signal that controls the motor. At this time, the correspondence between the analog quantity and the torque command can be arbitrarily specified.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F06.00	Main torque command A source	0：digit preset（F06.04） 1：AI1 2：AI2 3：communication preset	-	0	Effective immediately	Stop setting	T
F06.01	Auxiliary Torque Command B Source	0：digit preset（F06.04） 1：AI1 2：AI2 3：communication preset	-	1	Effective immediately	Stop setting	T
F06.04	Torque command keyboard setting	-300.0～300.0	%	0	Effective immediately	Stop setting	T

b）Torque command selection

The torque control mode has the following five torque command acquisition modes, which are set by function code [F06.02].

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F06.02	Torque command selection	0：Main torque command A source 1：Auxiliary Torque Command B Source 2：A+B source 3：A-B 4：A/B switch	-	0	Effective immediately	Stop setting	T

c) Torque command direction switching

By setting the function code FunIN.25, you can use the DI to control the direction of the torque command to meet the need to switch direction.

Code	Name	Function name	Description	Mark
FunIN.25	TOQDirSel	Torque command direction setting	Invalid: positive direction; Effective: the opposite direction.	The logical choice of the corresponding terminal, Recommended setting is: level effective

When the torque command selects "A/B switching", that is, the function code [F06.02] = 4, a separate function definition is required for the DI terminal. This input terminal selects whether the current A command input is valid or the B command input is valid.

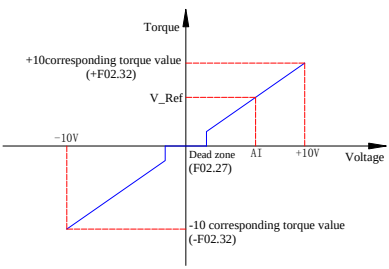
Code	Name	Function name	Description	Mark
FunIN.4	CMD-SEL	Main and auxiliary operation command switching	Invalid: the current running command is A; Valid: The current running command is B.	The logical choice of the corresponding terminal, Recommended setting is: level effective

Take AI1 as an example to illustrate the analog torque command method.

Table 5-5 Example of analog torque command operation

Process	Content	Mark
1	Set the command source to the AI1 source in the assist torque command B. F06.02=1, F06.01=1	Set the torque command source under torque control。
2	Adjust AI1 related parameters: (1) Offset setting (set by F02.26) (2) Dead zone setting (set by F02.27)	The AI1 samples are adjusted by offset and deadband settings.
3	F02.32 sets ±10V corresponding torque value	Specify the maximum forward torque value corresponding to +10V Specify the maximum negative torque value corresponding to -10V

When there is interference in the AI1 input signal, the AI1 low-pass filter parameter [F02.25] can be set to perform filtering processing.



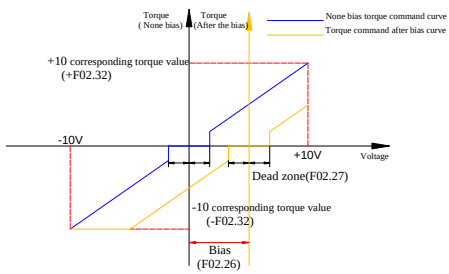


Fig. 5-14 No offset AI1 schematic **Fig.5-15 Schematic diagram of AI1 after offset**

The given torque command (percentage relative to the rated motor torque) can be viewed via [F10.02].

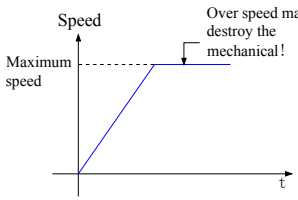
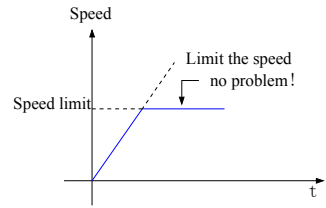
（2）Torque mode speed limit function

In the torque control mode, the speed of the servo motor is limited to protect the machine. During torque control, the servo motor is only controlled by the output torque command and does not control the speed. Therefore, if the set torque command is too large and higher than the load torque on the machine side, the motor will always accelerate and overspeed may occur. At this time, you need to set the motor speed limit value.

When the speed limit is exceeded, the speed difference between the overspeed and the speed limit is converted into a certain proportion of torque, and the speed is returned to the speed limit range

by the negative direction clearing. Therefore, the actual motor speed limit value will fluctuate due to different load conditions. The speed limit value can be given by internal reference or analog sampling. (speed command at the same speed control)

Table 5-6 Speed limit diagram

Speed less limit	Speed limit
	

DO function selection: The output signal of the motor speed after receiving the speed limit is as follows:

Code	Name	Function name	Description	Mark
FunOUT.8	V-LT	Revolving speed limit signal	Confirmation signal for speed limitation during torque control: Effective: motor speed limited Invalid: motor speed is not limited	-

Note： V-LT need to distribute the signal.

Sources of speed limits include sources of internal speed limits and sources of external speed limits. When the internal speed limit source is selected ([F06.13]=0, [F06.14]=0), directly set [F06.15] to limit the forward speed and [F06.16] to limit the negative speed. When [F06.13], [F06.14]=1 or 2, when selecting the external speed limit source, set the analog correspondence according to the need. At this time, the external limit value must be smaller than the internal speed limit value source to prevent external Improper setting of the speed limit source poses a hazard.

The speed limit mode is set by the following function code.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F06.13	Torque control forward speed limit source selection	0：confirmed by F06.15 1：AI1 2：AI2	-	0	Effective immediately	Run seting	T
F06.14	Torque control negative speed limit source selection	0：confirmed by F06.16 1：AI1 2：AI2	-	1	Effective immediately	Run seting	T
F06.15	Torque control forward speed limit	0～6000	rpm	3000	Effective immediately	Run seting	T
F06.15	Torque control	0～6000	rpm	3000	Effective	Run	T

	negative speed limit				immediately	seting	

（3）Torque command limit setting

To protect the mechanical device, the output torque can be limited by setting the function code [F06.05]. The torque limit can be selected in the following four ways:

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F06.05	Torque limit source	0: positive and negative internal torque limit 1: positive and negative external torque limit 2: External T-LMT torque limit 3: Positive and negative external torque limit and torque limit switching of external T-LMT	-	0	Effective immediately	Stop setting	PST

DI function selection: Input the forward/reverse external torque limit selection signal P-CL/N-CL.

Code	Name	Function name	Description	Mark
FunIN.16	P-CL	Positive external torque limit	According to the selection of F06.05, the torque limit source is switched. When F06.05=1: Valid: Forward external torque limit is valid; Invalid: The forward internal torque limit is valid. When F06.05=3 and the AI limit value is greater than the forward limit external limit value: Valid: The forward external torque limit is valid. Invalid: AI torque limit is valid. When F06.05=4: Valid: AI torque limit is valid; Invalid: The forward internal torque limit is valid.	The logical choice of the corresponding terminal, The recommended setting is: Level is valid.
FunIN.17	N-CL	Reverse external torque limit	According to the choice of F06.05, transfer Moment limit source switching. When F06.05=1: Valid: Reverse external torque limit is valid; Invalid: Reverse internal torque limit is valid. F06.05=3 and the AI limit value is less than the inverse When transferring external limit values: Valid: Reverse external torque limit is valid;	The logical choice of the corresponding terminal, Recommended setting is: level effective

			Invalid: AI torque limit is valid. When F06.05=4: Valid: AI torque limit is valid; Invalid: Reverse internal torque limit is valid.	

DO function selection: Output torque limit confirmation signal C-LT.

Code	Name	Function name	Description	Mark
FunOUT.7	C-LT	Torque limit signal	Confirmation signal for torque limit: Invalid: motor torque is limited; Effective: The motor torque is not limited.	–

DI/DO related function codes need to be set for function and logic assignment.

For example, when setting the analog input AI, first specify the T-LMT variable by function code [F06.06], and then set the correspondence between torque and analog voltage.

When [F06.05]=1, the forward and reverse external torque limit is triggered by the external DI reference (P-CL, N-CL), and the values set according to [F06.09] and [F06.10]. Perform torque limit. When the external limit and the T-LMT and its combination limit exceed the internal limit, the internal limit is taken, that is, all the constraints are controlled by the minimum limit value, so that the torque is limited to the maximum torque range of the motor. The T-LMT is symmetrical, with a |T-LMT| value for forward rotation and a -|T-LMT| value for reverse rotation.

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F06.05	Torque limit source	0: positive and negative internal torque limit 1: positive and negative external torque limit 2: External T-LMT torque limit 3: Positive and negative external torque limit and torque limit switching of external T-LMT	-	0	Effective immediately	Stop setting	PST
F06.06	T-LMT selection	1：AI1 2：AI2	-	2	Effective immediately	Stop setting	PST
F06.07	Positive internal torque limit	0.0～300.0 （100% corresponds to double rated torque）	%	300.0	Effective immediately	Run setting	PST
F06.08	Negative internal torque limit	0.0～300.0 （100% corresponds to double rated torque）	%	300.0	Effective immediately	Run setting	PST
F06.09	Positive internal torque limit	0.0～300.0 （100% corresponds to double rated torque）	%	300.0	Effective immediately	Run setting	PST
F06.10	Negative internal torque limit	0.0～300.0 （100% corresponds to double rated torque）	%	300.0	Effective immediately	Run setting	PST

5.4 Absolute value system instructions

5.4.1 Summary

The absolute encoder detects both the position of the motor within one revolution and the number of revolutions of the motor. The single-turn resolution is determined by the number of encoder bits. For example, the 23-bit encoder is 8388608 (223), which can remember 16 bits. Multiple laps of data. The absolute value system composed of absolute encoders currently has an absolute position linear mode, which can be used in position, speed and torque control modes. When the drive is powered off, the encoder backs up the data through the battery. After power-on, the driver passes the encoder absolutely. The position is calculated from the absolute position of the machine, eliminating the need to repeat the mechanical home position return operation.
When the ESS200P series servo driver matches the absolute encoder, set the [F00.21] parameter according to the number of encoders and set [F01.01] according to the actual application (absolute value system selection). AL.401 (encoder battery alarm) will occur when the battery is turned on for the first time. You need to set [F12.02]=1 to reset the encoder fault, and then perform the home position return operation.


Note

When the [F12.02] (absolute encoder reset enable) operation is modified, the absolute position of the encoder will be abrupt, causing the mechanical absolute position reference to change, so the mechanical original position reset operation is required. When the internal original position reset function of the drive is used, the absolute position of the machine and the absolute position deviation of the encoder are automatically calculated inside the home of the return-to-origin drive and stored in the E^2PROM of the drive.

5.4.2 Related function code setting

(1) Absolute value system setting
According to the encoder setting [F00.21]=5 or [F00.21]=6 or [F00.21]=7, select the relative position mode with [F01.01]. When [F01.01] = 0 (incremental position linear mode), the encoder does not require additional battery power and is only used as a single-turn absolute encoder. When [F01.01] = 1 (absolute position mode), the encoder's E+\E- must be additionally powered by a 3.6V battery.

Code	Name	Setting range	Function	Effective mode	Setting mode	Factory default
F00.21	Encoder code	0: 2500 line encoder -15 line encoder 1:2500 line line encoder -9 line encoder 2~4: Reserved 5: 17-bit bus absolute value encoding (Tama River Protocol) 6: 20-bit bus absolute value encoding (Tama River Protocol) 7: 23-bit bus absolute value encoding (Tama River Protocol)	Set parameters according to motor coding type	Power on again	Stop setting	7

F01.01	Absolute value system selection	0: incremental position mode 1: absolute position linear mode 2: Reserved	Absolute position mode selection	Power on again	Stop setting	0

(2) Encoder feedback data

Absolute encoder feedback data can be divided into encoder rotation lap data and encoder position within one revolution, incremental position mode without encoder rotation lap data feedback.

Code	Name	Setting range	Unit	Function	Effective mode	Setting mode	Factory default
F10.33	Absolute encoder rotation number data	-	r	The number of revolutions fed back by the absolute encoder.	-	Display	0
F10.34	One-turn position of the absolute encoder	-	Encoder unit	Absolute encoder feedback within 1 revolution absolute position	-	Display	0

The absolute encoder encoder rotation number data [F10.33] is an unsigned number, the range is 0 to 65535, assuming the encoder resolution RE (RE=223), and the absolute encoder position within one revolution [F10.34] 0 to RE.

(3) Absolute position linear mode

Code	Name	Setting range	Function	Effective mode	Setting mode	Factory default
F10.07	Absolute position counter	-	In position mode, the current absolute position of the motor (command unit) is displayed.	-	Display	0
F10.27	Mechanical absolute position (low 32 bits)	-	In absolute position linear mode, the load position is converted to the position of the motor end	-	Display	0
F10.29	Mechanical absolute position (high 32 bits)	-		-	Display	0
F10.36	Absolute encoder absolute position (low 32 bits)	-	Absolute encoder feedback absolute position	-	Display	0
F10.38	Absolute encoder absolute position (high 32 bits)	-		-	Display	0

This mode is mainly used when the load stroke range is fixed and the encoder does not overflow the multi-turn data, as shown in Figure 5-16 Ball screw drive mechanism.

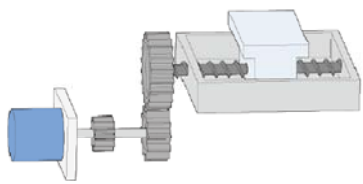


Fig. 5-16 Ball screw drive mechanism schematic

Assume that the mechanical absolute position ([F10.27] and [F10.29]) is PM, the absolute position of the encoder is PE [PE range is -238～(238-1)]], and the absolute position linear mode position is offset ([F04 .44] and [F04.46]) are PO, then the relationship between the three is PM = PE - PO. Assuming the electronic gear ratio is $\frac{B}{A}$, the absolute position counter [F10.07] indicates the current absolute position of the machine (command unit), [F10.07] = PM / (B / A). Absolute position linear mode position offset [F04.44] and [F04.46] default to 0, enabling the drive home position return function. After the home position return is completed, the drive automatically calculates the absolute position of the encoder and the mechanical absolute position deviation, and assigns it to [F04. 44] and [F04.46] are saved in the E2PROM.

The absolute position linear mode encoder multi-turn data range is -32768~32767. If the forward rotation number is greater than 32767 or the reverse rotation number is less than -32768, the Er.308 encoder multi-turn count overflow fault will occur, which can be set by [F09. 18] Mask the fault.

(4) Encoder multi-turn overflow fault selection

In the absolute position linear mode, the encoder is multi-turn overflow fault by setting [F09.18].

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F09.18	Encoder multi-turn overflow fault selection	0: Do not block 1: Block	-	0	Effective immediately	Stop setting	PST

(5) Absolute encoder reset operation

Reset the encoder internal fault or reset the encoder feedback multi-turn data by setting [F12.02].

Code	Name	Setting range	Unit	Factory default	Effective mode	Setting mode	Operation mode
F12.02	Absolute encoder reset enable	0: No operation 1: Reset fault 2: Reset fault and multi-turn data	-	0	Effective immediately	Stop setting	PST

Note

After performing the reset encoder feedback multi-turn data operation, the absolute position of the encoder is abrupt, and the mechanical origin return operation is required.

5.4.3 Absolute value system battery box use precautions

AL.401 (encoder battery alarm) will occur when the battery is turned on for the first time. It is necessary to set [F12.02]=1 to reset the encoder fault and then perform absolute position system operation.

When the detected battery voltage is less than 3.0V, AL.401 (encoder battery alarm) will occur. Please replace the battery. The replacement method is as follows:

The first step: the drive is powered on, in a non-operating state;

Step 2: Replace the battery;

Step 3: After the drive automatically releases AL.401 (encoder battery alarm), there is no other abnormal warning and it can run normally.

Note

(1) When the server is powered off, AL.401 (encoder battery alarm) will occur when the battery is replaced again. The multi-turn data is abrupt. Please set [F12.02]=1 to reset the encoder fault and re-origin the return. Functional operation.
(2) When the drive is powered off, please ensure that the maximum motor speed does not exceed 6000 rpm to ensure that the encoder position information is accurately recorded.
(3) Store during the storage according to the specified ambient temperature, and the brake battery is relieved and the power is sufficient. Otherwise, the encoder position information may be lost.

5.5 Soft limit function

Traditional hardware limit function: In the traditional mode, the limit can only be given by an external signal, and the external sensor signal is connected to the servo drive X5 interface.

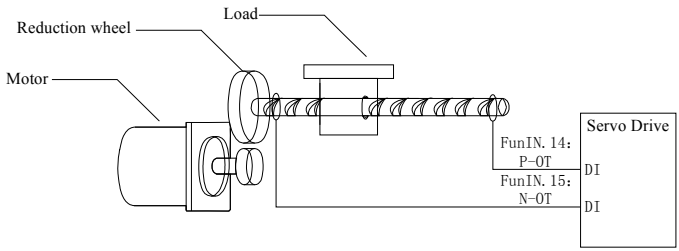


Fig. 5-17 Installation diagram of the limit switch

Soft limit function: It refers to the comparison between the internal position feedback of the drive and the set limit value. When the limit value is exceeded, it will alarm immediately and stop the operation. This function can be used in both absolute position mode and incremental position mode. Incremental position mode needs to be set **[F09.19=2]**. After the drive is powered on, first perform home position return to find the machine origin, and then enable the software limit function.

Comparison of advantages and disadvantages between traditional hardware limit and soft limit function.

Traditional hardware limit function		Soft limit function	
1	Can only be limited to linear motion, single-turn motion	1	Not only for linear motion, but also for rotary mode
2	Externally mounted mechanical limit switch required	2	No hardware wiring is required to prevent malfunction due to poor line contact
3	Unable to judge mechanical slip abnormality	3	Comparison of internal position to prevent mechanical slippage and abnormal operation
4	When the power is cut off, the machine moves out of the limit and cannot judge or alarm.		

Soft limit related function code

Code	Name	Setting range	Unit	Function	Setting mode	Effective mode	Factory default
F09.19	Soft limit setting	0: Do not enable the software limit 1: Enable the software limit immediately after power-on. 2: Enable the soft limit after the zero return to the origin	1	Soft limit function selection	Stop setting	Effective immediately	0
F09.20	Absolute position limit maximum	-214783648 ~ 214783647	Command unit	Soft limit function absolute position limit maximum	Stop setting	Effective immediately	2147483647
F09.22	Absolute position limit minimum	-214783648 ~ 214783647	Command unit	Soft limit function absolute position limit minimum	Stop setting	Effective immediately	-2147483648

(1) When **[F09.19=0]**, the software limit function is not enabled;
(2) When **[F09.19=1]**, the software limit function is enabled immediately after the drive is powered on. When the absolute position counter **[F10.07]** is greater than **[F09.20]** AL.405 warning occurs, the forward overtravel stop is executed; when the absolute position counter **[F10.07]** is less than **[F09.22]** AL.406 warning occurs, execution Negative overtime shutdown;
(3) When **[F09.19=2]**, the software limit is not enabled before the home position is restored after the drive is powered on. When the home position is reset, the absolute position counter **[F10.07]** is greater than **[F09.20]**, and the AL.405 warning occurs. The forward overtravel stop is executed; when the absolute position counter **[F10.07]** is less than **[F09.22]** after the return of the origin, the AL.406 warning occurs and the negative overtravel is executed;
(4) When **[F09.20]**<**[F09.22]**, the two values will be interchanged.

5.6 Pre-operation check

Please first remove the load connected to the servo motor, the coupling connected to the servo motor shaft and its related accessories. Ensure that the servo motor can work normally without load and then connect the load to avoid unnecessary danger.

Please check and ensure before running:
(1) There is no obvious damage on the appearance of the servo drive;
(2) The wiring terminals have been insulated;
(3) There are no conductive objects such as screws or metal sheets, flammable objects inside the driver, and there is no conductive foreign matter at the wiring port;
(4) The servo drive or the external brake resistor is not placed on the flammable object;
(5) Wiring is completed and correct: the wiring of the driver power supply, auxiliary power supply, and grounding terminal is correct; the wiring of each control signal cable is correct and reliable; the limit switches and protection signals are properly connected.
(6) The enable switch has been placed in the OFF state;
(7) cut off the power circuit and the emergency stop alarm circuit to maintain the path;
(8) The servo drive has a correct voltage reference.

When the controller does not send a run command signal, power up the drive, check and ensure:

① The servo motor can rotate normally without vibration or running sound too much;

② The parameters are set correctly. Unexpected actions may occur depending on the mechanical characteristics, and do not set excessively extreme parameters;

③There is no abnormality between the bus voltage indicator and the digital tube display.

5.7 Load inertia identification and gain adjustment

First, please install and wire correctly. After completing the relevant functional parameter settings, refer to the debugging process in Figure 5-18 to debug the inertia identification, rigid table and vibration suppression.

Inertia identification (see 5.7.1 for details). After obtaining the correct load inertia ratio, it is recommended to perform automatic gain adjustment (see 5.7.2). If the effect is not good, perform manual gain adjustment (see 5.7.3 for details). Two resonance frequencies can be set by suppressing mechanical resonance by a notch filter (see 5.7.4 for details). The general debugging process is shown in the flow chart below.

The general process of gain adjustment is shown in the figure below:

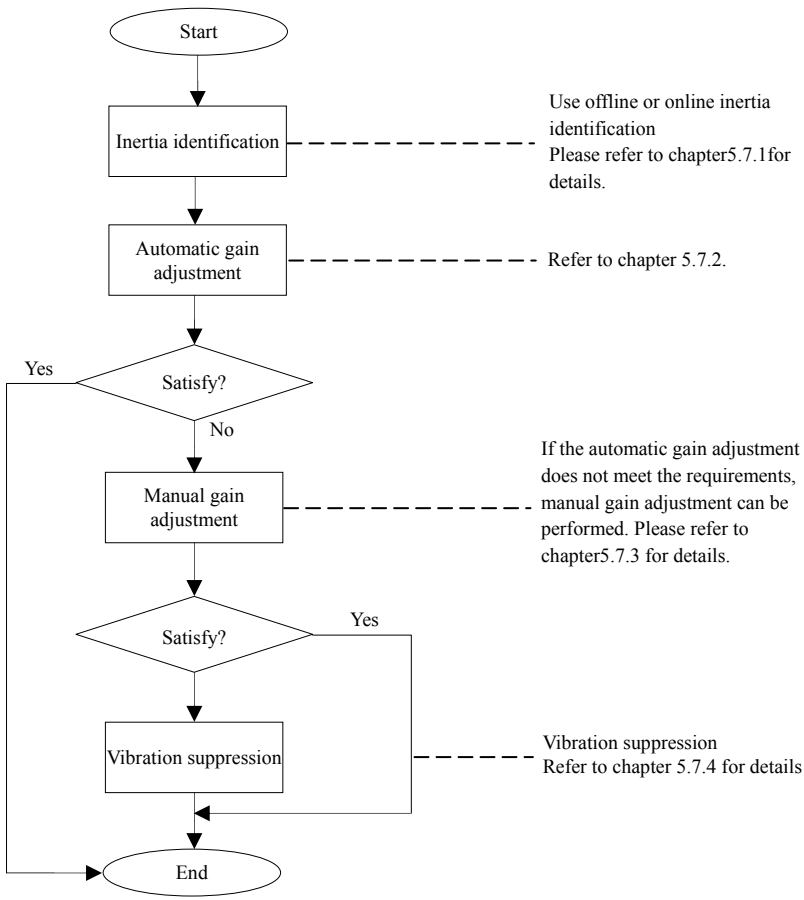


Fig.5-18 Gain adjustment process

5.7.1 Inertia identification

5.7.1.1 Offline inertia identification

Inertia identification is required before automatic gain adjustment or manual gain adjustment to obtain a true load inertia ratio. The flow chart for offline inertia identification is as follows:

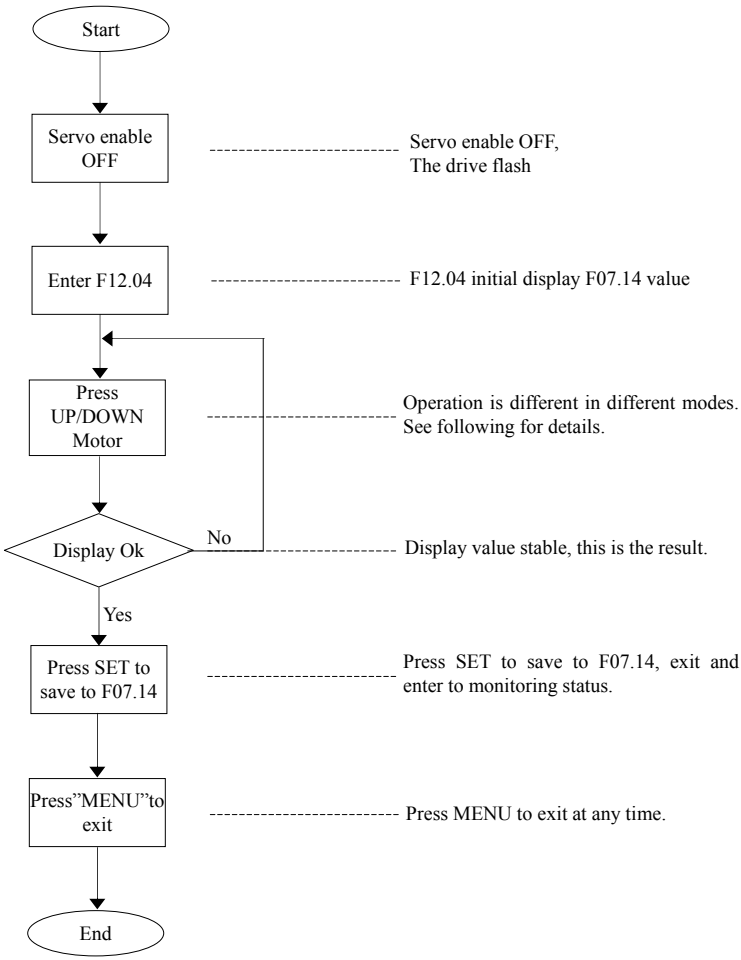


Fig.5-19 Offline inertia identification flow chart

Function code	Name	Setting range	Unit	Function	Setup way	Effective way	Default value
F08.03	Offline inertia identification mode	0: Positive and negative triangle wave mode 1: Forward mode 2: Reverse mode	-	Set offline inertia identification mode	Downtime set	Effective instantly	0
F08.04	Inertia identification max. Speed	50～6000	rpm	Set the maximum speed command for offline inertia identification	Downtime set	Effective instantly	500
F08.05	Acc/dec time when inertia identification	2～2000	ms	Set the interval between two consecutive speed commands when the forward and reverse triangle modes are used for offline inertia identification.	Downtime set	Effective instantly	125
F08.06	Interval after an inertia identification	20～10000	Ms	When setting the offline inertia identification function, the time interval between two consecutive speed commands, extending this time is beneficial to improve the identification accuracy.	Run time set	Effective instantly	1000
F08.07	Motor rotations for an inertia identification	-	r	Display the number of motor rotations required for a single offline inertia identification.	-	-	0.52

Conditions for inertia identification:

① The actual motor maximum speed is higher than 150rpm;

② The acceleration during actual acceleration and deceleration is above 3000 rpm/s;

③The load torque is relatively stable and cannot be changed drastically;

④ Maximum identifiable 120 times inertia;

⑤Failure may be recognized when the mechanical rigidity is extremely low or the backlash of the transmission is large.

5.7.1.2 Online inertia identification

The servo drive provides online inertia identification. Online inertia identification general operation process:

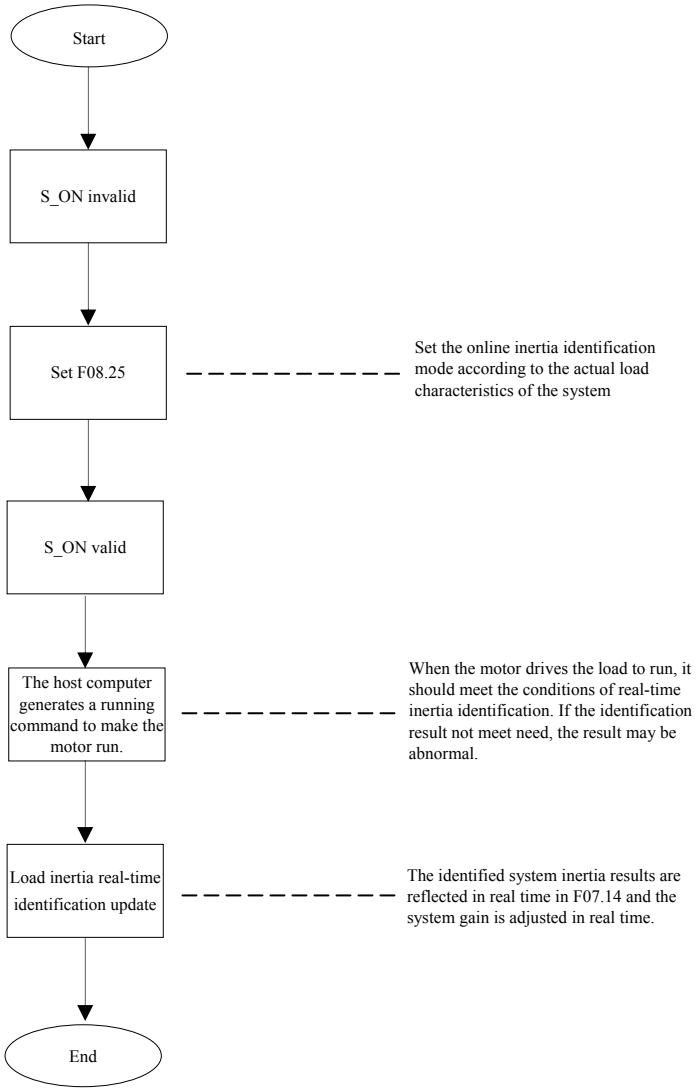


Fig. 5-20 Online inertia identification operation flow

Function code	Name	Setting range	Unit	Function	Setup way	Effective way	Default value
F08.25	Online inertia identification mode	0: Turn off online identification 1: Turn on online inertia identification, the load characteristics are basically unchanged 2: Turn on online inertia identification, and the load characteristics change slowly. 3: Turn on online inertia identification, the load characteristics change drastically	-	-	Effective Instantly	Down time set	0

Under the following conditions, the online identification inertia function may fail. In this case, change the mechanical load condition and motion command, or use offline inertia identification.

(1) When the speed is less than 150r/min and the low speed is continuously used;

(2) When the acceleration and deceleration is less than 350ms (acceleration from 0r/min to 1000r/min);

(3) When the torque is too small during acceleration/deceleration or the load torque changes drastically;

(4) When the load inertia ratio exceeds 200 times;

(5) When the rigidity of the mechanical equipment is too low or there is a nonlinear characteristic such as a gap.

Note

(1) **[F08.25≠0]** , online inertia identification is enabled, the identification result will be reflected in **[F07.14],** and the system gain will be adjusted in real time. If you are satisfied with the identification result, you can set **[F08.25=0]**, when you exit the online inertia identification, it will automatically save **[F07.14:Current identification result]**; if **[F08.25]** is not 0, the current identification result will be saved automatically to **[F07.14]** when the servo is powered off. After power-on again, the system inertia value **[F07.14]** is the inertia identification value before power off.

(2) If the inertia of the actual system is large, or the servo rigidity level gain **[F08.01]** is set small, the motor operation does not meet the online inertia identification condition. At this time, could set **[F08.25=0]**. Set the estimated inertia for **[F07.14]** according to the actual system inertia, or increase **[F08.01]** appropriately, and then restart the online inertia identification.

(3) If continuous vibration or noise occurs during the online inertia identification process, the inertia identification value will be an abnormal value. At this time, the online inertia identification should be stopped immediately and could set **[F08.25=0].**Set the estimated inertia for **[F07.14]** according to the actual system inertia, or reduce **[F08.01]** appropriately, and then restart the online inertia identification.

(4) If you are not satisfied with the online inertia identification effect, you can perform offline inertia identification or manually calculate the system inertia value.

5.7.2 Automatic gain adjustment

The general method of automatic gain adjustment is to first set **[F08.00]** to 1, and then apply the command to move the servo motor. At this time, adjust the value of **[F08.01]** rigidity level while observing the effect until a satisfactory result is achieved. If you are not satisfied at all, switch to manual gain adjustment mode.

Function code	Name	Setting range	Unit	Function	Setup way	Effective way	Default value
F08.00	Self-adjustment mode selection	0: Manual adjust parameters 1: Parameter self-adjustment mode, automatically adjust gain parameters with rigid table 2: Positioning mode, automatically adjust gain parameters with rigid table	-	Set the self-adjustment mode	Run time set	Effective Instantly	0
F08.01	Rigid level	0～31	-	Set the level of the rigid	Run time set	Effective Instantly	12

Recommended rigidity level	Load mechanism type
4～8	Some large machinery
8～15	Low rigidity applications such as belts
15～20	Highly rigid applications such as ball screws and straight connections

5.7.3 Manual gain adjustment

For manual gain adjustment, you need to set **[F08.00]** to 0 and adjust several gain-related parameters separately.

Increasing the position loop gain and speed loop gain will make the system's response faster, but too much gain will cause system instability. In addition, under the premise that the load inertia ratio is basically accurate, the speed loop gain and the position loop gain should satisfy a certain relationship, as shown below, otherwise the system is also prone to instability.

$$\frac{1}{3} \leqslant \frac{F07.00[Hz]}{F07.02[Hz]} \leqslant 1$$

Increasing the torque command filtering time [F07.12] is helpful for suppressing mechanical resonance, but it will reduce the response of the system. Relative to the speed loop gain, the filtering time cannot be increased arbitrarily. The following conditions should be met：

$$F07.00 \leqslant \frac{1000}{2\pi \times F07.12 \times 4}$$

Function code	Name	Setting value	Unit	Function	Setup way	Effective way	Default value
F07.00	Speed loop gain	0.1～1000.0	Hz	Set speed loop proportional gain	Run time set	Effective instantly	25.0

F07.01	Speed loop integration time constant	0.36～512.00	ms	Set the integral time constant of the speed loop	Run time set	Effective instantly	31.83
F07.02	Position loop gain	0.00～1570.0	rad/s	Set position loop proportional gain	Run time set	Effective instantly	40.0
F07.12	Torque command filter time constant	0.00～30.00	ms	Set torque command filter time constant	Run time set	Effective instantly	0.79

5.7.4 Notch filter

The mechanical system has a certain resonant frequency. If the servo gain is set too high, resonance may occur near the mechanical resonance frequency. In this case, a notch filter may be considered. The trap is designed to suppress mechanical resonance by reducing the gain of a specific frequency, and the gain can therefore be set higher.

There are 4 sets of traps, each set has 3 parameters, namely frequency, width level and attenuation level. When the frequency is the default value of 4000 Hz, the notch is actually invalid. The first and second sets of traps are manual traps, and the parameters are manually set by the user. The 3rd and 4th sets of traps are adaptive notch filters. When the adaptive filter mode is turned on, it is set by the driver itself. If the adaptive filter mode is not turned on, it can be set manually.

The mode of the adaptive notch is controlled by the **[F08.02]** function code. When **[F08.02]** is set to 1, the third group of traps is valid. When the servo is enabled and resonance is detected, the parameters are automatically set to suppress vibration. When **[F08.02]** is set to 2, the 3rd and 4th sets of traps are valid together, and both sets of traps can be automatically set.

If a trap is used to suppress resonance, the adaptive notch is preferred. If the adaptive notch is not effective or does not work well, you can use a manual notch. When using a manual notch, set the frequency parameter to the actual resonant frequency. This frequency can be obtained from the mechanical properties analysis tool of the background software. The width level is recommended to keep the default value of 2. The depth level is adjusted according to the situation. The smaller the setting of this parameter is, the stronger the suppression effect on resonance is. The larger the setting is, the weaker the suppression effect is. If it is set to 99, it will hardly work. Although reducing the depth level will enhance the suppression effect, it will also cause phase lag, which may make the system unstable, so it cannot be reduced at will.

Note

(1) The notch filter can only be used in modes other than torque mode.
(2) If **[F08.02]** is always set to 1 or 2, the parameters of the adaptive notch update are automatically written to the E2PROM once every 30 minutes, and the update within 30 minutes is not stored in the E2PROM.
(3) When **[F08.02]** is set to 0, the adaptive filter will keep the current parameters from changing. After using the adaptive filter to properly dampen and stabilize for a period of time. You can use this feature to fix the adaptive notch parameters.
(4) Although there are a total of 4 sets of traps, it is recommended that up to 2 sets of traps work at the same time, otherwise the vibration may be intensified.
(5) When the resonance frequency is below 300 Hz, the effect of the adaptive trap will be reduced.
(6) When using the adaptive notch filter, if the vibration cannot be eliminated for a long time, please turn off the drive enable in time.

Function code	Name	Setting value	Unit	Function	Effective way	Setup way	Default value
F08.02	Adaptive notch mode selection	0: The adaptive filter is no longer updated; 1: an adaptive filter is active; (Group 3 notch) 2: Two adaptive filters are active; (Group 3 and Group 4 traps) 3: Only the resonant frequency is detected, the trap parameters are not updated, and F08.20 shows the resonant frequency; 4: Restore the values of the 3rd and 4th traps to the factory state	1	0	Effective instantly	Run time set	PST
F08.08	1st group notch frequency	50～4000	Hz	4000	Effective instantly	Run time set	PS
F08.09	1st group notch width class	0～20	-	2	Effective instantly	Run time set	PS
F08.10	1st group notch depth level	0～99	-	0	Effective instantly	Run time set	PS
F08.11	2nd group notch frequency	50～4000	Hz	4000	Effective instantly	Run time set	PS
F08.12	2nd group notch width class	0～20	-	2	Effective instantly	Run time set	PS
F08.13	2nd group notch depth level	0～99	-	0	Effective instantly	Run time set	PS
F08.14	3rd group notch frequency	50～4000	Hz	4000	Effective instantly	Run time set	PS
F08.15	3rd group notch width class	0～20	-	2	Effective instantly	Run time set	PS
F08.16	3rd group notch depth level	0～99	-	0	Effective instantly	Run time set	PS
F08.17	4th group notch	50～4000	Hz	4000	Effective	Run time	PS

	frequency				instantly	set	
F08.18	4th group notch width class	0～20	-	2	Effective instantly	Run time set	PS
F08.19	4th group notch depth level	0～99	-	0	Effective instantly	Run time set	PS
F08.20	Resonance frequency identification result	-	Hz	-	-	-	PS

6 Troubleshooting

6.1 Failure and warning handling when startup

6.1.1 Position control operation mode

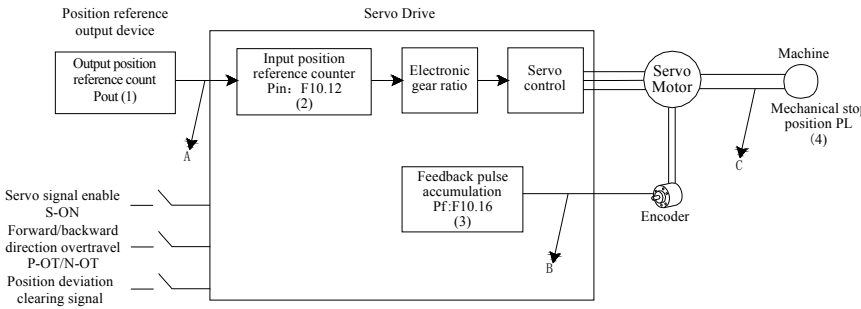
(1)Failure checking

Startup process	Fault symptom	Causes	Confirming methods
Connect control power supply (L1C L2C) Main power supply (L1 L2 L3)	The LED not light or without value in display	1、Control power supply voltage problem	1、After disconnect X5,X6,X3 and X4,the fault still occurs; 2、Measure the AC voltage between L1C and L2C.
		2、Main power supply voltage problem	1、For single-phase 220 V model, measure AC voltage between L1 and L2. The DC bus voltage between (+) and (-) lowerthan 190V, LED displays “P.off”. 2、For three-phase 220/380V model, measure the AC voltage between L1,L2 and L3. The DC bus voltage between (+) and (-),for 380V grade lower than 390V，220V grade lower than190V and LED displays “P.off”.
		3、Servo Drive problem	-
	The operation panel displays “Er.xxx”	Refer to “6.2 Failure and warning handling during operation”, Finding the causes and troubleshooting.	
	After the preceding causes are removed, the panel should display monitored objects.		
Servo enable signal(S-ON is ON)	The operation panel displays “Er.xxx”	Refer to “6.2 Failure and warning handling during operation”, Finding the causes and troubleshooting.	
	Servo motor shaft in free running status	1、Servo enable signal invalid	1、Set operation panel to servo status display and check whether the operation panel blinking displays monitored objects; 2、Check it whether setup servo enable signal parameters in group F02(DI function 1：S-ON)，If it has been setup, please check the corresponding terminal logic valid or not. If still not setup, please refer to Chapter 7“F02 Group：Terminal input parameters” to setup and make the terminal valid. 3、If the servo enable signal has been setup in F02 Group and the corresponding terminal has valid logic but the operation panel still blinking display monitored objects, please refer to "Chapter 4:Wiring instructions and check the wiring of DI is correct or not.
		2、Incorrect selection of control mode	Check the value of F01.00 is 0 or not. If it has been incorrect setup as 2(Torque control), Servo motor shaft also will be in free running status due to the default torque reference is 0.
	After the preceding causes are removed, the panel should display monitored objects.		

Input position reference	Servo motor not rotates	Input position reference counter (F10.12)is 0	High/low-speed pulse input terminal wired incorrectly. When F04.00=0(pulse position reference), Please refer to Chapter 4: Wiring instructions and check the wiring of high/low-speed is correct or not. Also check the settings ofF04.03 matched or not. Not input position reference 1. Whether used DI function No.13 (FunIN.13:Inhibit,Inhibit position reference) or DI function No. 37 (FunIN.35：Pulse Inhibit,Inhibit pulse reference); 2. When F04.00=0 (pulse position reference), The host device and other pulse devices not output pulses. Please refer to Chapter 4:Wiring and use oscilloscope to check whether the high/low-speed pulse port has pulse input or not; 3. When F04.00=1(Steps reference), check the value of F04.04 is 0 or not. If not 0,please check it whether it has been setup as DI function No. 20(FunIN.20：PosStep，Steps reference enable)and the corresponding terminal is valid or not; 4. When F04.00=2(Multi-step position reference), please check the settings in F14 correct or not. If correctly, please check whether it has been setup as DI function No.28(FunIN.28 ： PosInSen, Internal multi-step position enable)and the corresponding terminal valid or not; 5. If used the Interrupt fixed-length function, please check the value of F04.34 is 1 or not, (After complete the interrupt fixed-length whether response to other position reference).If it's 1, please ensure that whether using DI function No.29(FunIN.29: XintFree, Relieve the interrupt fixed-length status)to relieve it.
	Servo motor reverse rotates	Input position reference counter (F10.12) is negative	1. When F04.00=0 (pulse position reference), Please check whether the settings in F04.01 (pulse reference form) corresponds to the actual input pulse or not. Otherwise, it means incorrect settings of F04.01or wrong terminals wiring; 2. When F04.00=1(Steps reference), check the value of F04.04 is positive or negative; 3. When F04.00=2(Multi-step position reference), check t he positive and negative of each displacement in F14 Group; 4. Check if it has been setup as DI function No. 27 (FunIN.27: PosDirSel, position reference direction setting) and the corresponding terminal valid or not;
	After the preceding causes are removed, the servo motor can rotate.		
Slow rotation not	Speed not stable	Improperly Gain setting	Please refer to "5.7.2Automatic gain tuning"

smooth	during slow rotation		to adjust it.
	Motor shaft vibrates left and right	The load inertia ratio (F07.14) too large	If it can be run safely, perform inertia auto-tuning in accordance with "5.7.1 Inertia Identification"; Please refer to "5.7.2 Automatic gain tuning" to perform automatic gain tuning.
	After the preceding causes are removed, the servo motor can rotate.		
Normally operation	Positioning inaccurate	Unsatisfactory position deviation occurs	Confirm input position reference pulse counter (F10.12), feedback pulse counter (F10.16) and mechanical stop position according to the following steps.

(2)The procedure of checking the causes of positioning inaccurate is as follows:



When inaccurate positioning occurs, please check 4 signals in above figure:

① Output position reference counter Pout in position reference output device (Host device or internal parameters in servo drive);

②Input reference pulse counter Pin that received by the servo drive, corresponding to parameter **[F10.12]**;

③ Feedback pulses accumulation of the encoder in servo motor Pf, which corresponding to parameter **[F10.16]**;

④ Mechanical stop position PL.

There are 3 causes resulting in inaccurate positioning, corresponding to A, B and C in the figure:

Cause A:

➢ Counting of input position reference incorrect which caused by the noise in the wiring between position reference output device(Host device) and servo drive;

➢Input position reference is interrupted during motor running. The causes are Servo enable signal is set to invalid(S-ON is OFF), the forward/backward direction overtravel switch signal (P-OT or N-OT) valid and the position deviation clearing signal (ClrPosErr) is valid.

Cause B:

Wrong encoder feedback position signal (signal suffers interference);

Cause C:

Mechanical position slides between machine and servo motor.

In the ideal state without position deviation, the following relationship is established:

① Pout=Pin,Output position reference counter value = Input position reference counter value

② Pin× Electronic gear ratio =Pf,Input position reference counter value× Electronic gear ratio=Feedback pulses accumulation

③ Pf ×△L=PL,Feedback pulses accumulation× corresponding load displacement of one position reference=Mechanical stop position

In case of inaccurate positioning, please follow the below inspection methods:

① Pout ≠ Pin

Fault cause:A

Debug methods and procedures:

Please check whether the pulses input terminal(Low-speed or high-speed pulses input terminal, for more details refer to Chapter 4 Wiring) adopted shielded twisted pair cables;

Please change it into differential input mode if open-collector input of low-speed pulse input terminal mode is used;

The wiring of pulses input terminals should be separated from the wiring of main circuit (L1C、L2C、L1、L2、L3、U、V、W);

When using low-speed pulse input terminal, please increase the filter time constant of low-speed pulses input pin in **[F09.13]**.

② Pin× Electronic gear ratio ≠ Pf:

Fault cause: B

Debug methods and procedures:

Please whether check any alarms occurs during the operation which leads to the stop of the servo when the instruction is not fully executed;

If the cause is position deviation clearing signal (ClrPosErr) is valid, please check the position deviation clearing method in [F04.18] is correct or not.

6.1.2 Speed control operation mode

Startup process	Fault symptom	Causes	Confirming methods
Connect control power supply (L1C L2C) Main power supply (L1 L2 L3)	The LED not light or without value in display	1.Control power supply voltage problem	1.After disconnect X5,X6,X3 and X4,the fault still occurs; 2. Measure the AC voltage between L1C and L2C.
		2.Main power supply voltage problem	1.For single-phase 220 V model, measure AC voltage between L1 and L2. The DC bus voltage between (+) and (-) lower than 190V，LED displays “P.off”. 2.For three-phase 220/380 V model, measure the AC voltage between L1,L2 and L3. The DC bus voltage between (+) and (-),for 380V grade lower than 390V，220V grade lower than190V and LED displays “P.off”.
		3.Servo Drive problem	-

	The operation panel displays “Er.xxx”	Refer to “6.2 Failure and warning handling during operation”, Finding the causes and troubleshooting.	
	After the preceding causes are removed, the panel should display monitored objects.		
Servo enable signal(S-ON is ON)	The operation panel displays “Er.xxx”	Refer to “6.2 Failure and warning handling during operation”, Finding the causes and troubleshooting.	
	Servo motor shaft in free running status	1.Servo enable signal invalid	1.Set operation panel to servo status display and check whether the operation panel blinking displays monitored objects; 2.Check it whether setup servo enable signal parameters in group F02(DI function 1：S-ON)，If it has been setup, please check the corresponding terminal logic valid or not. If still not setup, please refer to Chapter 8“F02 Group：Terminal input parameters” to setup and make the terminal valid. 3.If the servo enable signal has been setup in F02 Group and the corresponding terminal has valid logic but the operation panel still blinking display monitored objects, please refer to Chapter 4:Wiring instructions and check the wiring of DI is correct or not.
		2.Incorrect selection of control mode	Check the value of F01.00 is 0 or not. If it has been incorrect setup as 2(Torque control)，servo motor shaft also will be in free running status due to the default torque reference is 0.
	After the preceding causes are removed, the panel should display monitored objects.		
Input speed reference	Servo motor not rotates or the servo motor speed abnormal	Speed reference(F10.01)is 0	Wrong wiring of AI When select analog speed input reference, please check the selection of AI analog input channels is correct or not in advance. Then check the wiring of AI terminal correct or not. For more details please refer to Chapter 4: Wiring. Wrong selection of speed reference, check the setting of F05.02 correct or not. Without speed reference or speed reference abnormal 1. When select analog speed input reference, please check the settings of AI related parameters in F02 group are correct or not in advance. Then check the input voltage of external signal source correct or not by the observing of scope or reading of F10.20 or F10.21； 2. When select digital setting reference，check the setting of F05.04 is correct or not；

			3. When select multi-step speed reference，check the settings of F15 group parameters are correct or not； 4.When communication reference used, check the setting of F20.02 is correct or not； 5. When Jog speed reference used, please check the value of F05.05. Also check the effective logic of DI function No.18 and No.19 matches with the predicted rotating direction. 6.Check the settings of Acc/Dec time in F05.06 and F05.07are correct or not； 7.Check whether the zero-position fixation function has been wrong used, wrong setup of DI function No.12 and whether the valid logic of corresponding DI terminal is correct or not.
Input speed reference	Servo motor reverse rotates	Speed reference(F10.01)is negative	1.When select analog input reference, please check whether the positive or negative polarity of the input signal is reverse or not; 2.When select digital setting reference, please check whether the value of F05.04 less than 0 or not; 3.When select multi-step speed reference, please check the positive and negative of each speed reference in F15 group; 4.When communication reference used, please check whether the value of F20.02 less than 0 or not; 5. When Jog speed reference used, please check the value of F05.05. Also check the valid logic of DI function No.18 and No.19 matches with the predicted rotating direction. 6.Check whether setup DI function No.26 (FunIN.26:SpdDirSel ， Speed reference direction setup) and the corresponding terminal valid or not;
	After the preceding causes are removed, the servo motor can rotate.		
Slow rotation not smooth	Speed not stable during slow rotation	Improperly gain setting	Please refer to “5.7.2 Automatic gain tuning” to adjust it.
	Motor shaft vibrates left and right	Load rotation inertia ratio(F07.14)is too large	If it can be run safely, perform inertia auto-tuning in accordance with “5.7.1 Inertia Identification”; Please refer to “5.7.2 Automatic gain tuning” to perform automatic gain tuning.

6.1.3 Torque control operation mode

Startup process	Fault symptom	Causes	Confirming methods
Connect control power supply (L1C L2C) Main power supply (L1 L2 L3)	The LED not light or without value in display	1.Control power supply voltage problem	1.After disconnect X5,X6,X3 and X4,the fault still occurs; 2. Measure the AC voltage between L1C and L2C.
		2.Main power supply voltage problem	1.For single-phase 220 V model, measure AC voltage between L1 and L2. The DC bus voltage between (+) and (-) lower than 190V，LED displays “P.off”. 2.For three-phase 220/380 V model, measure the AC voltage between L1,L2 and L3. The DC bus voltage between (+) and (-),for 380V grade lower than 390V，220V grade lower than190V and LED displays “P.off”.
		3.Servo Drive problem	-
	The operation panel displays “Er.xxx”	Refer to “6.2 Failure and warning handling during operation”, Finding the causes and troubleshooting.	
	After the preceding causes are removed, the panel should display monitored objects.		
Servo enable signal valid(S-ON is ON)	The operation panel displays “Er.xxx”	Refer to “6.2 Failure and warning handling during operation”, Finding the causes and troubleshooting.	
	Servo motor shaft in free running status	Servo enable signal invalid	1.Set operation panel to servo status display and check whether the operation panel blinking displays monitored objects; 2.Check it whether setup servo enable signal parameters in group F02(DI function 1：S-ON)，If it has been setup, please check the corresponding terminal logic valid or not. If still not setup, please refer to Chapter 7“F02 Group：Terminal input parameters” to setup and make the terminal valid. 3.If the servo enable signal has been setup in F02 Group and the corresponding terminal has valid logic but the operation panel still blinking display monitored objects, please refer to Chapter 4:Wiring instructions and check the wiring of DI is correct or not.
	After the preceding causes are removed, the panel should display monitored objects.		
Input torque reference	Servo motor not rotates	Internal torque reference (F10.02) is 0	Wrong wring of AI When select analog torque input reference, please check the wiring of AI is correct or not and refer to Chapter 4: Wiring. Wrong selection of torque reference Check the setting of F06.02 correct or not. Without input torque reference

			1. When select analog torque input reference, please check the settings of AI related parameters in F02 group are correct or not in advance. Then check whether the input voltage signal of external signal source is correct or not by oscilloscope observing or reading the value of F10.20 or F10.21. 2.When select digital setting reference，check the value of F06.04 is 0 or not； 3.When select communication reference，check the value of F20.03 is 0 or not.
	Servo motor reverse rotates	Internal torque reference (F10.02) is negative	1. When select analog torque input reference, Whether the polarity of external signal source input voltage is reverse or not can be check by oscilloscope or the value of F10.20 or F10.21. 2.When select digital setting reference，check whether F06.04 is less than 0 or not. 3.When select communication reference，check whether F20.03 is less than 0 or not. 4.Check whether has setup DI function No.25 (FunIN.25：ToqDirSel，Torque reference direction setup) and the corresponding terminal valid or not;
	After the preceding causes are removed, the servo motor can rotate.		
Slow rotation not smooth	Speed not stable during slow rotation	Improperly gain setting	Please refer to “5.7.2 Automatic gain tuning” to adjust it.
	Motor shaft vibrates left and right	The load inertia ratio (F07.14) too large	If it can be run safely, perform inertia auto-tuning in accordance with “7.2 Inertia Identification”; Please refer to “5.7.2 Automatic gain tuning” to perform automatic gain tuning.

6.2 Fault and warning handling during operation

6.2.1 Fault and warning code list

(1)Fault and warning grading

Faults and alarms of servo drive are graded into the following four grades，No.1,No.2, No.3, and No.4，the serious degree of each grade: No.1＞No.2＞No.3＞No.4, details as following:

NO.1: Non-resettable fault;

NO.2: Resettable fault;

NO.3: Resettable fault;

NO.4: Resettable warning.

“Resettable” means that the fault/warning display state of operation panel can be stopped by input “reset signal”.

Operation methods：Setup parameter **[F12.01=1]** (Fault reset) or use DI function

No.2(FunIN.2：ALM-RST，Fault reset) and makes the terminal logic valid so as to stops the fault display on operation panel.

The reset method for NO.2、NO.3 resettable faults: Turn off servo enable signal first(S-ON set as OFF)，then setup **[F12.01=1]** or use DI function No. 2.

The reset method for NO.4 resettable warnings: the program detects warnings status and exits automatically.

Note

For some faults/warnings, you must change some settings and remove the problem causes first, thereafter you can reset it. But the reset does not mean the modification takes effect. For modifications that need to be recharged (L1C, L2C) to take effect, please recharge control power supply. For modifications that require turning off the servo drive to take effect, the servo enable signal must be turned off. After it takes effect, the servo drive will work properly.

Function code	Name	Setup range	Function	Modification	Valid mode	Default
F12.01	Fault reset	0: No operation 1: Fault reset	For resettable faults and warnings, using operation panel to stops fault display. After the reset completed, it recovers to 0:No operation.	At stop	Immediate	0

Code	Name	Function name	Function
FunIN.2	ALM-RST	Fault reset signal	Edge valid mode recommended, according to the alarm types, after reset some faults and warnings, the servo drive can keep working. Invalid: Not reset faults and warnings； Valid: Reset faults and warnings;

(2)Fault record

Servo drive has fault recording function, it can record names of recent 6 faults and the servo drive status parameters of recent 2 faults when faults or warnings occurring.

After reset the fault, the fault record will still reserve the fault and warning；

Using the “Recover to factory default operation” **[F01.20=3]** can clear fault and warning record.

Servo drive status parameters when fault or warning occurs can be check in **[F17.06]～[F17.11]**, For more details about parameters please refer to Chapter 8: Parameters description.

The previous secondservo drive status parameters when fault or warning occurs can be check in **[F17.12]～[F17.17]** for more details about parameters please refer to Chapter 8: Parameters description.

When No.4 warnings occur, Warning code and status parameters of servo drive when warning occurs not save record.

When fault occurs, Fault code can be check by parameter **[F10.46]** with more fault classification information.

When reading **[F19.04]** through our servo drive debugging platform software or communication, the value is in decimal and no need to convert it.

The operation panel displays fault or warning "Er.xxx"	F19.04(Decimal)	Description
Er.101	101	0: No.1 Non-resettable fault 101: Fault code
Er.211	211	2: No.2 Resettable fault 211: Fault code
Er.311	311	6: No.3 Resettable fault 311: Fault code
Er.401	401	E: No.4 Resettable fault 401: Warning code

(3) Fault output

①NO.1 Non-resettable fault:

Display	Fault name	Fault type	Resettable
Er.100	Non-matched fault between motor and servo drive	NO.1	No
Er.101	Non-matched fault between position mode and encoder	NO.1	No
Er.102	Speed uncontrollable fault	NO.1	No
Er.103	IGBT protection	NO.1	No
Er.104	Grounding to earth during operation	NO.1	No
Er.105	Encoder fault(The angle that corresponding to Z signal changes too large)	NO.1	No
Er.106	Bus type encoder data validation error	NO.1	No
Er.107	Z pulse lost fault	NO.1	No
Er.108	Wrong reading of increment encoder UVW(Including BUS increment encoder)	NO.1	No
Er.109	Break wire of increment pulse encoder	NO.1	No
Er.110	Bus type encoder break wire	NO.1	No

②NO.2 Resettable fault:

Display	Fault name	Fault type	Resettable
Er.200	Servo drive overload protection	NO.2	Yes
Er.201	Over-current fault	NO.2	Yes
Er.202	Main circuit overvoltage	NO.2	Yes
Er.203	Main circuit under-voltage during operation	NO.2	Yes
Er.204	Motor parameter self-learning fault	NO.2	Yes
Er.205	Encoder self-turning (Includes wrong phase sequence of UVW power wires, wrong UVW signal wires and not found Z pulse etc.)	NO.2	Yes
Er.206	Break wire of temperature detection	NO.2	Yes
Er.207	Internal fault 1	NO.2	Yes
Er.208	Internal fault 2	NO.2	Yes
Er.209	Internal fault 3	NO.2	Yes

Er.210	Reserve	NO.2	Yes
Er.211	E^2PROM Read/write error	NO.2	Yes
Er.212	External device fault	NO.2	Yes
Er.213	Command conflict fault	NO.2	Yes
Er.214	Control circuit under-voltage during operation	NO.2	Yes
Er.215	Output loss phase fault	NO.2	Yes
Er.216	Heatsink overheat	NO.2	Yes
Er.217	Current detection circuit fault	NO.2	Yes
Er.218	Brake abnormal open	NO.2	Yes

③ NO.3 Resettable fault:

Display	Fault name	Fault type	Resettable
Er.300	Servo motor overload protection	NO.3	Yes
Er.301	Main circuit input loss phase	NO.3	Yes
Er.302	Over-speed protection	NO.3	Yes
Er.303	Pulse output over speed	NO.3	Yes
Er.304	Pulse input over speed	NO.3	Yes
Er.305	Motor blocked	NO.3	Yes
Er.306	Encoder battery failure	NO.3	Yes
Er.307	Encoder multi-cycle counting error	NO.3	Yes
Er.308	Encoder multi-cycle counting overflow	NO.3	Yes
Er.309	AD sampling overvoltage	NO.3	Yes
Er.310	Too large position deviation	NO.3	Yes
Er.311	Too large position deviation of full closed-loop	NO.3	Yes
Er.312	The settings of electronic gear ratio exceed limitation	NO.3	Yes
Er.313	Modbus communication fault	NO.3	Yes
Er.314	Braking resistor overload protection	NO.3	Yes
Er.315	Original position reset overtime fault	NO.3	Yes
Er.316	Original position reset abnormal	NO.3	Yes

④ Warnings, resettable automatically:

Display	Fault name	Fault type	Resettable
AL.400	Reserved	NO.4	Yes
AL.401	Encoder battery warning	NO.4	Yes
AL.402	DI emergency stop warning	NO.4	Yes
AL.403	Too small of external braking resistor connecting warning	NO.4	Yes
AL.404	Recharging need after parameters modification warning	NO.4	Yes
AL.405	Forward direction overtravel warning	NO.4	Yes
AL.406	Backward direction overtravel warning	NO.4	Yes
AL.407	IGBT overheat warning	NO.4	Yes
Er.408	Runninglimit time warning	NO.4	Yes

6.2.2 Troubleshooting of Faults

Fault code	Fault type	Principle of causing	Possible causes of failure	Countermeasures
Er.100	Mismatch fault between motor and servo drive	The rated current of motor larger than the rated current of servo drive	Product (motor or drive) serial No. not exist	When adopt our ESS200Pdrive and servo motor, please ensure the No. in F00.03 matches with motor nameplate.
			The rated current and voltage of motor and drive not exist	Please refer to “2.5 Servo system specifications” to replace unmatched product and ensure the rated voltage and rated current of the selected motor are less than the rated parameters of drive.
Er.101	Mismatch fault between position mode and encoder	Absolute position mode motor mismatch or wrong motor No. settings	Detected motor mismatch under absolute position mode or wrong motor No. settings	Reset F00.03 (Motor No.)According to motor nameplate or replace matched motor or set correct value in F00.21 (Encoder code).
Er.102	Speed uncontrollable fault	The torque reference direction reverses to the speed feedback direction under torque control mode； The speed reference direction reverses to the speed feedback direction under speed or position control mode；	Incorrect wiring of U,V and W phase sequence	Wiring according to correct U, V and W phase sequence.
			When power on, the signal disturbed and lead to wrong detection of motor shaft initial phase position	Recharge.
			Wrong encoder type or wrong wiring	Replaced matched drive and motor. When adopt our drive and motor, please ensure correct setting of F00.03. Reconfirm motor type, encoder type and wring of encoder.
			Wrong wiring or aging corrosion of encoder, loosening of encoder connector	Weld, fasten, or replace the encoder cable again.
			Gravity load too heavy in vertical axis working condition	Decrease the load of vertical axis, increase rigidity or disabled this fault if it not make influence on safety and using.
Er.103	IGBT protection	Short circuit signal detected by hardware	Braking resistor too small or short circuit	If internal braking resistor used and the value is “65535”, please change to using external braking resistor (F01.16=1/2) and removed the wire between RB and B. The resistance value and power can be chosen in accordance with the internal brake resistor specification;

				If used external braking resistor and the resistance value is less than the value in F01.11，please refer to “2.7 Braking resistor settings”, replace a new resistor and connect it between(+) and B.
			Poor motor cable contact	Tighten loose and detached wires
			Motor cable grounding	Replace motor when bad insulation
			Motor U V W cables short circuit	Connect motor cable correctly
			Servo motor burn out	Replace motor when unbalance of motor wires
			Wrong wiring or aging corrosion of encoder, loosening of encoder connector	Weld, fasten, or replace the encoder cable again.
			Servo drive fault	Replace servo drive
Er.104	Grounding to earth during operation	Short circuit signal detected by software	Poor motor cable contact	Tighten loose and detached wires
			Servo drive power cable of (U V W) short circuit to earth	Rewiring or replace servo drive power cable
			Motor cable grounding	Replace motor when bad insulation
			Motor U V W cables short circuit	Connect motor cable correctly
			Servo motor burn out	Replace motor when unbalance of motor wires
			Servo drive fault	Replace servo drive
Er.105	Encoder fault	Encoder Z signal be disturbed and lead to too large electrical angle that Z signal corresponding	Wrong wiring of encoder	Rewiring according to correct wiring diagram
			Loosing of encoder wires	Rewire and ensure the encoder terminals are tightly connected.
			Encoder Z signal be disturbed	Priority to use our standard cable; If non-standard wiring, please check whether the cables conform to the requirements of the specification, whether or not to use twisted-pair shielded wire, etc. As possible to separate the wring of strong and weak current lines. Do not tie and bound motor cables and

				encoder cable together. Ensure good contact of the ground of motor and drive. Check it whether the both ends of the encoder plug contact is good and whether any needles retract or not and so on.
			Encoder error	Replace encoder wires that can work normal. If no problem of encoder cables, so it's mainly encoder problem and need to replace servo motor.
Er.106	Bus type encoder data validation error	Abnormal of encoder internal parameters	Serial encoder cable break or loosen	Ensure whether the encoder cables break or in bad contact etc. If the motor cable and encoder cable are tied and bounded together, please separate the wring of them.
			Reading abnormal of serial encoder parameters	Replace servo motor.
Er.107	Z pulse lost fault	2500 lines increment encoder Z signal lost	Encoder failure leads to Z signal lost	Replace servo motor.
			Poor or wrong wiring leads to Z signal lost	Check the encoder cable contact well or not, rewiring or replace cables.
			Serious disturb on encoder signal	Adopt encoder connection cables that we provided and separate them from the wiring of power cables.
Er.108	Wrong reading of increment encoder UVW	After power on, wrong reading of 2500 lines increment encoder initial phase position information	Mismatch of drive and motor type	Replace matched motor and drive
			Encoder cables break	Replace encoder cables and tighten connects.
Er.109	Break wire of increment pulse encoder	Hardware detected AB signal of 2500 lines increment encode lost	Encoder failure leads to AB signal lost	Replace servo motor.
			Poor or wrong wiring leads to AB signal lost	Check the encoder cable contact well or not, rewiring or replace cables.
			Serious disturb on encoder signal	Adopt encoder connection cables that we provided and separate them from the wiring of power cables.
Er.110	Bus type	Hardware detected	Encoder failure leads to	Replace servo motor.

	encoder break wire	BUS type encode communication signal lost	communication signal lost	
			Serious disturb on encoder signal	Adopt encoder connection cables that we provided and separate them from the wiring of power cables.
Er.200	Drive overload	The accumulated heat of the drive is too high and reached the fault threshold.	Wrong settings of parameters	Please contact us when the value of F00.00 not matches with drive nameplate; Adjust gain parameters properly according to current feedback effect.
			High load rate of drive(load inertia large)	Reselect drive with larger power
			High load rate of drive(Mechanical stuck and stop)	Remove mechanical stuck and stop
			Motor blocked	Refer to Er.305 troubleshooting measures
Er.201	Over-current fault	Software detected over-current	Input reference synchronizes with servo on or too fast	Instruction sequencing：After the operation panel of servo drive displays normally, please turn on the servo enable signal (S-ON) first, then input instruction. Add instruction filter time constant or increase Acc/Dec time when allowable.
			Braking resistor too small or short circuit	If internal braking resistor used and the value is “65535”，please change to using external braking resistor (F01.16=1/2) and removed the wire between RB and B. The resistance value and power can be chosen in accordance with the internal brake resistor specification; If used external braking resistor and the resistance value is less than the value in F01.11，please refer to “2.7 Braking resistor settings”, replace a new resistor and connect it between(+) and B.
			Poor contact of motor cables	Tighten loose and detached wires
			Motor cable grounding	Replace motor when bad insulation

			Motor U V W cables short circuit	Connect motor cable correctly
			Servo motor burn out	Replace motor when unbalance of motor wires
			Improper gain settings makes motor to oscillate	Refer to “5.7 Load inertia identification and warning processing” and adjust gain.
			Wrong wiring or aging corrosion of encoder, loosening of encoder connector	Weld, fasten, or replace the encoder cable again.
			Servo drive fault	Replace servo drive
Er.202	Main circuit overvoltage	DC BUS voltage between + and – over fault threshold	High voltage input of main circuit	Change or adjust voltage according to below specifications: 220V drive: Effective value: 220V～240V Allowable deviation:-10%～+10%(198V～264V) 380V drive： Effective value: 380V～440V Allowable deviation:-10%～+10%(342V～484V)
			Power source not stable or influenced by lightning stroke	After connect the surge suppressor, turn on the control power and the main circuit power. If the fault still occurs, please replace the servo drive.
			Braking resistor failure	If the resistance value is “∞” (infinite), braking resistor broken inside. If used internal braking resistor, please change it to use external braking resistor (F01.16=1/2) and removed the wire between RB and B. The resistance value and power can be chosen in accordance with the internal brake resistor specification; If used external braking resistor, please replace a new resistor and connect it between (+) and B. Be sure to set F01.17 (external braking resistor power) and F01.18 (external braking resistor resistance value) consistent with specifications of the actual used external

				braking resistor.
			External braking resistor value is too large and maximum braking energy cannot be fully absorbed	Replace another external braking resistor which has recommended value and reconnect it between (+) and B. Be sure to set F01.17 (external braking resistor power) and F01.18 (external braking resistor resistance value) consistent with specifications of the actual used external braking resistor.
			Motor runs in the state of rapid acceleration and deceleration, and the maximum braking energy exceeds the absorbable value	Ensure the main circuit input voltage is in specification range firstly. Then increase Acc/Dec time if it's allowable.
			The sampling value of DC BUS voltage has large deviation	Consult our technical support.
			Servo drive fault	Replace servo drive
Er.203	Main circuit under-voltage during operation	DC BUS voltage between + and – under fault threshold	Main circuit power source not stable or power off	Increase power source capacity, for more details please refer to "2.5 Servo system specifications"
			Interrupt power-supply	
			Power source voltage decreases during operation	
			Loss phase: The drive runs with single phase input but actually 3 phase power source needed.	Replace cables and wiring main circuit power cables correctly: Three phase:L1、L2、L3 Single phase:L1、L2
			Servo drive fault	Replace servo drive
Er.204	Motor parameter self-learning fault	The drive occurs fault during servo motor parameters self-learning	Poor contact of three phase output cables	Replace cables and wiring them correctly
			Current abnormal during self-learning	Select motor matches with drive
			If F10.46=2041, fault occurs during stator identification	Restart identification after confirm the output cables are normal.
			If F10.46=2042 or F10.46=2043 ,fault occurs during inductance identification	Restart identification after confirm the output cables are normal and select matched servo motor with drive.
			Incorrect settings of carrier frequency during identification	If F10.46 is 2044, please contact with manufacturer
Er.205	Encoder self-turning	Fault occurs in the drive during	Incorrect sequence wiring of motor power terminals UVW	1. If the motor runs clockwise during self-learning, exchange

	fault	self-learning of 2500 lines optical-electricity encoder installing information and motor UVW wiring sequence		any two phases of the UVW power line and restart self-learning after exchanged. 2. If the motor runs counterclockwise during self-learning and the motor encoder is 2500 lines optical-electricity type, exchange the wiring of encoder A and B signals. Restart self-learning after exchanged. 3. If the motor runs counterclockwise during self-learning and the motor encoder is BUS type, it means the encoder is mismatch, please contact manufacturer to replace motor.
			Not found Z signal	Restart identification after confirm the wiring of 2500 lines encoder is reliable.
			The UVW signal wires of 2500 lines optical-electricity encoder have problem	Restart identification after confirm the wiring of 2500 lines encoder is reliable.
Er.206	Break wire of temperature detection	Software detected temperature circuit occurred fault	IGBT temperature detection circuit fault	Replace servo drive
Er.207	Internal fault 1	Internal watchdog fault	Internal watchdog trigger	Consult our technical support.
Er.208	Internal fault 2			
Er.209	Internal fault 3	Internal timing error		
Er.211	EEPROM Read/write fault	① Can't write parameters value into E^2PROM; ②Can't read parameters value from E^2PROM;	Abnormal when writing parameters	After modify some parameters, recharge the drive and check whether the settings of the parameters saved or not. If still be saved and the fault still exist, please replace drive.
			Abnormal when reading parameters	
Er.212	External device fault		External device fault	Disconnect the external device fault terminal after the external fault has been handled.
Er.213	Command conflict fault	Redundant servo command signal occurs when the drive is executing a command	When internal enable signal valid, the external servo enable signal(S-ON)is valid	The servo drive can only execute one command of the auxiliary function or serve ON command at any time.
Er.214	Control circuit under-voltage during	For 220V drive: Normal value: 310V,	Control circuit power source not stable or instantaneous power failure occurs	Recharge the drive. In case of abnormal power loss, please ensure the power source is

	operation	Fault value: 160V; For 380V drive: Normal value: 540V, Fault value: 350V.		stable and increase the power source capacity.
			Poor contact of control cables	Rewiring or replace cables
Er.215	Output loss phase fault	Motor output loss phase detected by the drive	Poor contact of motor cables	Tighten loose and detached wires
			Motor cables grounding	Replace motor when bad insulation
			Motor U V W cables short circuit	Connect motor cable correctly
			Servo motor burn out	Replace motor when unbalance of motor wires
			If the above problems not exist, please disable function of the output loss phase detection during operation (F09.02=0).	
Er.216	Heatsink overheat	The temperature of the drive power IGBT is higher than high temperature protection point	Ambient temperature is too high.	Improve cooling conditions of servo drive and reduce ambient temperature.
			When overload occurs, Power off the servo drive to reset overload fault many times	Change reset method of fault. After overload occurs, wait 30s and then reset it. Increase capacity of servo drive and motor, increase Acc/Dec time and reduce load.
			Fans broken	Replace drive
			The installation direction of servo drive and the separation from other servo drives are unreasonable	Install servo drive according to mounting requirements.
			Servo drive failure	Replace drive
Er.217	Current detection circuit fault	Current detection circuit fault detected by drive	Control board connection or plug-in loose	Rewiring and then power on again
			Auxiliary power failure	Seek service from manufacturer or agents.
			Current detection parts failure	
			Amplify circuit abnormal	
Er.218	Brake abnormal open	After brake protection is enabled, the brake output signal is inactive, but detected that the motor rotates for two revolutions.	Motor brake abnormal open	Rewiring according to correct wring or replace the motor.
Er.300	Motor overload	Heat accumulation of the motor is too	Wiring of motor and encoder is incorrect	Connect cables according to correct wiring diagram;

	protection	high and reaches the fault level.	or poor	Priority to use our standard configured cables; Self-made cable used, please make and connect them according to hardware wiring guidance.
			The load is too heavy and the motor keeps output effective torque which higher than rated torque for a long time.	Replace servo drive with larger power and matched servo motor or reduce the load and increase Acc/Dec time.
			Acceleration or deceleration is too frequent or the load inertia is too large.	Increase Acc/Dec time during each operation.
			The gain is Improper or rigidity is too high.	Adjust the gain by referring to "5.7 Load inertia identification and warning processing and readjust the gain.
			The drive or motor model set incorrectly.	Check drive and motor nameplate and set correct drive type and motor type according to "2.5 Servo system specifications".
			Locked-rotor occurs due to mechanical factors lead to motor blocked and resulting in much heavy load during operation.	Eliminate mechanical factors.
			Servo drive failure	Replace drive
Er.301	Main circuit input loss phase	Three phase drive loss phase	Poor wiring of three phase input cables	Replace cables and wiring main circuit cables correctly.
			Single phase power is applied to three phase specification drive.	If input voltage satisfies specification requirements, please set F09.00 as 0 (Disable input loss phase detection); In other cases, if input voltage does not satisfy specification requirements, replace or adjust power source.
			Three phase power source unbalanced or voltages of all three phases too low.	
Er.302	Over-speed protection	The actual speed of the servo motor exceeds the fault threshold	Motor cables UVW phase sequence incorrect.	Connect UVW cables according to correct phase sequence.
			Incorrect setting of F09.09 parameter	Reset over-speed fault threshold according to mechanical requirement
			Input reference exceeds the fault threshold.	Position control mode: When the position reference is

				pulse reference,: on the premise of ensuring the accuracy of the final positioning, please reduce the pulse reference frequency or reduce the electronic gear ratio if the operating speed is allowed; Speed control mode: check the input speed reference value or speed limitation value in (F05.08～F05.10) and ensure them within the range of over speed fault threshold; Torque control mode: please set the speed limitation threshold within the over speed fault threshold and the speed limitation in torque control mode please refer to "5.3 Torque control mode".
			Motor speed overshoot	Refer to "5.7 Inertia identification" to adjust gain or adjust the operating conditions of machinery.
			Servo drive failure	Replace servo drive
Er.303	Pulse output over speed	When pulse output function used (F04.25=0 or 1), the frequency of output pulses exceeds frequency upper limit allowed by the hardware (392KHz).	The frequency of output pulses exceeds frequency upper limit allowed by the hardware(240KHz)	① When F04.25=0，decrease F04.26(Encoder Frequency demultiplication pulses)，making output pulse frequency below frequency upper limit allowed by hardware in the speed range required by mechanical condition. ② When F04.25=1，Decrease input pulse frequency to within frequency upper limit allowed by hardware. In this case, if not modify electronic gear ratio, motor speed will be slow. If input pulse frequency is very high but is still within frequency upper limit allowed by hardware, take anti-interference measures(use shielded twisted pair cables for pulses input and set pin filter parameters F09.13 or F09.16), which prevents interference pulse adding to actual pulse and resulting in fault

				misreported.
Er.304	Pulse input over speed	Input pulses frequency higher than Max. position pulses frequency(F09.12)	Input pulses frequency higher than Max. position pulses frequency(F09.12)	Reset F09.12 according to the maximum position pulses frequency that required for normal operation of the machine. If output pulse frequency of host computer is higher than 4 MHz, it has to be decreased.
			Input pulses disturbed	Firstly, use shielded twisted pair cables for pulses input and separate pulse input cable from servo drive power cables. Secondly, if differential input is selected on the condition of using low-speed pulse input terminal (F04.03=0), host computer ground must be connected to GND of servo drive reliably. If open-collector input is selected, host computer ground must be connected to COM of servo drive reliably. Only differential input can be selected on the condition of using high-speed pulse input terminal (F04.03=1), host computer ground must be connected to GND of servo drive reliably. Finally, according to selected hardware input terminal, increase pin filter time of pulse input terminal in F09.13.
Er.305	Motor blocked	Actual motor speed lower than 10 rpm but torque reference reaches the limit and the duration reaches the value set in F09.17	Drive U,V,W output loss phase or wrong phase sequence connection	Connect cables correctly again or replace them.
			Drive U,V,W output cables or encoder cables break wire	
			Mechanical factors caused motor blocked	Eliminate mechanical factors.
Er.306	Encoder battery failure	The voltage of absolute encoder battery lower than 3.0V	Battery not connected during power off period	Set F12.02 as 1to clear fault
			Encoder battery voltage too low	Replace new battery with matched voltage
Er.307	Encoder multi-cycle	Encoder multi-cycle counting error	Encoder failure	Replace motor

	counting error			
Er.308	Encoder multi-cycle counting overflow	Encoder multi-cycle counting overflow detected	When F09.18=0, encoder multi-cycle counting overflow detected	Replace motor
Er.309	AD sampling overvoltage	AI sampling value is larger than the voltage value in F09.07	Input voltage of AI channel is high	Adjust input voltage and check the sampling voltage until sampling voltage not exceeds the set voltage in F09.07.
			Wrong wiring of AI channel or interference exists	Use shielded twisted pair cable and choose shorten length cable. Increase AI filter time constant: AI1 filter time constant：F02.25 AI2 filter time constant：F02.28
Er.310/ Er.311	Too large position deviation/ Too large position deviation of full closed-loop	Position deviation larger than the setting value in F09.10 in position control mode	Drive U,V,W output loss phase or wrong phase sequence connection	Connect cables correctly again or replace them.
			Drive U,V,W output cables or encoder cables break wire	Rewiring and power cables UVW of servo motor and power cables UVW of servo drive must be one to one correspondence. Replace the cable if necessary and ensure its reliable connection.
			Mechanical factors caused motor blocked	Eliminate mechanical factors.
			Servo drive gain is low	Refer to Chapter 5 adjust gain manually or automatic auto-tuning
			High frequency of input pulses	Reduce position reference frequency or decrease electronic gear ratio. When host computer is used to output position pulses, set the Acc/Dec time in host computer. If host computer not allowed to set Acc/Dec time, please increase parameters F04.05 and F04.06 to increase smoothen parameters of position reference.
			According to operation condition, fault value in (F09.10)too small	Increase the value in F09.10
			Servo drive or motor failure	If the position reference is not 0 but the position feedback is

				always 0, please replace the servo drive or motor.
Er.312	The settings of electronic gear ratio exceed limitation	Any group of electronic gear ratio exceeds the limit value	The set value of electronic gear ratio beyond the above range	Make the ratio value of encoder resolution/F04.07, F04.09/F04.11 and F04.13/F04.15 set within the limit.
			Parameter modify order problems	Use the fault reset function or power on again
Er.313	Modbus communication fault	Communication occurs problems	Incorrect Baud rate setting	Setup Baud rate properly
			Incorrect setting of fault and warning parameters	Set proper values according to the communication of the upper computer.
			Interference is too large	Rewiring

6.2.3 Troubleshooting of warnings

Fault code	Fault type	Principle of causing	Possible causes of failure	Countermeasures
AL.400	Reserved			
AL.401	Encoder battery warning	The voltage of absolute encoder battery is lower than 3.0V	The voltage of absolute encoder battery is lower than 3.0V	Replace new battery with matched voltage
AL.402	DI emergency stop warning	DI function No.33(FunIN.33：Brake，Emergency)	DI function No.33，Brake is triggered	Check the operation mode ,after confirm the safety then remove the DI brake valid signal
AL.403	Too small of external braking resistor connecting warning	F01.18(external braking resistor resistance value) less than F01.11(The Min. value of external braking resistor for drive operation)	When using external braking resistor (F01.16=1),the resistance value less than minimum value allowed by the drive	① When the external resistor resistance value less than F01.11，replace resistor that match with the drive. After set the selected resistance value in F01.18, please connect the resistor between + and B. ② If the external resistor resistance value larger than F01.11，set the resistance value of the actual external resistor in F01.18.
AL.404	Recharging needed after parameters modification warning	When the valid mode of servo drive function code is “valid after power on again”, the value of the parameters has been changed,	Modify parameters which is valid after power on again	Power on again

		the drive reminds the user to power on again.		
AL.405	Forward direction over-travel warning	Forward direction over-travel signal occurs	DI function No.14: Forbid forward direction drive used and the terminal is valid	Check the operation mode. After confirm it is safety, send a reverse reference or turn around the motor and make the terminal logic of "Forward direction over-travel" invalid.
			Maximum value of software limit over range	Check the value of F10.07 whether out of the limit of F09.20，if out of range, please adjust F09.20.
AL.406	Backward direction over-travel warning	Backward direction over-travel signal occurs	DI function No.15: Forbid reverse direction drive used and the terminal is valid	Check the operation mode. After confirm it is safety, send a forward reference or turn around the motor and make the terminal logic of "reverse direction over-travel" invalid.
			Minimum value of software limit over range	Check the value of F10.07 whether out of the limit of F09.20，if out of range, please adjust F09.20.
AL.407	IGBT overheat warning	Drive detected IGBT temperature exceeds warning level	Ambient temperature is too high.	Improve cooling conditions of servo drive and reduce ambient temperature.
			After warning occurs, Power off the servo drive to reset warnings many times	Increase capacity of servo drive and motor, increase Acc/Dec time and reduce load.
			Fans broken	Replace servo drive
			The installation direction of servo drive and the separation from other servo drives are unreasonable	Install servo drive according to mounting requirements.
			Servo drive failure	Replace servo drive
AL.408	Running limit time warning	The running limit time arrived	Drive limit time of running arrived	Please contact supplier

6.2.4 Operation panel communication fault

Fault code	Fault type	Principle of causing	Possible causes of failure	Countermeasures
Er.999	Operation panel communication fault	Operation panel CPU has communication fault with host computer CPU	Operation panel CPU has communication fault with host computer CPU	Replace drive or control board

7 Function code parameter list

7.1 Symbol description in the table

P ---- Position mode
S ---- Speed mode
T ---- Torque mode

7.2 Function code directory

Function code group	Parameter group summary	Function code group	Parameter group summary
F00	Servo motor parameters	F11	Communication parameters
F01	Basic control parameters	F12	Auxiliary function parameters
F02	Input terminal parameters	F13	Full closed-loop function parameters
F03	Output terminal parameters	F14	Multi-position function parameters
F04	Position control parameters	F15	Multi-speed function parameters
F05	Speed control parameters	F16	Reserved parameters
F06	Torque control parameters	F17	Fault record parameters
F07	Gain parameters	F18	Manufacturer parameters
F08	Automatic gainadjustmentparameters	F19	Servo variables reading via communication(keypad not display)
F09	Protection parameters	F20	Servo variables setting via communication(keypad not display)
F10	Monitoring parameters	-	-

7.3 Function code parameter list

F00-Servo motor parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F00.00	Driver rated power	0.01～655.35	KW	Model determination	-	Display	-
F00.01	Driver rated current	0.01～655.35	A	Model determination	-	Display	-
F00.02	Driver rated voltage	100～480	V	Model determination	-	Display	-
F00.03	Motor code	0～83(See the motor selection table for details.)	-	Model determination	Power on again	Downtime sset	-
F00.04	Motor rated power	0.01～655.35	KW	Model determination	Effective instan	Downtime set	-

					tly		
F00.05	Motor rated voltage	100～480	V	Model determination	Effective instantly	Down time set	-
F00.06	Motor rated current	0.01～655.35	A	Model determination	Effective instantly	Down time set	-
F00.07	Motor rated torque	0.01～655.35	Nm	Model determination	Effective instantly	Down time set	-
F00.08	Motor max. torque	0.01～655.35	Nm	Model determination	Effective instantly	Down time set	-
F00.09	Motor rated rotate speed	100～6000	rpm	Model determination	Effective instantly	Down time set	-
F00.10	Motor max. rotate speed	100～6000	rpm	Model determination	Effective instantly	Down time set	-
F00.11	Rotor inertia Jm	0.01～655.35	$Kg.cm^2$	Model determination	Effective instantly	Down time set	-
F00.12	Pole pairs number of PMSM Np	2～360	Pole pairs	Model determination	Effective instantly	Down time set	-
F00.13	Stator resistance Rs	0.001～65.535 (Motor power of 3KW and above accuracy is 0.0001Ω)	Ω	Model determination	Effective instantly	Down time set	-
F00.14	Stator inductance Ld	0.01～655.35 (Motor power of 3KW and above accuracy is 0.001mH)	mH	Model determination	Effective instantly	Down time set	-
F00.15	Stator inductance Lq	0.01～655.35 (Motor power of 3KW and above accuracy is 0.001mH)	mH	Model determination	Effective instantly	Down time set	-
F00.16	Linear back EMF coefficient Ke	0.01～655.35 (Line voltage valid value)	V/Krpm	Model determination	Effective instantly	Down time set	-
F00.17	Torque coefficient Kt	0.01～655.35	Nm/Arms	Model determination	Effective instantly	Down time set	-
F00.18 ～ F00.20	Reserved						

F00.21	Encoder code	0：2500 lines encoder-15 lines encoder 1：2500 lines wires simplified encoder-9 lines encoder 2～4：Reserved 5：17-bit bus absolute value encoding(Tamagawa protocol) 6：20-bit bus absolute value encoding(Tamagawa protocol) 7：23-bit bus absolute value encoding(Tamagawa protocol) 8～15：Reserved	-	Model determination	Power on again	Down time set	-
F00.22	Encoder fine	1000～8388608	P/r	Encoder determination	Effective instantly	Down time set	-
F00.24	Electrical angle of signal Z	0.0～360.0	°	Model determination	Effective instantly	Down time set	-
F00.25	Encoder direction negative	0：invalid 1：reverse Note: valid only for photoelectric encoders	-	0	Effective instantly	Down time set	-
F00.26	Abs. encoder angle of installation	0.0～360.0	°	Model determination	Effective instantly	Down time set	-
F00.27	Delay time of encoder	0.0～360.0	us	Encoder determination	Effective instantly	Down time set	-
F00.28	Electrical angle of U、V、W=001	0.0～360.0	°	Model determination	Effective instantly	Down time set	-
F00.29	Electrical angle of U、V、W=010	0.0～360.0	°	Model determination	Effective instantly	Down time set	-
F00.30	Electrical angle of U、V、W=011	0.0～360.0	°	Model determination	Effective instantly	Down time set	-
F00.31	Electrical angle of U、V、W=100	0.0～360.0	°	Model determination	Effective instantly	Down time set	-
F00.32	Electrical angle of U、V、W=101	0.0～360.0	°	Model determination	Effective instantly	Down time set	-
F00.33	Electrical angle of U、V、W=110	0.0～360.0	°	Model determination	Effective instantly	Down time set	-
F00.34	Manufacturer						

～ F00.60	parameters						

F01-Basic control parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F01.00	Control mode selection	0：Position mode 1：Speed mode 2：Torque mode 3：Torque mode⟷Speed mode 4: Speed mode⟷ Position mode 5：Torque mode⟷ Position mode	-	0	Effective instantly	Down time set	-
F01.01	Absolute system selection	0：Incremental position mode 1：Absolute position linear mode 2：Reserved	-	0	Power on again	Down time set	PST
F01.02	Reserved						
F01.03	S-ON OFF stop mode selection	0: Free stop, keep free running 1：Slow down, keep free running	-	0	Effective instantly	Down time set	PST
F01.04	Fault No3 stop mode selection	0：Free stop, keep free running 1：Deceleration stop, keep free running	-	0	Effective instantly	Down time set	PST
F01.05	over-stroke stop mode selection	0：Free stop, keep free running 1：Zero speed stop, position remains locked 2：Zero speed stop, keep free running	-	2	Effective instantly	Down time set	PST
F01.06	Brake control selection	0：Invalid 1：Valid	-	0	Effective instantly	Down time set	PST
F01.07	Release braketo command receive delay	0～1000 (The position/speed/torque command is 0 during this time)	ms	250	Effective instantly	Down time set	PST
F01.08	Brake to motor no power on delay	1～1000 Note: This parameter must match the deceleration stop mode.	ms	150	Effective instantly	Down time set	PST
F01.09	Speed threshold for motor brake	0～3000	rpm	30	Effective instantly	Down time set	PST
F01.10	Reserved						
F01.11	Min. resistance of braking resistor allowed by driver	1～65535	Ω	Model determination	-	Display	-
F01.12	Power of built in braking resistor	0～65535	W	Model determinatio	-	Displ ay	-

				n			
F01.13	Resistance of built in braking resistor	1～65535 (65535represents no built-in resistor)	Ω	Model determination	-	Display	-
F01.14	Voltage value of built in braking	300.0～1100.0	V	380.0/690.0	Effective instantly	Run time set	-
F01.15	Resistor heat dissipation coefficient	10～100	%	30	Effective instantly	Run time set	-
F01.16	Braking resistor setting	0：Use built-in braking resistor 1：Use external braking resistor 2：Without using braking resistor, rely on capacitor absorption	-	0	Effective instantly	Run time set	-
F01.17	Power of external braking resistor	0～65535	W	0	Effective instantly	Run time set	-
F01.18	Resistance of external braking resistor	1～65535	Ω	65535	Effective instantly	Run time set	-
F01.19	Parameters operation control	0: All parameters are allowed to be modified 1: Except for this parameter, all other parameters are not allowed to be modified 2: Except for the F00 group parameters, all other parameters are allowed to be modified	-	2	Effective instantly	Down time set	-
F01.20	Reset to default value	0: no action 1: All parameters except the motor parameters are restored to the Default value (excluding the F00 and F17 parameters) 2: The fault record restores the Default value (only F17 group) 3: All parameters are restored to the Default value of 1 (excluding the F00 group) 6666: All parameters are restored to the Default value of 2 (excluding the F17 group parameters) 7777: All parameters are restored to the Default value of 3 (all parameters)	-	0	Power on again	Down time set	-
F01.21	Monitoring status C-0 selection	0～66 Note 1: The monitoring interface includes two types: parameter editing interface and monitoring interface. Note 2: Parameter editing interface: auxiliary operation interface of each level and special	-	0	Effective instantly	Run time set	-

		monitoring parameters (motor test run shows current running speed, inertia learning shows current inertia, three self-learning operation shows turn1, 2, 3 fixed angle output shows current specific Z state and electrical angle variables), the rigid table adjust display interface. In the auxiliary operation interface, the alarm, alarm interface, and bus undervoltage interface are also displayed preferentially. Note 3: The priority of the monitoring interface is as follows: Power-on display 88888--not flashing display; Alarm and alarm interface--flashing display; Busbar undervoltage interface--flashing display; LED full light indication interface - no flashing; C-X monitoring interface--C-X content is displayed when the machine is stopped. When the servo is on, the content of C-X is displayed without flashing. When Shift is pressed, C-X is displayed first, and then the corresponding content is displayed.					
F01.22	Monitoring status C-1 selection	0～66		3	Effective instantly	Run time set	-
F01.23	Monitoring status C-2 selection	0～66		4	Effective instantly	Run time set	-
F01.24	Monitoring status C-3 selection	0～66		5	Effective instantly	Run time set	-
F01.25	Monitoring status C-4 selection	0～66		14	Effective instantly	Run time set	-
F01.26	Monitoring status C-5 selection	0～66		50	Effective instantly	Run time set	-
F01.27	Refresh time of display	1～20	10ms	4	Effective instantly	Run time set	-
F01.28	Bus voltage adjust	0.900～1.100	-	1.000	Effective	Run time	-

	coefficient				instantly	set	
F01.29	Encryption time	0～65535	h	0	Effective instantly	Run time set	-
F01.30	Cooling fan control selection	0：Intelligent fan 1：Always running after power-on 2：The fan is forbidden to run,but automatically running when the temperature is higher than 75 degrees	-	0	Effective instantly	Run time set	-
F01.31	LED alarm display selection	0：Immediately output warning information 1：Do not output warning information	-	0	Effective instantly	Run time set	PST
F01.32	Reserved						
F01.33	Fault reset selection setting	0：Fault reset when servo enable is invalid 1：Fault reset when servo enable is invalid and valid	-	0	Effective instantly	Run time set	PST
F01.34	Reserved						
F01.35	Reserved						

F02-Input terminal parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F02.00	DI source selection	0～FF (2^8,The corresponding bit is 1, which is derived from the communication given F20.00)	-	0	Effective instantly	Run time set	-
F02.01	DI1 filter time	0～50	125us	8	Effective instantly	Run time set	-
F02.02	DI1 function selection	0: No function 1: Servo enable 2: Fault and warning reset 3: Gain switching 4: Main and auxiliary operation command switching 5: Multi-speed DI switching direction setting 6: Multi-segment running command switch 1 7: Multi-segment running command switch 2 8: Multi-segment running command switch 3 9: Multi-segment running command switch 4 10: Control mode switching 11: External device fault input	-	1	Effective instantly	Run time set	-

		12: Zero fixed enable 13: Position command is forbidden 14: Forward over-stroke switch 15: Reverse over-stroke switch 16: positive external torque limit 17: Negative external torque limit 18: Forward jog 19: Reverse jog 20: Step enable 21~23: Reserved 24: Electronic gear selection 25: Torque command direction setting 26: Speed command direction setting 27: Position command direction setting 28: Multi- position command enable 29: Interrupt fixed length state release (edge valid) 30: Origin switch 31: Origin return enable (edge valid) 32: Interrupt fixed length prohibition 33: Emergency stop 34: Clear position deviation (edge valid) 35: Pulse command prohibition 36: Simple PLC pause 37: Simple PLC status reset 38: Interrupt fixed length trigger switch 39～63：Reserved					
F02.03	DI1 logic selection	Input polarity: 0~4 0： low level is valid 1： high level is valid 2： rising edge is valid 3： falling edge is valid 4： both rising and falling edges are valid	-	0	Effective instantly	Run time set	-
F02.04	DI2 filter time	0～50	125us	8	Effective instantly	Run time set	-
F02.05	DI2 function selection	Same as F02.02	-	14	Effective instantly	Run time set	-
F02.06	DI2 logic selection	Input polarity: 0~4 0： low level is valid 1： high level is valid 2： rising edge is valid 3： falling edge is valid 4： both rising and falling edges are valid	-	0	Effective instantly	Run time set	-

F02.07	DI3 filter time	0～50	125us	8	Effective instantly	Run time set	-
F02.08	DI3 function selection	Same as F02.02	-	15	Effective instantly	Run time set	-
F02.09	DI3 logic selection	Input polarity: 0~4 0： low level is valid 1： high level is valid 2： rising edge is valid 3： falling edge is valid 4： both rising and falling edges are valid	-	0	Effective instantly	Run time set	-
F02.10	DI4 filter time	0～50	125us	8	Effective instantly	Run time set	-
F02.11	DI4 function selection	Same as F02.02	-	13	Effective instantly	Run time set	-
F02.12	DI4 logic selection	Input polarity: 0~4 0： low level is valid 1： high level is valid 2： rising edge is valid 3： falling edge is valid 4： both rising and falling edges are valid	-	0	Effective instantly	Run time set	-
F02.13	DI5 filter time	0～50	125us	8	Effective instantly	Run time set	-
F02.14	DI5 function selection	Same as F02.02	-	2	Effective instantly	Run time set	-
F02.15	DI5 logic selection	Input polarity: 0~4 0： low level is valid 1： high level is valid 2： rising edge is valid 3： falling edge is valid 4： both rising and falling edges are valid	-	0	Effective instantly	Run time set	-
F02.16	DI6 filter time	0～50	125us	8	Effective instantly	Run time set	-
F02.17	DI6 function selection	Same as F02.02	-	12	Effective instantly	Run time set	-
F02.18	DI6 logic selection	Input polarity: 0~4 0： low level is valid 1： high level is valid 2： rising edge is valid	-	0	Effective instantly	Run time set	-

		3： falling edge is valid 4： both rising and falling edges are valid					
F02.19	DI7 filter time	0～50	125us	8	Effective instantly	Run time set	-
F02.20	DI7 function selection	Same as F02.02	-	31	Effective instantly	Run time set	-
F02.21	DI7 logic selection	Input polarity: 0~4 0： low level is valid 1： high level is valid 2： rising edge is valid 3： falling edge is valid 4： both rising and falling edges are valid	-	0	Effective instantly	Run time set	-
F02.22	DI8 filter time	0～50	125us	2	Effective instantly	Run time set	-
F02.23	DI8 function selection	Same as F02.02(high speed input terminal)	-	0	Effective instantly	Run time set	-
F02.24	DI8 logic selection	Input polarity: 0~4 0： low level is valid 1： high level is valid 2： rising edge is valid 3： falling edge is valid 4： both rising and falling edges are valid	-	0	Effective instantly	Run time set	-
F02.25	AI1 filter time	0～655.35	ms	2.00	Effective instantly	Run time set	-
F02.26	AI1 offset	-5000～5000	mV	0	Effective instantly	Run time set	-
F02.27	AI1 dead zone	0～1000.0	mV	10.0	Effective instantly	Run time set	-
F02.28	AI2 filter time	0～655.35	ms	2.00	Effective instantly	Run time set	-
F02.29	AI2 offset	-5000～5000	mV	0	Effective instantly	Run time set	-
F02.30	AI2 dead zone	0～1000.0	mV	10.0	Effective instantly	Run time set	-

F02.31	Speed corresponding to 10V	0～6000	rpm	3000	Effective instantly	Run time set	-
F02.32	Torque corresponding to 10V	0.10 times～8.00 times rated torque	Times	1.00	Effective instantly	Run time set	-

F03-Output terminal parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F03.00	DO1 function selection	0: No function 1: Servo ready 2: Motor rotation output 3: Zero speed 4: Consistent speed 5: Positioning completed 6: Positioning is close 7: Torque limit 8: Speed limit 9: Brake output 10: Warning output 11: Fault output 12: Interrupt fixed length is completed 13: Origin return output 14: Electrical zero return output 15: Torque reach output 16: Speed reach output 17: DB braking output 18: Internal command output 19～31：Reserved	-	1	Effective instantly	Run time set	-
F03.01	DO1 logic selection	Output polarity inversion setting: 0~1 0：output low level when valid (optocoupler conduction) 1：output high level when valid (optocoupler off)	-	0	Effective instantly	Run time set	-
F03.02	DO2 function selection	Same as F03.00	-	5	Effective instantly	Run time set	-
F03.03	DO2 logic selection	Output polarity inversion setting: 0~1 0：output low level when valid (optocoupler conduction) 1：output high level when valid (optocoupler off)	-	0	Effective instantly	Run time set	-
F03.04	DO3 function selection	Same as F03.00	-	3	Effective instantly	Run time set	-
F03.05	DO3 logic	Output polarity inversion setting:	-	0	Effect	Run	-

	selection	0~1 0：output low level when valid (optocoupler conduction) 1：output high level when valid (optocoupler off)			ive instantly	time set	
F03.06	DO4 function selection	Same as F03.00	-	11	Effective instantly	Run time set	-
F03.07	DO4 logic selection	Output polarity inversion setting: 0~1 0：output low level when valid (optocoupler conduction) 1：output high level when valid (optocoupler off)	-	0	Effective instantly	Run time set	-
F03.08	DO5 function selection	Same as F03.00	-	13	Effective instantly	Run time set	-
F03.09	DO5 logic selection	Output polarity inversion setting: 0~1 0：output low level when valid (optocoupler conduction) 1：output high level when valid (optocoupler off)	-	0	Effective instantly	Run time set	-
F03.10	DO source selection	0～1F (2^5, The corresponding bit is 1, which is derived from the communication given F20.01)	-	0	Effective instantly	Run time set	-
F03.11	AO1 signal selection	00: Motor speed (1V/1000rpm) 01: Speed command (1V/1000rpm) 02: Torque command (1V/100%) 03: Position deviation (0.05V/instruction Unit) 04: Position deviation (0.05V/encoder Unit) 05: Position command speed (1V/1000rpm) 06: Positioning completion command (positioning completed: 5V; positioning is not completed: 0V) 07: Speed feed forward (1V/1000rpm) 08: AI1 voltage 09: AI2 voltage 10: Output current 1 (0 to 4 times rated motor current) 11: Output current 2 (0 to 4 times rated driver current) 12: Output voltage (0 to 1.2 times rated motor voltage) 13: Bus voltage (0 to 1.5 times rated bus voltage) 14: Communication given (determined by F20.05)	-	0	Effective instantly	Run time set	-

		15: Feedback torque (1V/100%)					
F03.12	AO1 filter time	0～655.35	ms	0.00	Effective instantly	Run time set	-
F03.13	AO1 offset voltage	-9999～9999	mV	0	Effective instantly	Run time set	-
F03.14	AO1 gain	-99.99～99.99	Times	1.00	Effective instantly	Run time set	-
F03.15	AO2 signal selection	Same as F03.11	-	0	Effective instantly	Run time set	-
F03.16	AO2 filter time	0～655.35	ms	0.00	Effective instantly	Run time set	-
F03.17	AO2 offset voltage	-9999～9999	mV	0	Effective instantly	Run time set	-
F03.18	AO2 gain	-99.99～99.99	Times	1.00	Effective instantly	Run time set	-

F04-Position control parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F04.00	Position command source	Interrupt fixed length origin return operation 0: pulse command 1: step amount given 2: Multi-position command given	-	0	Effective instantly	Down time set	P
F04.01	Pulse command form	0: pulse + direction 1: A phase + B phase orthogonal pulse, 4 times frequency 2: CW+CCW	-	0	Power on again	Down time set	P
F04.02	Instruction pulse inversion	0：invalid 1：invert	-	0	Effective instantly	Down time set	P
F04.03	Pulse input terminal selection	0：low speed 1：high speed	-	0	Effective instantly	Down time set	P
F04.04	Step amount	-9999～9999	Command Unit	50	Effective instantly	Down time set	P

F04.05	Position first order low pass filter time	0～1000.0	ms	0.0	Effective instantly	Down time set	P
F04.06	Average value filter time	0.0～128.0	ms	0.0	Effective instantly	Down time set	P
F04.07	Number of position commands per motor revolution	0～8388608（2^{23}）	P/r	0	Power on again	Down time set	P
F04.09	Electronic gear ratio 1 (numerator)	1～1073741824	-	Determined by encoder	Effective instantly	Run time set	P
F04.11	Electronic gear ratio 1 (denominator)	1～1073741824	-	10000	Effective instantly	Run time set	P
F04.13	Electronic gear ratio 2 (numerator)	1～1073741824	-	Determined by encoder	Effective instantly	Run time set	P
F04.15	Electronic gear ratio 2 (denominator)	1～1073741824	-	10000	Effective instantly	Run time set	P
F04.17	Electronic gear ratio switchover condition	0: The position command (command unit) is 0. And switch after 2.5ms 1: real-time switching	-	0	Effective instantly	Down time set	P
F04.18	Position deviation clear action selection	0: Servo enable OFF or when a fault occurs, Clear position deviation 1: When the enable is turned OFF or a fault occurs, Clear position deviation pulse 2: Enable OFF or DI input ClrPosErr signal clears position deviation	-	0	Effective instantly	Down time set	P
F04.19	Output condition of positioning completed	0：output when the absolute value of the position deviation is less than F04.20 1：output when the absolute value of position deviation is less than F04.20 and position command is 0 after filter 2：output when the absolute value of position deviation is less than F04.20 and position command is 0 before filter 3：output when the absolute value of position deviation is less than F04.20 and position command is 0 before filter.Keep the time set by F04.21 valid	-	0	Effective instantly	Down time set	P

F04.20	Positioning completion threshold	1 ～65535	Encoder Unit	Determined by encoder	Effective instantly	Down time set	P
F04.21	Positioning completion window time	0 ～30000	ms	1	Effective instantly	Run time set	P
F04.22	Positioning completion retention time	0 ～30000	ms	0	Effective instantly	Run time set	P
F04.23	Positioning close to the threshold	1～1073741824	Encoder Unit	Determined by encoder	Effective instantly	Down time set	P
F04.25	Servo pulse output source selection	0：Encoder frequency division output 1: Pulse command synchronous output 2：Frequency division or synchronous output prohibit	-	0	Power on again	Down time set	P
F04.26	Encoder frequency division pulse number	35～40000	P/r	500	Power on again	Down time set	P
F04.27	Z pulse output polarity selection	0: Positive output (Z pulse is high level) 1: Negative polarity output (Z pulse is low level)	-	1	Power on again	Down time set	P
F04.28	Frequency division pulse output phase	0: A is ahead of B 1:B is ahead of A	-	0	Power on again	Down time set	P
F04.29	Interrupt fixed length enable	0：Forbid interrupt fixed length function 1：Use interrupt fixed length function	-	0	Power on again	Down time set	P
F04.30	Interrupt fixed length displacement	0～1073741824	Command Unit	1000	Effective instantly	Down time set	P
F04.32	Interrupt fixed length constant speed	0～6000	rpm	200	Effective instantly	Down time set	P
F04.33	Interrupt fixed length acceleration and deceleration time	0～1000	ms	10	Effective instantly	Down time set	P
F04.34	Fixed length lock /release signal enable	0: not enabled 1: enable	-	1	Effective instantly	Down time set	P
F04.35	Origin return enable control	0: Turn off the origin return 1: Input Hom\ming Start signal by DI, enable origin return function 2: Input Homming Start signal by	-	0	Effective instantly	Run time set	P

		DI, enable electrical zero return 3: Start origin return immediately after power on 4: Immediate execute origin return 5: Start the electrical zero return command 6: Taking the current position as the origin					
F04.36	Origin return mode	0: Forward zero return, deceleration point, origin is motor Z signal 1: Reverse zero return, deceleration point, origin is motor Z signal 2: Forward zero return, deceleration point, origin is the origin switch 3: Reverse zero return, deceleration point, origin is the origin switch 4: Forward zero return, deceleration point is the origin switch, the origin is motor Z signal 5: Reverse zero return, the deceleration point is the origin switch, and the origin is the motor Z signal. 6: Forward zero return, deceleration point, origin is forward overtravel switch 7: Reverse zero return, deceleration point, origin is reverse overtravel switch 8: Forward zero return, the deceleration point is the forward overstroke switch, and the origin is the motor Z signal. 9: Reverse zero return, the deceleration point is reverse overstroke switch, the origin is motor Z signal 10: Forward zero return, deceleration point, origin is mechanical limit position 11: Reverse zero return, deceleration point, origin is mechanical limit position 12: Forward zero return, deceleration point is mechanical limit position, origin is motor Z signal 13: Reverse zero return, the deceleration point is the mechanical limit position, and the origin is the motor Z signal.	-	0	Effective instantly	Down time set	P
F04.37	High speed search origin	0～3000	rpm	100	Effective	Down time	P

	switching signal speed				instantly	set	
F04.38	Low speed search origin switching signal speed	0～1000	rpm	10	Effective instantly	Down time set	P
F04.39	Acceleration/deceleration time when searching for the origin	0～6000	ms	1000	Effective instantly	Down time set	P
F04.40	Limit the time to find the origin	0～65535	ms	10000	Effective instantly	Down time set	P
F04.41	Mechanical origin offset	-1073741824 ～1073741824	Command Unit	0	Effective instantly	Down time set	P
F04.43	Mechanical origin offset and processing when a limit is encountered	0:F04.41 is the coordinate after the origin return.After encountering limit re-trigger the origin return enable,then reverse to find the origin. 1:F04.41 is the relative offset after the origin return. After encountering limit re-trigger the origin return enable,then reverse to find the origin. 2:F04.41 is the coordinate after the origin return. Automatically reverse to find zero after encountering Limit. 3:F04.41 is the relative offset after the origin return. Automatically reverse to find zero after encountering Limit.	-	0	Effective instantly	Down time set	P
F04.44	Absolute position linear mode position offset (low 32 bits)	-2147483648～2147483647	Encoder Unit	0	Power on again	Down time set	P
F04.46	Absolute position linear mode position offset (high 32 bits)	-2147483648～2147483647	Encoder Unit	0	Power on again	Down time set	P
F04.48 ～ F04.52	Reserved						
F04.54	Touch stop to zero speed judgment threshold	0～1000	rpm	2	Effective instantly	Run time set	P
F04.55	Touch stop to zero speed torque limit	0～300.0	%	100.0	Effective instan	Run time set	P

					tly		
F04.56 ～ F04.58	Reserved						

F05-Speed control parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F05.00	Main speed command A source	0: Digital given (F05.04) 1: AI1 2: AI2 3: Communication given	-	0	Effective instantly	Run time set	S
F05.01	Auxiliary speed command B source	0: Digital given (F05.04) 1: AI1 2: AI2 3: Multi-speed command 4: Communication given	-	1	Effective instantly	Run time set	S
F05.02	Speed command selection	0: Main speed command A source 1: Auxiliary speed command B source 2: A+B 3: A-B 4: A/B switching	-	0	Effective instantly	Run time set	S
F05.03	Speed command logic inversion	0: positive logic 1: negative logic	-	0	Effective instantly	Run time set	S
F05.04	Speed command keyboard setting value	-6000～6000	rpm	200	Effective instantly	Run time set	S
F05.05	Jog speed setting value	0～6000	rpm	100	Effective instantly	Run time set	PST
F05.06	Speed command acceleration ramp time constant	0～65535	ms	0	Effective instantly	Run time set	S
F05.07	Speed command deceleration ramp timeconstant	0～65535	ms	0	Effective instantly	Run time set	S
F05.08	Maximum speed threshold	0～6000	rpm	4500	Effective instantly	Run time set	PST
F05.09	Forward speed threshold	0～6000	rpm	4500	Effective instantly	Run time set	PST
F05.10	Reverse speed threshold	0～6000	rpm	4500	Effective instan	Run time set	PST

					tly		
F05.11	Zero position fixed speed threshold	0～6000	rpm	10	Effective instantly	Run time set	S
F05.12	Motor rotation speed threshold	0～1000	rpm	20	Effective instantly	Run time set	PST
F05.13	Speed consistent signal threshold	0～100	rpm	10	Effective instantly	Run time set	S
F05.14	Speed arrival signal threshold	10～6000	rpm	1000	Effective instantly	Run time set	S
F05.15	Zero speed output signal threshold	1～6000	rpm	10	Effective instantly	Run time set	S
F05.16	Speed DO filter time constant	0～500.00	ms	10.00	Effective instantly	Run time set	S
F05.17	Reserved						
F05.18	Reserved						

F06-Torque control parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F06.00	Main torque command A source	0: Digital given (F06.04) 1: AI1 2: AI2 3: Communication given	-	0	Effective instantly	Run time set	T
F06.01	Auxiliary torque command B source	0: Digital given (F06.04) 1: AI1 2: AI2 3: Communication given	-	1	Effective instantly	Run time set	T
F06.02	Torque command selection	0: Main torque command A source 1: Auxiliary torque command B source 2: Main command A source + auxiliary command B source 3: Main command A source - auxiliary command B source 4: Main command A source / auxiliary command B source switching	-	0	Effective instantly	Run time set	T
F06.03	Torque command logicinversion	0：positive logic 1：negative logic	-	0	Effective instantly	Run time set	T

F06.04	Torque command keyboard setting value	-300.0～300.0(motor rated torque)	%	0	Effective instantly	Run time set	T
F06.05	Torque limit source	0: positive and negative internal torque limit 1: positive and negative external torque limit (Using P-CL, N-CL selection) 2: T-LMT is used as external torque limit input 3: Switch between positive/ negative internal torque limit and T-LMT torque limit (using P-CL, N-CL selection)	-	0	Effective instantly	Run time set	PST
F06.06	T-LMT selection	0：AI1 1：AI2	-	0	Effective instantly	Run time set	PST
F06.07	Positive internal torque limit	0.0～300.0(motor rated torque)	%	300.0	Effective instantly	Run time set	PST
F06.08	Negative internal torque limit	0.0～300.0(motor rated torque)	%	300.0	Effective instantly	Run time set	PST
F06.09	Positive external torque limit	0.0～300.0(motor rated torque)	%	300.0	Effective instantly	Run time set	PST
F06.10	Negative external torque limit	0.0～300.0(motor rated torque)	%	300.0	Effective instantly	Run time set	PST
F06.11	Torque compensation	0.0～150.0(motor rated torque)	%	0.0	Effective instantly	Run time set	T
F06.12	Torque compensation cutoffspeed	0～6000	rpm	1000	Effective instantly	Run time set	T
F06.13	Torque control forward speed limit source selection	0：determined by F06.15 1：AI1 2：AI2	-	0	Effective instantly	Run time set	T
F06.14	Torque control reverse speed limit source selection	0：determined by F06.16 1：AI1 2：AI2	-	0	Effective instantly	Run time set	T
F06.15	Torque control forward speed limit value	0～6000	rpm	3000	Effective instantly	Run time set	T
F06.16	Torque control reverse speed	0～6000	rpm	3000	Effect ive	Run time	T

	limit value				instantly	set	
F06.17	Torque arrival reference value	0.0～300.0	%	0.0	Effective instantly	Run time set	PST
F06.18	Torque arrival valid value	0.0～300.0	%	20.0	Effective instantly	Run time set	PST
F06.19	Torque arrival invalid value	0.0～300.0	%	10.0	Effective instantly	Run time set	PST
F06.20	Speed limited window time in Torque mode	0～1000	ms	1	Effective instantly	Run time set	T
F06.21	Gravity load detection value	-300.0～300.0	%	0.0	Effective instantly	Down time set	PS
F06.22	Reserved						
F06.23	Reserved						

F07-Gain parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F07.00	1st speed loop gain	0.1～1000.0	Hz	25.0	Effective instantly	Run time set	PS
F07.01	1st speed loop integration time	0.36～512.00	ms	31.83	Effective instantly	Run time set	PS
F07.02	1st position loop gain	0.0～1570.0	rad/s	40.0	Effective instantly	Run time set	P
F07.03	2nd speed loop gain	0.1～1000.0	Hz	40.0	Effective instantly	Run time set	PS
F07.04	2nd speed loop integration time	0. 36～512.00	ms	40.00	Effective instantly	Run time set	PS
F07.05	2nd position loop gain	0.0～1570.0	rad/s	64.0	Effective instantly	Run time set	P

F07.06	2nd gain mode set	0: The 1st gain is fixed, and the external DI is used for P/PI switching. 1: Use gain switching according to the condition setting of F07.07	-	1	Effective instantly	Run time set	PST
F07.07	Gain switchover condition selection	0: 1st gain fixed (PS) 1: Use external DI switchover(PS) 2: Torque command is large (PS) 3: Speed command is large (PS) 4: Speed command change rate is large (PS) 5: Speed command high and low speed threshold (PS) 6: Large positional deviation (P) 7: With position command (P) 8: Positioning completed (P) 9: Actual speed is large (P) 10: With position command + actual speed (P)	-	0	Effective instantly	Run time set	PST
F07.08	Gain switchover delay	0～6000(two-way delay, linearly varying according to time)	125us	40	Effective instantly	Run time set	PST
F07.09	Gain switchover level	0～20000	According to the switching condition	50	Effective instantly	Run time set	PST
F07.10	Gain switchover time lag	0～20000	According to the switching condition	30	Effective instantly	Run time set	PST
F07.11	Position gain switchover time	0～60000	125us	24	Effective instantly	Run time set	PS
F07.12	1st torque command filter time	0～30.00	ms	0.79	Effective instantly	Run time set	PST
F07.13	2nd torque command filter time	0～30.00	ms	0.79	Effective instantly	Run time set	PST
F07.14	Load inertia ratio	0.00～200.00	Times	0.00	Effective instantly	Run time set	PST
F07.15	Speed feed forward selection	0: internal speed feedforward 1: Use AI1 as speed feedforward input 2: Use AI2 as speed feedforward input	-	0	Effective instantly	Run time set	P
F07.16	Speed feed	0.00～64.00	ms	1.00	Effect	Run	P

	forward filter time constant				ive instantly	time set	
F07.17	Speed feed forward gain	0.0～100.0	%	0.0	Effective instantly	Run time set	P
F07.18	Torque feed forward selection	0: no torque feedforward 1: Internal torque feedforward	-	1	Effective instantly	Run time set	PS
F07.19	Torque feed forward filter time constant	0.00～64.00	ms	1.00	Effective instantly	Run time set	PS
F07.20	Torque feed forward gain	0.0～200.0	%	0	Effective instantly	Run time set	PS
F07.21	Speed feedback filter time	0～30.00	ms	0.00	Effective instantly	Run time set	PST
F07.22	Position deviation limit	0～65535	Encoder Unit	Determined by encoder	Effective instantly	Run time set	P
F07.23	Rigid test running circles	1～100	Rev	2	Effective instantly	Down time set	PS

F08-Automatic gain turning parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F08.00	Self-adjustmentmode selection	0: Manual adjust parameters 1: Parameter self-adjustmentmode, automatic adjust gain parameters with rigid table 2: Positioning mode, automatic adjust gain parameters with rigid table	-	1	Effective instantly	Run time set	PST
F08.01	Rigid levelselection	0～31	-	12	Effective instantly	Run time set	PST
F08.02	Adaptive notch mode selection	0: Adaptive notch is no longer updated 1:1 adaptive notch filter is valid(3rd notch filter) 2: 2 adaptive notch filters are valid (3rd and 4th notch filter) 3: Only test the resonance point, F08.20-F08.21 display	-	0	Effective instantly	Run time set	PST

		4: Restore 3rd and 4th notch filter to Default value					
F08.03	Offline inertia identification mode	0: Positive and negative triangle wave mode 1: Forward mode 2: Reverse mode	-	0	Effective instantly	Down time set	PST
F08.04	Inertia identificationmax. Speed	50～6000	rpm	500	Effective instantly	Run time set	PST
F08.05	Acc/dec time when inertia identification	2～2000	ms	125	Effective instantly	Run time set	PST
F08.06	Interval after an inertia identification	20～10000	ms	1000	Effective instantly	Run time set	PST
F08.07	Motor revolutions for an inertia identification	0.00～655.35	r	-	Effective instantly	Display	PST
F08.08	1st notch frequency	100～4000	Hz	4000	Effective instantly	Run time set	PST
F08.09	1st notch width level	0～10	-	2	Effective instantly	Run time set	PST
F08.10	1st notch depth level	0～99	-	0	Effective instantly	Run time set	PST
F08.11	2nd notch frequency	100～4000	Hz	4000	Effective instantly	Run time set	PST
F08.12	2nd notch width level	0～10	-	2	Effective instantly	Run time set	PST
F08.13	2nd notch depth level	0～99	-	0	Effective instantly	Run time set	PST
F08.14	3rd notch frequency	100～4000	Hz	4000	Effective instantly	Run time set	PST
F08.15	3rd notch width level	0～10	-	2	Effective instantly	Run time set	PST
F08.16	3rd notch depth level	0～99	-	0	Effective instan	Run time set	PST

					tly		
F08.17	4th notch frequency	100～4000	Hz	4000	Effective instantly	Run time set	PST
F08.18	4th notch width level	0～10	-	2	Effective instantly	Run time set	PST
F08.19	4th notch depth level	0～99	-	0	Effective instantly	Run time set	PST
F08.20	Resonance frequency identification result (frequency)	100～4000	Hz	-	-	Display	PST
F08.21	Resonance frequency identification result (depth level)	0～99	-	-	-	Display	PST
F08.22	Low frequency resonance suppression mode selection	0：Manual setting 1：Self-turning setting	-	0	Effective instantly	Down time set	P
F08.23	Low frequency resonance frequency	4.0～100.0	Hz	100.0	Effective instantly	Down time set	P
F08.24	Low frequency resonance times	1～15	-	2	Effective instantly	Down time set	P
F08.25	Online inertia identification mode	0～3	-	0	Effective instantly	Down time set	PST
F08.26 ～ F08.32	Reserved						

F09-Protection parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F09.00	Input phase loss protection	0: no detection 1: fault, free stop	-	1	Effective instantly	Run time set	-
F09.01	Short circuitto PE detection in operation	0: no detection 1: fault, free stop	-	1	Effective instantly	Run time set	-

F09.02	Output phase loss detection in operation	0: no detection 1: fault, free stop	-	1	Effective instantly	Run time set	-
F09.03	Speed protection function	0: no detection 1: fault, free stop	-	1	Effective instantly	Run time set	-
F09.04	Encoder cable break detection	0: no detection 1: fault, free stop	-	1	Effective instantly	Run time set	-
F09.05	Brake protection detection	0: no detection 1: Enable detection of brake protection	-	0	Effective instantly	Run time set	-
F09.06	Reserved						
F09.07	AD sampling overvoltage point	5000～12000(Not detected at 12000)	mV	12000	Effective instantly	Run time set	PST
F09.08	Motor overload protection gain	50～800(Not detected at 800)	%	100	Effective instantly	Run time set	-
F09.09	Overspeed fault threshold	0～10000(0 means no detection)	rpm	0	Effective instantly	Run time set	PST
F09.10	Position deviation too large fault threshold	1～1073741824	Encoder Unit	Determined by encoder	Effective instantly	Run time set	P
F09.12	Max. position pulse frequency	100～4000	kHz	4000	Power on again	Down time set	P
F09.13	Low speed pulse input pin filter constant	0～3	-	3	Effective instantly	Down time set	-
F09.14	Quadrature encoder input pin filter constant	0～3	-	2	Effective instantly	Down time set	-
F09.15	Reserved						
F09.16	Bus encoder interface filter constant	0～1	-	1	Effective instantly	Down time set	-
F09.17	Stall protection time	10～65535(Not detected at 65535)	ms	500	Effective instantly	Down time set	-
F09.18	Encoder multi-turn overflow fault	0: not shielded 1: shielded Note: Automatic shielding in	-	1	Effective instan	Down time set	-

	selection	speed and torque mode			tly		
F09.19	Soft limit setting	0: Do not enable the soft limit 1: Enable the soft limit immediately after power-on. 2: Enable the soft limit after the origin returns to zero	-	0	Effective instantly	Down time set	PST
F09.20	Soft limit max. value	-2147483648～2147483647（2^31）	Command Unit	2147483647	Effective instantly	Down time set	PST
F09.22	Soft limit min. value	-2147483648～2147483647（2^31）	Command Unit	-2147483648	Effective instantly	Down time set	PST
F09.24	Overvoltage suppression coefficient	0～100.0%	%	0.0	Effective instantly	Run time set	PST
F09.25	Reserved						
F09.26	Reserved						

F10-Monitoring parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F10.00	Actual motor speed (1 rpm)	-	rpm	-	-	Display	PST
F10.01	Speed command	-	rpm	-	-	Display	PS
F10.02	Internal torque command	-	%	-	-	Display	PST
F10.03	Current effective value	0.00～655.35	A	-	-	Display	PST
F10.04	Bus voltage value	-	V	-	-	Display	PST
F10.05	Input signal (DI signal) monitoring	-	-	-	-	Display	PST
F10.06	Output signal (DO signal) monitoring	-	-	-	-	Display	PST
F10.07	Absolute position counter (32-bit decimal display)	-	Command Unit	-	-	Display	PST
F10.09	Mechanical angle (number of pulses starting from 0 to 65535 at the origin)	-	Encoder Unit	-	-	Display	PST
F10.10	Electrical angle (0.0 ~ 360.0)	-	°	-	-	Display	PST
F10.11	Input position command corresponding speed information	-	rpm	-	-	Display	P
F10.12	Input command pulse counter (32-bit decimal display)	-	Command Unit	-	-	Display	P

F10.14	Encoder position deviation counter (32-bit decimal display)	-	Encoder Unit	-	-	Display	P
F10.16	Motor encoder reverse pulse counter (32-bit decimal display)	-	Encoder Unit	-	-	Display	PST
F10.18	Total power-on time	-	H	-	-	Display	PST
F10.19	Total running time	-	H	-	-	Display	PST
F10.20	AI1 sampling voltage value	-	V	-	-	Display	PST
F10.21	AI2 sampling voltage value	-	V	-	-	Display	PST
F10.22	Module temperature	-	℃	-	-	Display	PST
F10.23	Position deviation counter	-	Command Unit	-	-	Display	P
F10.25	Actual motor speed (0.1rpm)	-	rpm	-	-	Display	PST
F10.27	Mechanical absolute position (low 32 bits)	-	Encoder Unit	-	-	Display	PST
F10.29	Mechanical absolute position (high 32 bits)	-	Encoder Unit	-	-	Display	PST
F10.31	Real-time input position command counter	-	Command Unit	-	-	Display	PST
F10.33	Absolute encoder rotation laps data	-	R	-	-	Display	PST
F10.34	Absolute encoder position within 1 lap	-	Encoder Unit	-	-	Display	PST
F10.36	Absolute encoder absolute position (low 32 bits)	-	Encoder Unit	-	-	Display	PST
F10.38	Absolute encoder absolute position (high 32 bits)	-	Encoder Unit	-	-	Display	PST
F10.40	Reserved						
F10.41	Reserved						
F10.42	Positioning completion time	-	ms	-	-	Display	P
F10.43	Over pulse numbers	-	Encoder Unit	-	-	Display	P
F10.45	Motor output torque	-	%	-	-	Display	PST
F10.46	Current fault details	-	-	-	-	Display	PST
F10.47	Encoder Z,U,V,W status	-	-	-	-	Display	PST
F10.48	Average torque	-	%	-	-	Display	PST
F10.49	Peak torque (maximum torque in the past 10 seconds)	-	%	-	-	Display	PST
F10.50	Output power (1W)	-	W	-	-	Display	PST

F10.51	The reason why the servo motor does not turn	-	-	-	-	Display	PST
F10.52	Reserved	-					
F10.53	Reserved						
F10.54	Output voltage	-	V	-	-	Display	PST
F10.55 ～ F10.64	Reserved	-					

F11-Communication parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F11.00	Protocol selection	0：Modbus 1：Reserved	-	0	Effective instantly	Downtime set	PST
F11.01	Servo axis address	1~247, 0 is the broadcast address	-	1	Effective instantly	Run time set	PST
F11.02	Serial port baud rate setting	0：2400Kbp/s 1：4800Kbp/s 2：9600Kbp/s 3：19200Kbp/s 4：38400Kbp/s 5：57600Kbp/s 6：115200Kbp/s 7：230400Kbp/s	-	6	Effective instantly	Run time set	PST
F11.03	MODBUS data format	0: no check, 2 end bits - RTU 1: even check, 1 end bit - RTU 2: odd check, 1 end bit - RTU 3: no check, 1 end bit - RTU	-	0	Effective instantly	Run time set	PST
F11.04	MODBUS command response delay	0～5000	ms	1	Effective instantly	Run time set	PST
F11.05	Reserved						
F11.06	Reserved						
F11.07	Communication timeout checkout time	0.0～1000.0	s	0.0	Effective instantly	Run time set	PST
F11.08	Communication error checkout time	0.0～1000.0	s	0.0	Effective instantly	Run time set	PST
F11.09 ～ F11.24	Reserved						

F12-Auxiliary function parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F12.00	Software rest	0: No operation 1: Enable	-	0	Effective instantly	Downtime set	-
F12.01	Fault reset	0: No operation 1: Enable	-	0	Effective instantly	Downtime set	-
F12.02	Absolute encoder reset	0: No operation 1: Reset fault 2: Reset fault and multi-turn data	-	0	Effective instantly	Downtime set	-
F12.03	JOG trial run function	Press SET to start and keep zero speed, UP forward, DOWN reverse, press MENU to exit; press SET to display the rotation speed.	-	-	-	-	-
F12.04	Offline inertia identification	Press SET to enter the identification display interface, press UP or DOWN button to start identification, press MENU to exit identification. In the identification interface, long press SET and store to F07.14.	-	-	Effective instantly	Downtime set	-
F12.05	Motor parameters self-learning	0: no operation 1: Encoder self-learning---motor UWV power cable phase sequence and EncoderAB phase sequence self-learning, installation angle learning (Z signal and UVW signal) 2: Motor parameter static self-learning 3: Motor parameter rotation self-learning F12.05 is not 0. Press SET button to start identification. In the process of identification, you can press MENU to exit self-learning.	-	0	Effective instantly	Downtime set	-
F12.06	Fixed angle output	After pressing SET, press UP to start, press MENU to exit - internal global variable display	-	-	Effective instantly	Downtime set	-
F12.07	Emergency stop	0: No operation 1: Enable emergency stop	-	0	Effective instantly	Runtime set	-
F12.08	DI force input	0～0xFF(0 means invalid)	-	0x00	Effective instantly	Runtime set	-

F12.09	DO force output	0～0x1F(0 means invalid)	-	0x00	Effective instantly	Run time set	-
F12.10	In-plantDebugging parameters	0: No operation 1: LED is fully illuminated	-	0	Effective instantly	Run time set	-
F12.11	Store all parameters	0: No operation 1: Valid	-	0	Effective instantly	Downtime set	-
F12.12	Rigid test auxiliary parameter	0: No operation 1: Forward speed debugging (multiplexing inertia identification parameters) 2: Reverse speed debugging (multiplexing inertia identification parameters) 3: Number of revolutions: F07.23 laps, direction of rotation: forward → reverse 4: Number of revolutions: F07.23 laps, direction of rotation: reverse → forward 5: Number of revolutions: F07.23 laps, direction of rotation: forward → forward 6: Number of revolutions: F07.23 laps, direction of rotation: reverse → reverse	-	0	Effective instantly	Downtime set	-
F12.13	Fixed angle (for In-plantdebugging)	0.0～360.0	°	0.0	Effective instantly	Downtime set	-
F12.14	Fixed current (for In-plantdebugging)	10～300	%	100	Effective instantly	Downtime set	-
F12.15	Reserved						

F13-Full closed-loop function parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F13.00	Encoder feedback mode	0: Internal encoder feedback 1: Position feedback signal from full-closed external encoder using Group 1 electronic gear ratio 2: Closed-loop switching of internal and external positions using electronic gears. Invalid, internal encoder feedback, using Group 1 electronic gear ratio;	-	0	Effective instantly	Downtime set	P

		Valid, external encoder feedback, using Group 2 electronic gear ratio					
F13.01	External encoder usage	0: Use in standard running direction 1: Use in reverse running direction	-	0	Effective instantly	Downtime set	P
F13.02	The number of external encoder pulses per revolution of the motor	1 ～1073741824	External encode Unit	10000	Power on again	Downtime set	P
F13.04	Full closed loop hybrid position deviation excessive threshold	0 ～1073741824	External encode Unit	10000	Effective instantly	Downtime set	P
F13.06	Full closed loop hybrid position deviation clear setting	0～100	r	0	Effective instantly	Downtime set	P
F13.07	Full closed loop hybrid position deviation counter	-1073741824～1073741824	External encode Unit	-	-	Display	P
F13.09	External encoder feedback pulse counter	-1073741824～1073741824	External encode Unit	-	-	Display	P
F13.11 ～ F13.15	Reserved						

F14-Multi-position function parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F14.00	Mult-position running mode	0: Single run end shutdown (F14.01 selects the number of segments) 1: Cycle operation (F14.01 selects the number of segments) 2: DI switching operation (selected by DI) 3: Run in sequence (F14.01 selects the number of segments)	-	1	Effective instantly	Downtime set	P
F14.01	Number of the displacement command end points	1～16	-	1	Effective instantly	Downtime set	P
F14.02	Balance processing	Valid in the other three modes except DI mode 0: Continue to run the segment	-	0	Effective instan	Downtime set	P

		that has not finished 1: Restart from the first segment			tly		
F14.03	Time unit	0：ms 1：s	-	0	Effective instantly	Downtime set	P
F14.04	Displacement command type	0: Relative displacement command 1: Absolute displacement command	-	0	Effective instantly	Downtime set	P
F14.05	Sequence running start segment selection	0～16	-	0	Effective instantly	Downtime set	P
F14.06	1st segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.08	1st displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.09	1st displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.10	1st displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.11	2nd segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.13	2nd displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.14	2nd displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.15	2nd displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.16	3rd segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.18	3rd displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.19	3rd	0～65535	ms(s)	10	Effec	Run	P

	displacement acceleration and deceleration time				tive instantly	time set	
F14.20	3rd displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.21	4th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.23	4th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.24	4th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.25	4th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.26	5th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.28	5th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.29	5th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.30	5th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.31	6th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.33	6th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.34	6th displacement acceleration and deceleration	0～65535	ms(s)	10	Effective instantly	Run time set	P

	time						
F14.35	6th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.36	7th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.38	7th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.39	7th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.40	7th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.41	8th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.43	8th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.44	8th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.45	8th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.46	9th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.48	9th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.49	9th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.50	9th displacement	0～10000	ms(s)	10	Effective	Run time	P

	waiting time after the completion				instantly	set	
F14.51	10th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.53	10th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.54	10th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.55	10th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.56	11th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.58	11th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.59	11th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.60	11th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.61	12th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.63	12th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.64	12th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.65	12th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P

F14.66	13th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.68	13th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.69	13th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.70	13th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.71	14th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.73	14th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.74	14th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.75	14th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.76	15th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instantly	Run time set	P
F14.78	15th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.79	15th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.80	15th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P
F14.81	16th segment movement displacement	-1073741824 ～1073741824	Command Unit	10000	Effective instan	Run time set	P

					tly		
F14.83	16th displacement maximum running speed	1～6000	rpm	200	Effective instantly	Run time set	P
F14.84	16th displacement acceleration and deceleration time	0～65535	ms(s)	10	Effective instantly	Run time set	P
F14.85	16th displacement waiting time after the completion	0～10000	ms(s)	10	Effective instantly	Run time set	P

F15-Multi-speed function parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F15.00	Multi-speed command operation mode	0: Single run end shutdown (F15.03 for segment number selection) 1: Keep the final value after a single cycle 2: Continuous cycle operation (F15.03 for segment number selection) 3: Switching by external DI	-	2	Effective instantly	Downtime set	S
F15.01	Interrupt run restart mode	0: Restart from the 1st segment 1: Continue to run from the phase of the interruption moment 2: Continue to run from the running speed of the interruption moment	-	0	Effective instantly	Downtime set	S
F15.02	Power-down storage option	0: No storage 1: Power-down storage is valid	-	0	Effective instantly	Downtime set	S
F15.03	Speed command end segment selection	1～16	-	16	Effective instantly	Downtime set	S
F15.04	Run time unit selection	0～sec 1～min	-	0	Effective instantly	Downtime set	S
F15.05	Acceleration time 1	0～65535	ms	10	Effective instantly	Downtime set	S
F15.06	Deceleration time 1	0～65535	ms	10	Effective instantly	Downtime set	S

F15.07	Acceleration time 2	0～65535	ms	50	Effective instantly	Downtime set	S
F15.08	Deceleration time 2	0～65535	ms	50	Effective instantly	Downtime set	S
F15.09	Acceleration time 3	0～65535	ms	100	Effective instantly	Downtime set	S
F15.10	Deceleration time 3	0～65535	ms	100	Effective instantly	Downtime set	S
F15.11	Acceleration time 4	0～65535	ms	150	Effective instantly	Downtime set	S
F15.12	Deceleration time 4	0～65535	ms	150	Effective instantly	Downtime set	S
F15.13	1st segment speed command	-6000～6000	rpm	0	Effective instantly	Downtime set	S
F15.14	1st segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.15	1st segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.16	2nd segment speed command	-6000～6000	rpm	100	Effective instantly	Downtime set	S
F15.17	2nd segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.18	2nd segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration	-	0	Effective instantly	Downtime set	S

		time 3 4: Acceleration and deceleration time 4					
F15.19	3rd segment speed command	-6000～6000	rpm	300	Effective instantly	Downtime set	S
F15.20	3rd segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.21	3rd segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.22	4th segment speed command	-6000～6000	rpm	500	Effective instantly	Downtime set	S
F15.23	4th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.24	4th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.25	5th segment speed command	-6000～6000	rpm	700	Effective instantly	Downtime set	S
F15.26	5th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.27	5th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S

F15.28	6th segment speed command	-6000～6000	rpm	900	Effective instantly	Downtime set	S
F15.29	6th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.30	6th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.31	7th segment speed command	-6000～6000	rpm	600	Effective instantly	Downtime set	S
F15.32	7th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.33	7th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.34	8th segment speed command	-6000～6000	rpm	300	Effective instantly	Downtime set	S
F15.35	8th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.36	8th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.37	9th segment speed command	-6000～6000	rpm	100	Effective instan	Downtime set	S

					tly		
F15.38	9th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.39	9th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.40	10th segment speed command	-6000～6000	rpm	-100	Effective instantly	Downtime set	S
F15.41	10th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.42	10th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.43	11th segment speed command	-6000～6000	rpm	-300	Effective instantly	Downtime set	S
F15.44	11th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.45	11th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.46	12th segment speed command	-6000～6000	rpm	-500	Effective instantly	Downtime set	S
F15.47	12th segment command run	0～6553.5	s(min)	5.0	Effective	Downtime	S

	time				instantly	set	
F15.48	12th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.49	13th segment speed command	-6000～6000	rpm	-700	Effective instantly	Downtime set	S
F15.50	13th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.51	13th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.52	14th segment speed command	-6000～6000	rpm	-900	Effective instantly	Downtime set	S
F15.53	14th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.54	14th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effective instantly	Downtime set	S
F15.55	15th segment speed command	-6000～6000	rpm	-600	Effective instantly	Downtime set	S
F15.56	15th segment command run time	0～6553.5	s(min)	5.0	Effective instantly	Downtime set	S
F15.57	15th segment	0: Zero acceleration and	-	0	Effec	Dow	S

	acc. and dec. time	deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4			tive instan tly	ntime set	
F15.58	16th segment speed command	-6000～6000	rpm	-300	Effec tive instan tly	Dow ntime set	S
F15.59	16th segment command run time	0～6553.5	s(min)	5.0	Effec tive instan tly	Dow ntime set	S
F15.60	16th segment acc. and dec. time	0: Zero acceleration and deceleration time 1: Acceleration and deceleration time 1 2: Acceleration and deceleration time 2 3: Acceleration and deceleration time 3 4: Acceleration and deceleration time 4	-	0	Effec tive instan tly	Dow ntime set	S

F17-Fault record parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effec tive way**	**Setu p way**	**Oper ating mode**
F17.00	Last1st fault record	000: No fault **No1: Non-resettable fault** 100: Motor and drive match fault 101: Position mode and encoder match fault 102: Speeding fault 103: Inverter module protection 104: Short circuit to ground during operation 105: Encoder fault (the angle corresponding to the Z signal changes too much) 106: Bus encoder data verification error 107: Z pulse loss failure 108: Incremental encoder UVW read error (including bus incremental encoding) 109: Incremental pulse type encoder disconnection 110: Bus type encoder disconnection	-	-	-	Displ ay	-

		No2: Resettable fault 200: Drive overload protection 201: Overcurrent fault 202: Main circuit overvoltage 203: Undervoltage in main circuit operation 204: Motor parameter self-learning failure 205: Encoder self-tuning fault (including UVW power line phase sequence error, UVW signal cable error, Z pulse not found, etc.) 206: Temperature detection disconnection 207: In-plant failure 1 208: In-plant failure 2 209: In-plant failure 3 210: Reserved 211: E2PROM read and write error 212: External device failure 213: Command conflict failure 214: Undervoltage in the control loop operation 215: Output phase loss fault 216: The radiator is overheated 217: Current detection circuit failure 218: Brake is open unnormally **No3: Resettable fault** 300: Motor overload protection 301: Main circuit input phase loss 302: Overspeed protection 303: Pulse output overspeed 304: Pulse input overspeed 305: Motor stall 306: Encoder battery failed 307: Encoder multi-turn count error 308: Encoder multi-turn count overflow 309: AD sampling overvoltage 310: The position deviation is too large 311: Full-closed hybrid position deviation is too large 312: Electronic gear ratio setting exceeds limit 313: Modbus communication failure 314: Braking resistor overload 315: Back to origin timeout failure 316: Origin return to zero unnormally					

		No4: Resettable alarm: 400: Reserved 401: Encoder battery alarm 402: DI emergency shutdown alarm 403: External brake resistor too small alarm 404: Change parameters need to be powered on again. 405: Forward overstroke alarm 406: Reverse overstroke alarm 407: Module overheat alarm 408: Run limit alarm					
F17.01	Last 2nd fault record	-	-	-	-	Display	-
F17.02	Last 3rd fault record	-	-	-	-	Display	-
F17.03	Last 4th fault record	-	-	-	-	Display	-
F17.04	Last 5th fault record	-	-	-	-	Display	-
F17.05	Last 6th fault record	-	-	-	-	Display	-
F17.06	Motor speed in last 1st fault	-	rpm	-	-	Display	-
F17.07	Output current in last 1st fault	-	0.01A	-	-	Display	-
F17.08	Bus voltage in last 1st fault	-	0.1V	-	-	Display	-
F17.09	Module temperature in last 1st fault	-	℃	-	-	Display	-
F17.10	Input terminals status in last 1st fault	-	-	-	-	Display	-
F17.11	Running time in last 1st fault	-	min	-	-	Display	-
F17.12	Motor speed in last 2nd fault	-	rpm	-	-	Display	-
F17.13	Output current in last 2nd fault	-	0.01A	-	-	Display	-
F17.14	Bus voltage in last 2nd fault	-	0.1V	-	-	Display	-
F17.15	Module temperature in last 2nd fault	-	℃	-	-	Display	-
F17.16	Input terminals status in last 2nd fault	-	-	-	-	Display	-
F17.17	Running time in last 2nd fault	-	min	-	-	Display	-
F17.18 ～ F17.23	Manufacturer parameters	-	-	-	-	Display	-

F18-Manufacturer parameters							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F18.00	User password	0～65535	-	-	Effective instantly	Run time set	-
F18.01	Reserved						
F18.02	Software version	0～65535	-	-	-	Display	-
F18.03～F18.47	Reserved						

F19-Servo variables reading via communication							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F19.00	Servo status read via communication	Bit0://1=Bus voltage has been established Bit1://1=Run command is valid Bit2://1=Drive is running Bit3://1=Servo On command is valid Bit4://1=The current running direction is reverse Bit5://1=The direction of the running command is reverse Bit6://1=Accelerating Bit7://1=Decelerating Bit8://1=The alarm is valid. Bit9://1=The fault is valid Bit10://1=NO3 fault is valid Bit11://1=Servo ready Bit12://1=The position command has changed Bit13://1=Motor auto-tuning Bit14://1=Position is close to valid Bit15://1=Location is complete	-	-	-	Communication read only	PST
F19.01	DO function status 1 read via communication	-	-	-	-	Communication read only	PST
F19.02	DO function status 2 read via communication	-	-	-	-	Communication read	PST

						only	
F19.03	Current alarm code read via communication	-	-	-	-	Communication read only	PST
F19.04	Current fault code read via communication	-	-	-	-	Communication read only	PST
F19.05 ～ F19.06	Reserved						

F20-Servo variables setting via communication							
Function code	**Name**	**Setting range**	**Unit**	**Default value**	**Effective way**	**Setup way**	**Operating mode**
F20.00	DI status set via communication	0～0xFF	-	0	Effective instantly	Run time set	PST
F20.01	DO status set via communication	0～0x1F	-	0	Effective instantly	Run time set	PST
F20.02	Speed command set via communication	-6000～6000	rpm	0	Effective instantly	Run time set	S
F20.03	Torque command set via communication	-100.0～100.0	%	0	Effective instantly	Run time set	T
F20.04	Modbus communication command	0: no command 1:Reserved 2: Servo ON 3: Communication jog forward command 4: Communication jog reverse command 5: Communication inertia identification command 6: Communication rigidity test command 7: Current loop test command	-	-	-	-	-

		8: Mechanical characteristic test command					
F20.05	AO1 set	-10000～10000	mv	0	Effective instantly	Run time set	-
F20.06	AO2 set	-10000～10000	mv	0	Effective instantly	Run time set	-
F20.07 ～ F20.12	Reserved						

Input terminal function list				
FunIN.0	NoUse			
FunIN.1	S-ON	Servo enable	Invalid: Servo motor enable is disabled; Valid: Servo motor enable when power on	The logic selection of the corresponding terminal must be set to: Level active.
FunIN.2	ALM-RST	Fault reset	Invalid: disable Valid: Enable	The logic selection of the corresponding terminal is recommended to be set to: edge valid. According to the type of alarm, the servo can continue to work after some alarms are reset.
FunIN.3	GAIN-SEL	Gain switching	F07.06=0: Invalid: the speed control loop is controlled by PI; Valid: The speed control loop is controlled by P. F07.06=1, F07.07=1: Invalid: fixed to the 1st gain; Valid: Fixed to the 2nd gain.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.4	CMD-SEL	Main and auxiliary operation command switching	Invalid: The current running command is A; Valid: The current running command is B.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.5	DIR-SEL	Multi-speed DI switching direction setting	Invalid: Default command direction; Valid: The command is in the opposite direction.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.6	CMD1	Multi-segment run command switch 1	16-segment command selection.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.7	CMD2	Multi-segment run	16-segment command	The logic selection of

		command switch 2	selection.	the corresponding terminal is recommended to be set to: Level active.
FunIN.8	CMD3	Multi-segment run command switch 3	16-segment command selection.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.9	CMD4	Multi-segment run command switch 4	16-segment command selection.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.10	M1-SEL	Control mode switching	Switching between speed, position, and torque is performed according to the selected control mode (3, 4, 5).	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.11	Out-Fault	External device fault input	Invalid: Current external without fault; Valid: There is a fault in the current external.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.12	ZCLAMP	Zero position fixed enable	Valid: Enable zero position fixed function; Invalid: The zero position fixed function is disabled.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.13	INFIBIT	Position command prohibited	Valid: Prohibit command pulse input; Invalid: Allow command pulse input.	The position command is forbidden and contains internal and external position commands. The logic selection of the corresponding terminal must be set to: level effective。
FunIN.14	P-OT	Forward overstroke switch	Valid: Prohibit forward drive; Invalid: Allow forward drive.	When the mechanical motion exceeds the movable range, enter the overtravel prevention function: The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.15	N-OT	Reverse overstroke switch	When the mechanical motion exceeds the movable range, enter theoverstrokeprevention function: Valid: Prohibit forward drive; Invalid: Allow forward drive.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.16	P-CL	Positive external torque limit	According to the selection of F06.05, the torque limit source is switched.	The logic selection of the corresponding terminal is

			F06.05 =1: Valid: Forward external torque limit is valid; Invalid: Forward internal torque limit is valid. F06.05 = 3: Valid: AI torque limit is valid; Invalid: Forward internal torque limit is valid.	recommended to be set to: Level active.
FunIN.17	N-CL	Negative external torque limit	According to the selection of F06.05, the torque limit source is switched. F06.05 =1: Valid: Reverse external torque limit is valid; Invalid: Reverse internal torque limit is valid. F06.05 = 3 and the AI limit value is less than the reverse external limit value: Valid: Reverse external torque limit is valid. Invalid: AI torque limit is valid. F06.05 = 4: Valid: AI torque limit is valid; Invalid: Reverse internal torque limit is valid.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.18	JOGCMD+	Forward jog	Valid: Input according to the given command; Invalid: Run command stops input.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.19	JOGCMD-	Reverse jog	Valid: Reverse input according to the given command; Invalid: Run command stops input.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.20	POSSTEP	Step size enable	Valid: Execute step size command; Invalid: The command is zero, which is the positioning state.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.24	GEAR_SEL	Electronic gear selection	Invalid: Electronic gear ratio 1; Valid: Electronic gear ratio 2.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.25	TOQDirSel	Torque command direction setting	Invalid: forward direction; Valid: reverse direction.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.26	SPDDirSel	Speed command direction setting	Invalid: forward direction; Valid: reverse direction.	The logic selection of the corresponding terminal is recommended to be set

				to: Level active.
FunIN.27	POSDirSel	Position command direction setting	Invalid: forward direction; Valid: reverse direction.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.28	PosInSen	Multi- position command enable	Edge valid Invalid: Ignore internal multi-segment command; Valid: Start internal multi-segment.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.29	XintFree	Interrupt fixed length release (edge valid function)	Invalid: prohibited; Valid: Enable.	The logic selection of the corresponding terminal must be set to: Edge valid.
FunIN.30	HomeSwitcF	Origin switch	Invalid: not triggered; Valid: Trigger.	The logic selection of the corresponding terminal must be set to: Level active. It is recommended to assign it to the fast DI terminal.
FunIN.31	HomingStart	Origin return enable (edge valid function)	Invalid: prohibited; Valid: Enable.	The logic selection of the corresponding terminal must be set to: Edge valid.
FunIN.32	XintInFibit	Interrupt fixed length prohibition	Valid: It is forbidden to interrupt the fixed length; Invalid: Allows to interrupt the fixed length.	The logic selection of the corresponding terminal must be set to: Level active.
FunIN.33	EmergencyStop	Emergency stop	Valid: Position lock after zero speed stop; Invalid: no effect on current running status	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.34	ClrPosErr	Clear position deviation (edge valid function)	Valid: the position deviation is cleared; Invalid: The position deviation is not cleared.	The logic selection of the corresponding terminal must be set to: edge valid. It is recommended to assign it to the fast DI terminal.
FunIN.35	PulseInFibit	Pulse command prohibition	In the position control mode, when the position command source is the pulse command (F04.00=0): Invalid: can respond to pulse command; Valid: can't respond to pulse command.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.36	Plc_Stop	Simple PLC pause	Valid: PLC operation is invalid; Invalid: No effect on the current running state.	The logic selection of the corresponding terminal is recommended to be set to: Level active.
FunIN.37	Plc_Reset	Simple PLC status reset	Valid: PLC status reset; Invalid: No effect on the	The logic selection of the corresponding

			current running state.	terminal is recommended to be set to: Level active.
FunIN.38	XIntScale	Interrupt fixed length trigger switch	Valid: Interrupt fixed length is valid; Invalid: No effect on the current running state.	The logic selection of the corresponding terminal is recommended to be set to: edge active.
FunIN.39 ～ FunIN.63				

Output terminal function list

FunOUT.0	NoUse	No function		
FunOUT.1	S-RDY	Servo ready	The servo status is ready to receive the S-ON valid signal: Valid: the servo is ready; Invalid: The servo is not ready.	-
FunOUT.2	TGON	Motor rotation output	When the servo motor speed is higher than the speed threshold F05.12: Valid: The motor rotation signal is valid; Invalid: The motor rotation signal is invalid.	-
FunOUT.3	ZERO	Zero speed	The signal output when the servo motor speed is lower than the zero threshold value F05.15: Valid: motor speed is zero; Invalid: motor speed is not zero.	-
FunOUT.4	V-CMP	Consistent speed	In the speed control, valid when the absolute value of the difference between the servo motor speed and the speed command is less than the F05.13 speed deviation setting value.	-
FunOUT.5	COIN	Positioning completed	In the position control, the position deviation pulse is valid when it reaches the positioning completion range F04.20.	-
FunOUT.6	NEAR	Positioning close	In the position control, the position deviation pulse is valid when it reaches the set value close to the signal amplitude F04.23.	-
FunOUT.7	T-LMT	Torque limit	Confirmation signal for torque limit: Valid: motor torque is limited; Invalid: motor torque is not limited.	-
FunOUT.8	V-LMT	Speed limit	Confirmation signal for speed limitduring torque control: Valid: motor speed is limited;	-

			Invalid: motor speed is not limited.	
FunOUT.9	BRK	Brake output	Brake signal output: Valid: close, release the brake; Invalid: Start the brake.	-
FunOUT.10	WARN	Warning output	The warning output signal is valid.	-
FunOUT.11	ALM	Fault output detect	The status is valid when the fault is detected.	-
FunOUT.12	Xintcoin	Interrupt fixed length completed	Valid: Interrupt fixed length positioning is completed; Invalid: Interrupt fixed length positioning is not completed.	-
FunOUT.13	FomeAttain	Origin return to zero output	Origin return to zero status: Valid: Origin return to zero; Invalid: Origin not return to zero.	-
FunOUT.14	ElecFomeAttain	Electrical zero return output	Electrical zero return status: Valid: the electrical origin returns to zero; Invalid: The electrical origin does not return to zero.	-
FunOUT.15	ToqReacF	Torque arrival output	Valid: The absolute value of the torque reaches the set value; Invalid: The absolute value of the torque is less than the set value.	-
FunOUT.16	V-Arr	Speed arrival output	Valid: Speed feedback reaches the set value; Invalid: Speed feedback does not reached the set value.	-
FunOUT.17	DB	DB brake output	Valid: Energy braking is valid Invalid: Energy braking is invalid	-
FunOUT.18	CmdOk	Internal command output	Valid: internal command completed Invalid: internal command not completed	-
FunOUT.19 ～ FunOUT.31	Reserved			

8 Appendix

8.1 Servo drive mounting size

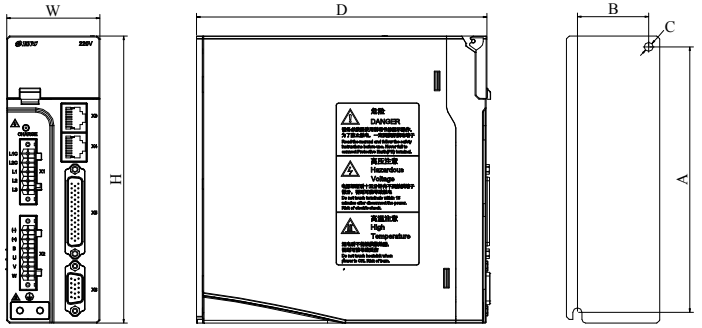


Fig.8-1 A type servo drive outline drawing

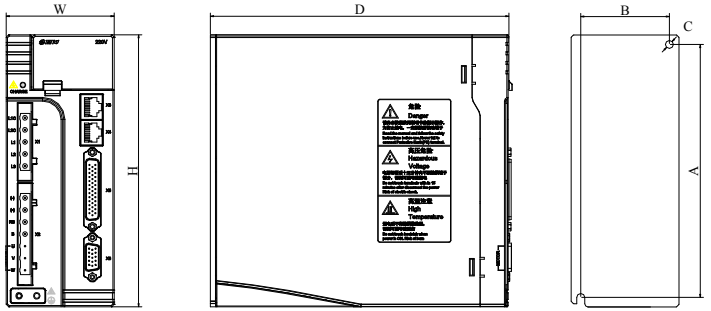


Fig.8-2 B type servo drive outline drawing

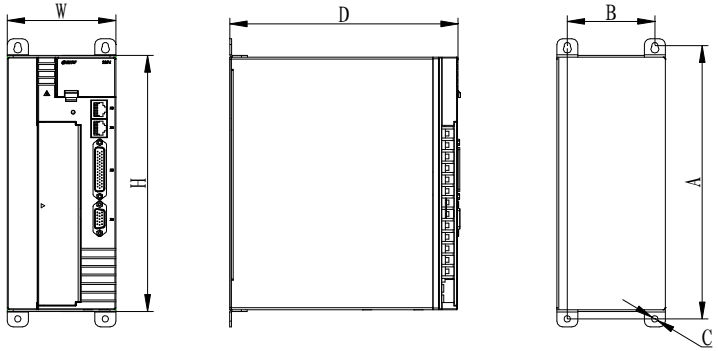


Fig.8-3C type servo drive outline drawing

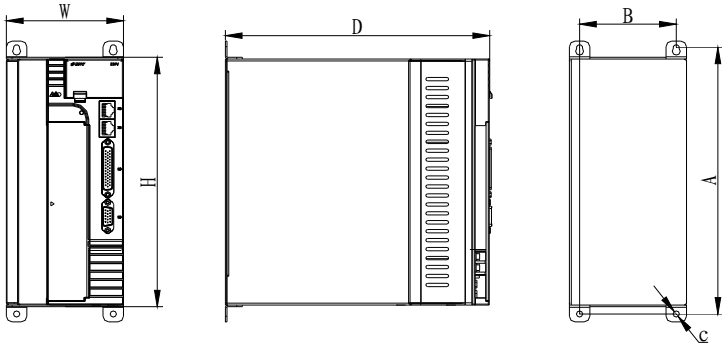


Fig.8-4D type servo drive outline drawing

Table 8-1 Servo drive series installation size

Servo drive model	Chassis type	A (mm)	B (mm)	W (mm)	H (mm)	D (mm)	C (mm)	Fig. number
ESS200P-2S101	A type	36	148	51	160	159	5	Fig.12-1
ESS200P-2S201								
ESS200P-2S401								
ESS200P-2S751	B type	55	160	67	172	185	5	Fig.12-2
ESS200P-2T102								
ESS200P-2T152								
ESS200P-4T102								
ESS200P-4T152								
ESS200P-4T202								
ESS200P-2T202	C type	238	72	93	223	195.5	5.5	Fig.12-3
ESS200P-2T302								
ESS200P-4T302								
ESS200P-4T442								
ESS200P-4T552								
ESS200P-4T752	C type	238	94	115	223	232.5	5.5	Fig.12-4

8.2 Servo motor parameters and installation dimensions

8.2.1 40Base servo motor parameters and installation dimensions

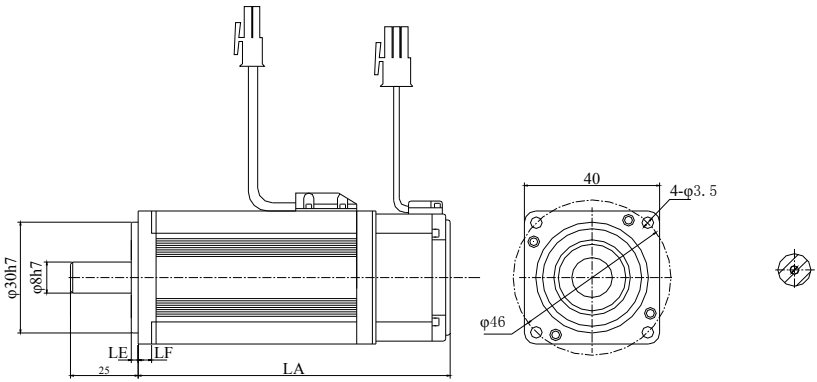


Fig. 8-5 40Base outline drawing

Type	LE（mm)	LF(mm)	LA(mm)	LA(mm) with brake
EMS-04101L-30S-xxxA	3	6	90	124

8.2.2 60Base servo motor parameters and installation dimensions

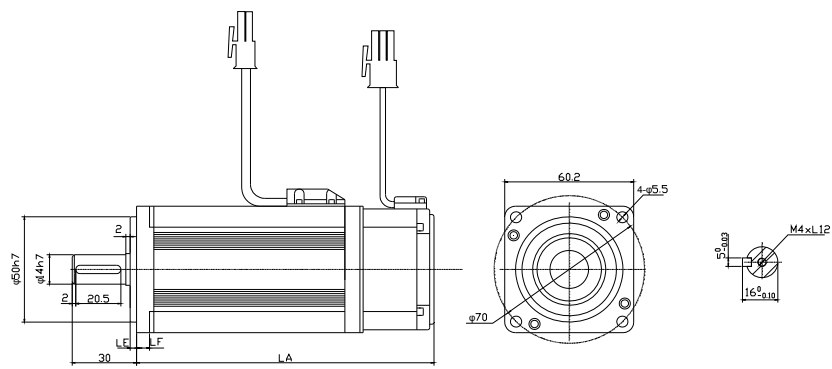


Fig. 8-6 60Base outline drawing

Type	LE（mm)	LF(mm)	LA(mm)	LA(mm) with brake
EMS-06201L-30S-xxxA	3	7.5	116	164
EMS-06201M-30S-xxxA	3	7	109	157
EMS-06401L-30S-xxxA	3	7.5	141	189
EMS-06401M-30S-xxxA	3	7	133	181

8.2.3 80Base servo motor parameters and installation dimensions

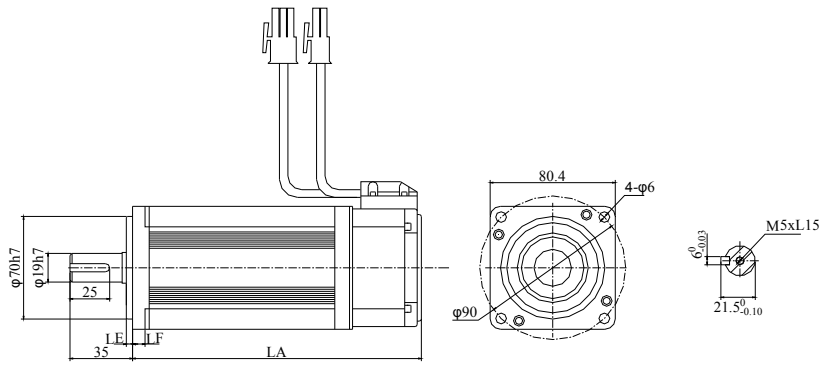


Fig.8-7 80Base outline drawing

Type	LE（mm)	LF(mm)	LA(mm)	LA(mm) with brake
EMS-08401H-30S-xxxA	3	8	124	166
EMS-08731H-20S-xxxA	3	8	179	221
EMS-08751L-30S-xxxA	3	8	151	193
EMS-08102L-25S-xxxA	3	8	191	233
EMS-08122L-30S-xxxA	3	8	191	233

8.2.4 90Base servo motor parameters and installation dimensions

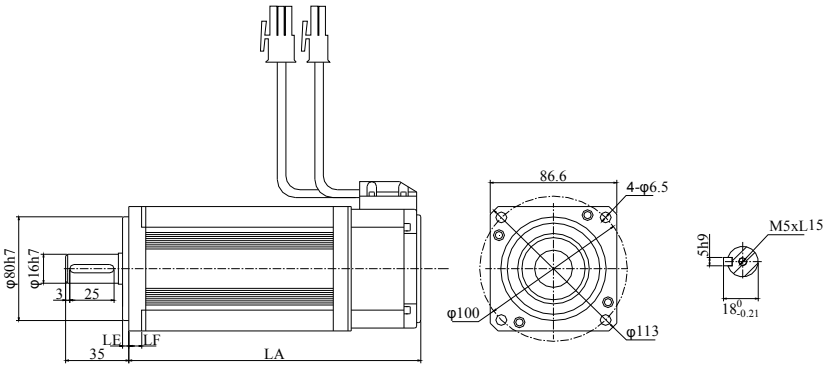


Fig. 8-8 90Base outline drawing

Type	LE（mm)	LF(mm)	LA(mm)	LA(mm) with brake
EMS-09751H-30S-xxxA	3	10	150	198

8.2.5 110Base servo motor parameters and installation dimensions

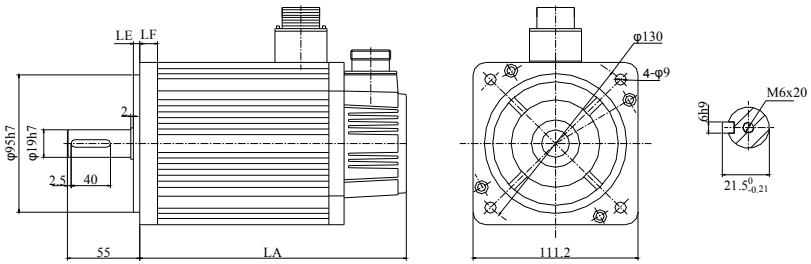


Fig.8-9 110Base outline drawing

Type	LE（mm)	LF(mm)	LA(mm)	LA(mm) with brake
EMS-11152M-30S-xxxA	5	12	204	278
EMS-11182L-30S-xxxA	5	12	219	293

8.2.6 130Base servo motor parameters and installation dimensions

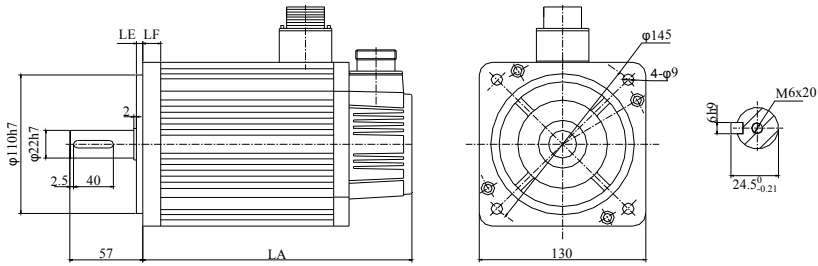


Fig. 8-10 130Base outline drawing

Type	LE（mm)	LF(mm)	LA(mm)	LA(mm) with brake
EMS-13152M-25S-xxxA	5	14	179	236
EMS-13102H-10S-xxxA	5	14	213	294
EMS-13152H-15S-xxxA	5	14	213	294
EMS-13202M-25S-xxxA	5	14	192	249
EMS-13262M-25S-xxxA	5	14	209	290
EMS-13102M-25T-xxxA	5	14	166	223
EMS-13152M-25T-xxxA	5	14	179	236
EMS-13202M-25T-xxxA	5	14	192	249
EMS-13102M-25S-xxxA	5	14	166	229
EMS-13102H-10T-xxxA	5	14	213	294
EMS-13122L-30T-xxxA	5	14	166	229
EMS-13152M-15T-xxxA	5	14	213	276
EMS-13232H-15T-xxxA	5	14	241	322
EMS-13262M-25T-xxxA	5	14	209	290
EMS-13382L-25T-xxxA	5	14	231	312

8.2.7 150Base servo motor parameters and installation dimensions

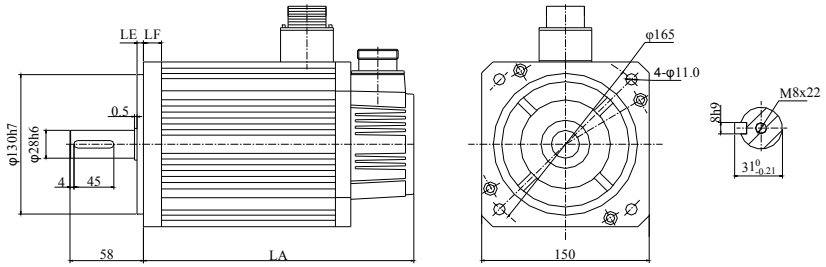


Fig. 8-11 150Base outline drawing

Type	LE（mm)	LF(mm)	LA(mm)	LA(mm) with brake
EMS-15302M-20S-xxxA	5	14	230	303

8.2.8 180Base servo motor parameters and installation dimensions

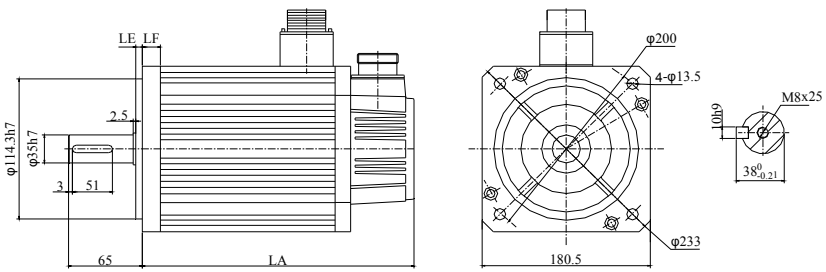
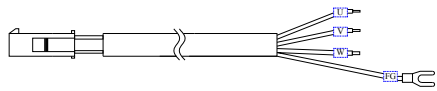
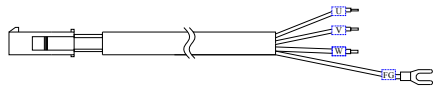
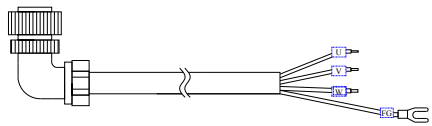
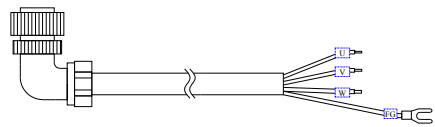
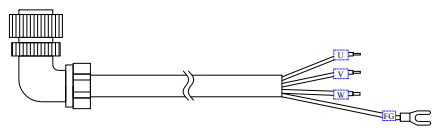
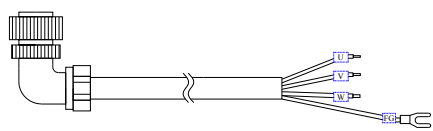
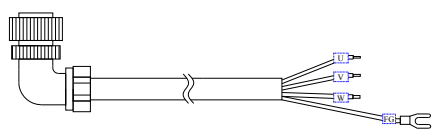
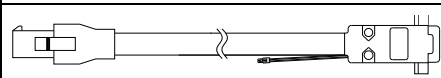
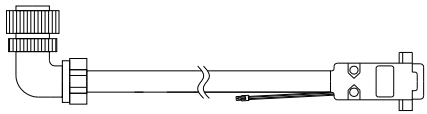
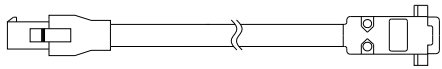
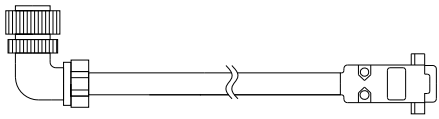
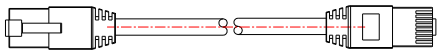
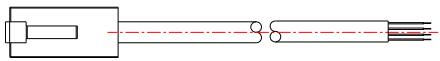
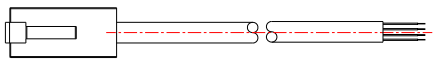
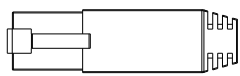
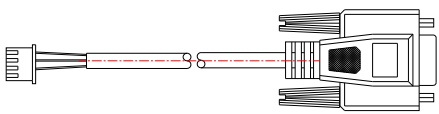
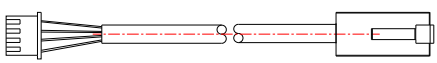


Fig. 8-12 180Base outline drawing

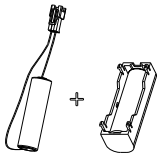
Type	LE（mm)	LF(mm)	LA(mm)	LA(mm) with brake
EMS-18292H-10S-xxxA	3.2	18	262	334
EMS-18272H-15T-xxxA	3.2	18	226	298
EMS-18302H-15T-xxxA	3.2	18	232	304
EMS-18452M-20T-xxxA	3.2	18	243	315
EMS-18552M-15T-xxxA	3.2	18	292	364
EMS-18752M-15T-xxxA	3.2	18	346	418
EMS-18302H-15S-xxxA	3.5	18	232	304
EMS-18432M-15T-xxxA	3.5	18	262	334

8.3 Cable model description

Cable name	Cable type	Cable length L (M)	Cable appearance
Servo motor main circuit cable	EN-D201	3M	
		5M	
		10M	
	EN-D202	3M	
		5M	
		10M	
	EN-D211	3M	
		5M	
		10M	
	EN-D212	3M	
		5M	
		10M	
	EN-D221	3M	
		5M	
		10M	
	EN-D222	3M	
		5M	
		10M	
	EN-D223	3M	
		5M	
		10M	
Servo motor encoder cable	EN-M601	3M	
		5M	
		10M	

	EN-M611	3M	
		5M	
		10M	
	EN-M602	3M	
		5M	
		10M	
	EN-M612	3M	
		5M	
		10M	
Servo drive multi-machine parallel cable	EN-M401	0.3M	
Servo drive CAN communication cable	EN-M402	2M	
Servo drive 485 communication cable	EN-M403	2M	
Servo driver termination matching resistor	EN-M404	-	
Servo drive PC 232 communication cable	EN-M701	1.5M	
Servo drive keyboard copy parameter communication cable	EN-M702	1.5M	

8.4 Absolute encoder battery box kit

Name	Type	Appearance
Battery box kit	ESS-C100	

8.5 Background software description

Our website provides free download and use of background software. With the PC communication cable (EN-M701) provided by the company, the personal computer can communicate with the servo driver. The communication cable can also be self-made, and the wiring method can be found in the wiring section.
The background software has the following functions:
(1) The oscilloscope can detect and save transient data in servo operation.
(2) Parameter management, which can read and download parameters in batches.
(3) The database can correctly identify the function codes of some non-standard software.
(4) Inertia identification, the load inertia ratio can be identified through a series of actions.
(5) Motion JOG, a position command can be planned to make the motor run repeatedly.
(6) Gain adjustment, which can adjust the rigidity level of the servo and has simple motion information monitoring function.
(7) Support for Windows XP, Windows 7 and above. Users can download the background software on our official website. For details on how to use the background software, please refer to the help file of the background software.