XINJE

DS5L2 series servo driver
User manual

WUXI XINJE ELECTRIC CO., LT
Data No. SC5 14 20240621 1.1.3

Basic explanation

- Thank you for purchasing Xinje DS5L2 series servo driver products.
- This manual mainly introduces the product information of DS5L2 series servo driver and MS series servo motor.
- Before using the product, please read this manual carefully and connect the wires on the premise of fully understanding the contents of the manual.
- Please deliver this manual to the end user.

This manual is suitable for the following users

- Designer of servo system
- Installation and wiring workers
- Commissioning and servo debugging workers
- Maintenance and inspection workers

Get the manual

- Please consult the supplier, agent and office who purchased the product.

Declaration of liability

- Although the contents of the manual have been carefully checked, errors are inevitable, and we cannot guarantee complete consistency.
- We will often check the contents of the manual and make corrections in the subsequent versions. We welcome your valuable comments.
- If there is any change to the contents introduced in the manual, please understand without further notice.

Contact information

- Tel: 400-885-0136
- Fax: 0510-85111290
- Address: No.816, Jianzhu West Road, Binhu District, Wuxi City, Jiangsu Province, China
- Postcode: 214072

Mar. 2023

Safety Precautions

Before using this product, please read this part carefully and operate after fully understanding the use, safety and precautions of the product. Please connect the product correctly on the premise of paying great attention to safety.

The problems that may arise during the use of the product are basically listed in the safety precautions, and all are indicated by the two levels of attention and danger. For other unmentioned matters, please follow the basic electrical operation rules.

Caution	When used incorrectly, there may be danger, moderate injury or minor injury, and property loss.
Danger	When used incorrectly, it may cause danger, personal casualties or serious injuries, as well as serious property losses.

Attention to Product Confirmation

1. Don't install damaged drives, drives that lack spare parts, or drives whose models don't meet the requirements.

Installation Notes

1. Before installing wiring, be sure to disconnect the power supply to prevent electric shock.
2. It is forbidden to expose the product to water, corrosive gases, flammable gases and other substances, causing electric shock and fire hazards.
3. Don't touch the conductive part of the product directly, which may cause misoperation and malfunction.

Cautions for wiring

1. Please connect AC power to LN or L1/L2/L3 or R/S/T on the dedicated power terminal of the driver. Don't connect the output terminals U, V, W of the driver to the three-phase power supply.
2. Please connect the ground wire correctly. Poor grounding may cause electric shock. Please use 2mm^2 wire to ground the ground terminal of the driver.
3. Please lock the fixed screw of the terminal, otherwise it may cause fire.
4. Be sure to disconnect all external power supply before wiring the driver.
5. Wiring, please ensure that the encode line, power line is loose, don't tighten, lest cable damage.

Operation Cautions

1. Don't touch the rotating part of the motor after the driver is running. There is a danger of injury.
2. Please pay attention to the test run of the motor once, don't connect the motor with the machine, there is the possibility of injury.
3. After connecting the machine, please set the appropriate parameters before running, otherwise it may cause the machine out of control or failure.
4. In operation, don't touch the radiator, there is a risk of scald.
5. Under power-on condition, don't change the wiring, there is a risk of injury.
6. Don't switch power frequently. If you need to switch power many times, please control it once in 2 minutes.

Maintenance and inspection

1. Don't touch the inside of servo driver and servo motor, otherwise it may cause electric shock.
2. When the power is started, it is forbidden to remove the driver panel, otherwise it may cause electric shock.
3. Within 10 minutes of power off, the terminal should not be contacted. Otherwise, the residual voltage may cause electric shock.

Wiring attention

1. Don't cross the power line and the control signal line from the same pipeline, nor tie them together. The power line and the control signal line are separated by more than 30 centimeters.
2. For signal line and encoder (PG) feedback line, please use multi-stranded wire and multi-core stranded integral shielding line. For wiring length, the longest signal input line is 3 meters and the longest PG feedback line is 20 meters.

Catalog

►► Confirmation on product arrival

After the product arrives, please confirm the integrity of the product in the following aspects.

Items	Notes
Does the product on arrival match the specified model?	Please confirm according to the nameplate of servo motor and servo unit.
Does the servomotor shaft rotate smoothly?	The servo motor shaft is normal if it can be turned smoothly by hand. Servo motors with brakes, however, cannot be turned manually.
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Are there any loose screws?	Check screws for looseness using a screwdrive.
Is the motor code the same with the code in drive?	Check the motor code marked on the nameplates of the servomotor and the parameter **U3-70** on the servo drive.

If any of the above is faulty or incorrect, contact Xinje or an authorized distributor.

1 Selection of servo system

1.1 Selection of servo driver

1.1.1 Model name

DS5 L2-2 □P□ - PTA

Name	Product name
DS5	Servo drive

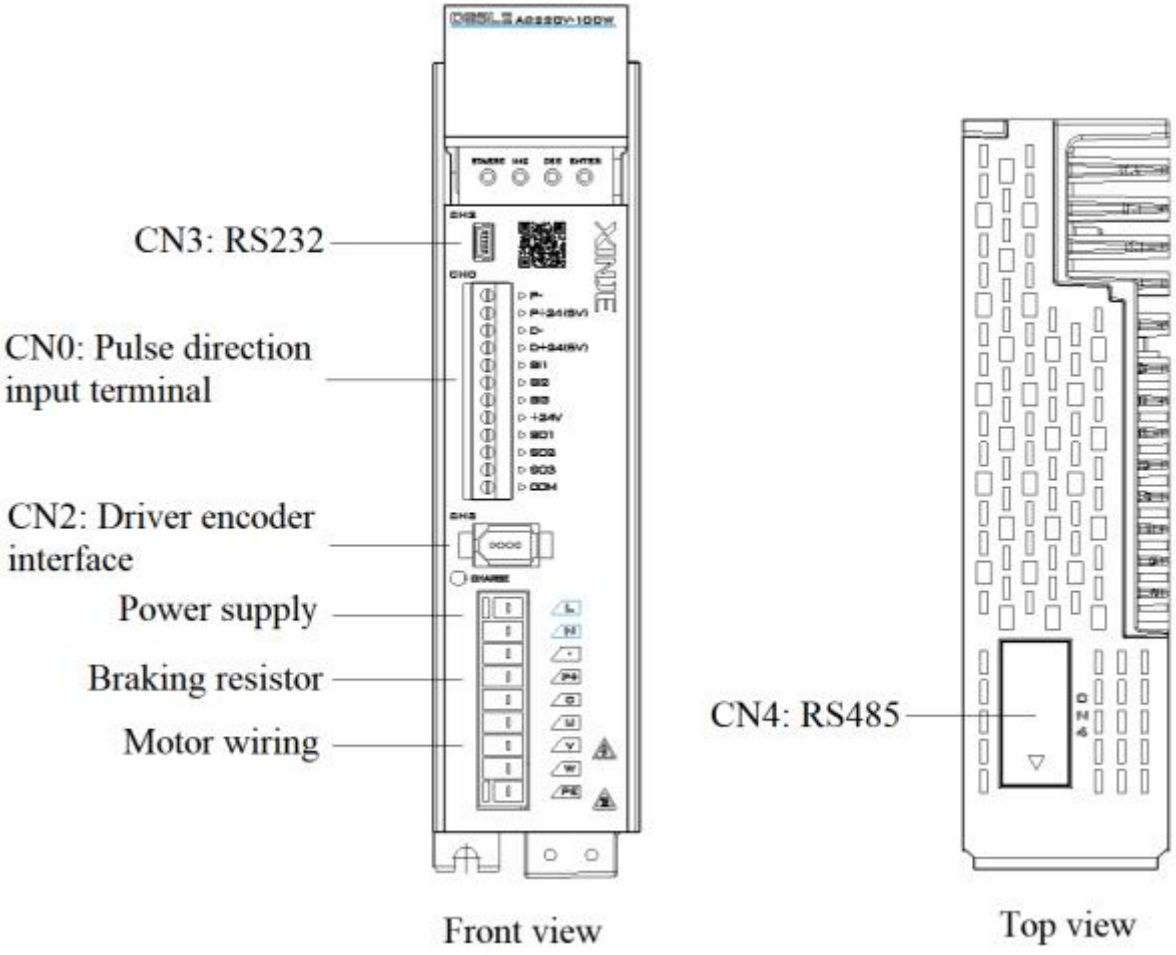
Name	Product series
L2	Upgraded version

Name	Rated input voltage
2	AC220V
4	AC380V

Name	Encoder type
T	Communication

Name	Rated output power
0P1	100W
0P2	200W
0P4	400W
0P7	750W
1P0	1000W
1P5	1500W
2P3	2300W
2P6	2600W
3P0	3000W

1.1.2 Description of each part



1.1.3 Performance specification

Servo unit		DS5 series servo driver
Applicable encoder		Standard: 19-bit communication encoder
Input power supply		DS5L2-2□P□-PTA: single phase/three phase AC200-240V, 50/60Hz DS5L2-4□P□-PTA: three phase AC380-440V, 50/60Hz
Control mode		Three-phase full-wave rectifier IPM PWM control sinusoidal current drive mode
Using condition	Using temperature	-10~+40 ℃
	Storage temperature	-20~+60 ℃
	Environment humidity	Below 90% RH (no condensation)
	Vibration resistance	4.9m/s^2
	Altitude	Not exceeding 1000m, please reduce the rating for use above 1000m (1% reduction for every 100m height)

1.1.4 Electrical specification

Drive model	Driver power (kW)	Continuous output current (A)	Maximum output current(A)	Power supply input current(A)	Power supply	Cooling mode
DS5L2-20P1-PTA	0.1	0.9	3.15	1.3	single phase AC200~240V，50/60Hz	Self cooling
DS5L2-20P2-PTA	0.2	1.9	6.65	2.7		Self cooling
DS5L2-20P4-PTA	0.4	2.8	9.8	4		Self cooling
DS5L2-20P7-PTA	0.75	4.8	16.8	5.5		Forced air cooling
DS5L2-21P0-PTA	1.0	6	18	9	Single phase/Three phase AC200~240V，50/60Hz	Forced air cooling
DS5L2-21P5-PTA	1.5	8	20	9		Forced air cooling
DS5L2-22P3-PTA	2.3	9	18	8		Forced air cooling
DS5L2-22P6-PTA	2.6	10.5	29.93	10		Forced air cooling
DS5L2-41P0-PTA	1.0	3.2	9.6	2.6	Three-phase AC380~440V，50/60Hz	Forced air cooling
DS5L2-41P5-PTA	1.5	5.5	13.75	2.6		Forced air cooling
DS5L2-42P3-PTA	2.3	8.5	21.75	6.8		Forced air cooling
DS5L2-43P0-PTA	3.0	11	29.7	8		Forced air cooling

1.2 Servo motor selection

1.2.1 Model name

■ MS6 motor

MS6S - 80 CN 30 B Z 3 - 2 1P0

Name	Inertia
MS6S	Low inertia
MS6H	High inertia
MS6G	Medium inertia

Name	Seat number
40	40 seat
60	60 seat
80	80 seat
130	130 seat
180	180 seat

Name	Encoder type
CN	Single multi turn integrated 19 bit magnetic
TH	Multi loop 23 bit photoelectric

Name	Rated speed (rpm)
15	1500
20	2000
25	2500
30	3000

Name	Motor shaft specifications
A	Keyed, no oil seal, with threaded hole
B	With keys, oil seals, and threaded holes
C	Keyless, oil-free, with threaded holes
D	Keyless, with oil seal, with threaded hole
E	Special shaft specifications (length, shaft diameter, etc.)

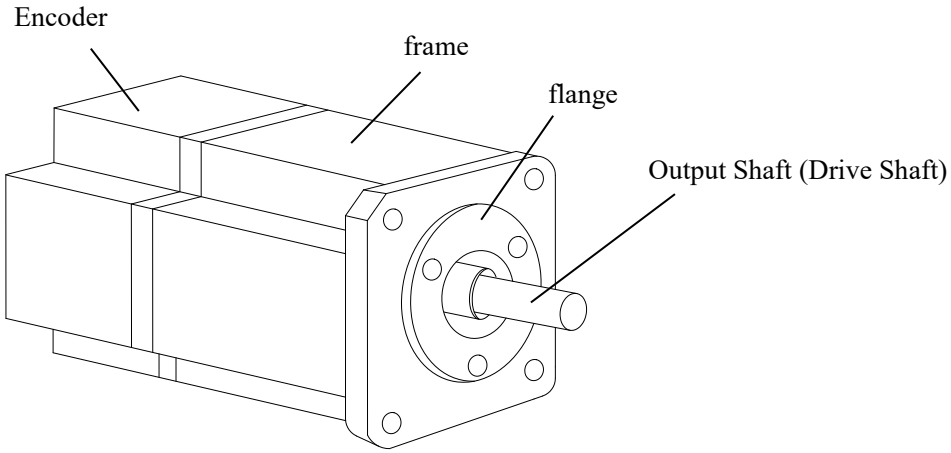
Name	Rated output power
0P1	100W
0P2	200W
0P4	400W
0P7	750W
1P0	1kW
1P5	1.5kW
2P3	2.3kW
2P6	2.6kW
3P0	3kW
4P4	4.4kW
5P5	5.5kW
7P5	7.5kW

Name	Voltage level
2	220V
4	380V

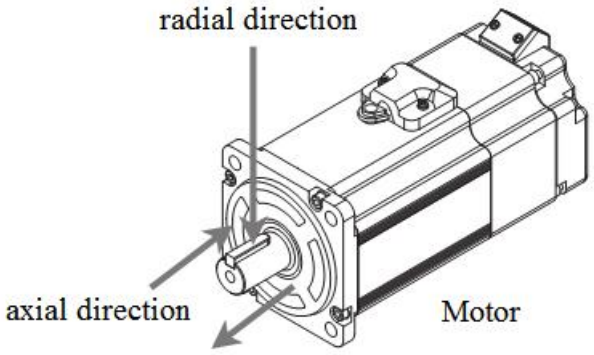
Name	Motor connector type
2	Aviation plug
3	Waterproof connector
4	Waterproof connector to Anpu plug

Name	Power-off brake
Empty	Without
Z	With

1.2.2 Description of each part



1.2.3 Axial force and radial force



Base no.	40ST	60ST	80ST	100ST	110ST	130ST	180ST	220ST/265ST
Axial force	54N	74N	147N	≤200N	250N	300N	400N	≤500N
Radial force	78N	245N	392N	500N	500N	600N	800N	1000N

1.3 Cable selection

1.3.1 Model name

■ Encoder cable

CP T - SC T - B - 03

Name	Cable type
CP	Encoder cable

Name	Cable type
T	High flexibility
G	High flexibility and oil resistance
Empty	Normal

Name	Plug type
SE	B3 positive outlet plug
SF	B3 reverse wire plug
SC	10 core small aviation plug
SL	15 core aviation plug

Name	Length (M)	Name	Length (M)
02	2	03	3
05	5	08	8
10	10	12	12
16	16	20	20
25	25	30	30

Name	Plug type
B	With battery box
BM	With battery box
M	Without battery box

Name	Plug type
T	Threaded buckle type
Empty	Buckle type

■ Power cable

CM T - E 05 A - 03

Name	Cable type
CM	Power line - no brake
CMB	Power line - with brake

Name	Cable type
T	High flexibility
G	High flexibility and oil resistance
Empty	Normal

Name	Plug type
E	B3 positive outlet plug
F	B3 reverse wire plug
L	4-core small aviation plug
XL	4-core medium-sized aviation plug

Name	Length (M)	Name	Length (M)
02	2	03	3
05	5	08	8
10	10	12	12
16	16	20	20
25	25	30	30

Name	Terminal
Empty	U-shaped terminal (driver side)
A	Pin terminal (driver side)
T	Thread protection type (motor side)

Name	Wire diameter (mm ²)
03	0.3
05	0.5
15	1.5
20	2.0
60	6.0

■ Brake cable explanation

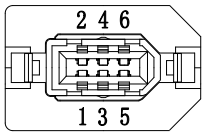
➢ For 80 and below flange motors with suffix S01, the brake cable model shall be selected: CB-P03-length.

➢ The standard wiring length of Xinje is 3m, 5m, 8m, 10m, 12m, 16m and 20m.

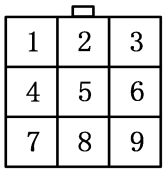
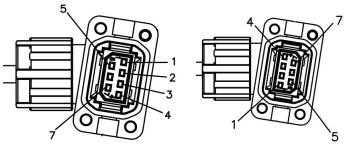
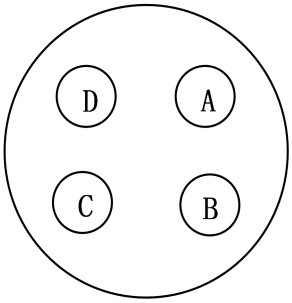
1.3.2 Description of each part

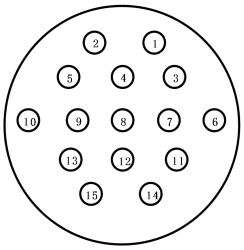
■ Encoder cable

(1) Pin definition of encoder on servo driver side

Connector appearance	Pin definition	
	No.	Definition
	1	5V
	2	GND
	3	/
	4	/
	5	485-A
	6	485-B

(2) Cable connection of encoder on motor side

Motor model	Connector	Pin definition	
MS6-40, 60, 80 base B4 motor		No.	Name
		1	Battery +
		2	Battery -
		3	Shielding wire
		4	485-A
		5	485-B
		6	/
		7	5V
		8	GND
		9	/
MS6-40, 60, 80 base B3 motor		No.	Name
		1	5V
		2	GND
		3	Battery +
		4	Battery -
		5	485-A
		6	485-B
		7	Shielding wire
MS6-110、130 base motor		No.	Name
		1	/
		2	5V
		3	GND
		4	485-A
		5	485-B
		6	Battery +
		7	Battery -
		8	/
		9	/
		10	Shielding wire

Motor model	Connector	Pin definition	
		No.	Name
MS6-180 base B2 motor		1	Shielding wire
		2	/
		3	485-B
		4	485-A
		5	/
		6	GND
		7	Battery -
		8	5V
		9	Battery +
		10-15	/

Battery box description:

1) The encoder including the cable definition of battery +, battery- is for the absolute motor, and the non-absolute motor cable has no such pin.

2) Only the cable of absolute value motor has external battery box, which contains a 3.6V/2.7Ah large capacity battery, and has the function of replacing batteries when power on. The using life is more than two years. Please refer to 5.7.2 Replace the battery.

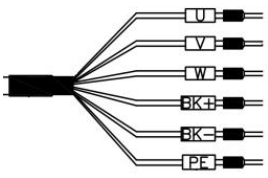
At present, the length of encoder cables includes 2 meters, 3 meters, 5 meters, 8 meters, 10 meters, 12 meters, 16 meters, 20 meters, 25 meters, 30 meters, 35 meters, 40 meters, 45 meters, and 50 meters.

■ Power cable

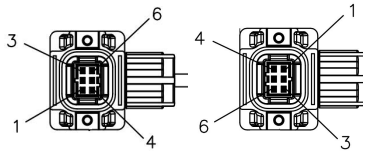
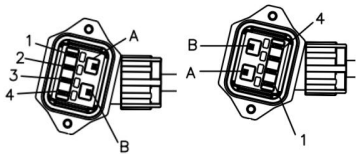
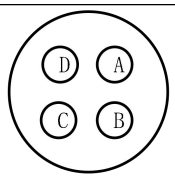
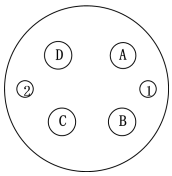
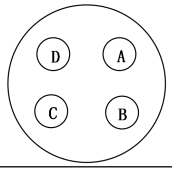
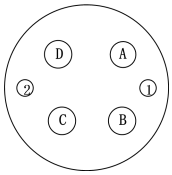
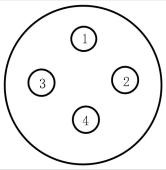
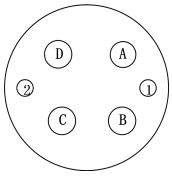
(1) Pin definition of power cable on servo driver side

(Pin terminals are installed and wired using random buckles)

Connector appearance	Pin definition	
	Color	Definition
	Brown	U
	Black	V
	Blue	W
	Yellow-green	PE

	Color	Definition
	Red	U
	White	V
	Black	W
	Yellow green	PE
	Blue	BK+
	Brown	BK-

(2) Power cable connection on motor side

<table>
<tr><th>Motor model</th><th>Connector</th><th colspan="2">Pin definition</th></tr>
<tr><td rowspan="8">MS6-40 base B3 motor</td><td rowspan="8"> 
Forward outlet reverse outlet
(user's view)</td><td>No.</td><td>Name</td></tr>
<tr><td>1</td><td>W</td></tr>
<tr><td>2</td><td>V</td></tr>
<tr><td>3</td><td>U</td></tr>
<tr><td>4</td><td>PE</td></tr>
<tr><td>5</td><td>BK+</td></tr>
<tr><td>6</td><td>BK-</td></tr>
<tr><td rowspan="8">MS6-60, 80 base B3 motor</td><td rowspan="8"> 
Forward outlet reverse outlet
(user's view)</td><td>No.</td><td>Name</td></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>
<tr><td>A</td><td>BK+</td></tr>
<tr><td>B</td><td>BK-</td></tr>
<tr><td rowspan="6">MS6G-130 base non brake motor</td><td rowspan="6">  </td><td>No.</td><td>Name</td></tr>
<tr><td>A</td><td>W</td></tr>
<tr><td>B</td><td>V</td></tr>
<tr><td>C</td><td>U</td></tr>
<tr><td>D</td><td>PE</td></tr>
<tr><td rowspan="8">MS6G-130 base brake motor</td><td rowspan="8">  </td><td>No.</td><td>Name</td></tr>
<tr><td>A</td><td>W</td></tr>
<tr><td>B</td><td>V</td></tr>
<tr><td>C</td><td>U</td></tr>
<tr><td>D</td><td>PE</td></tr>
<tr><td>1</td><td>BK+</td></tr>
<tr><td>2</td><td>BK-</td></tr>
<tr><td rowspan="6">MS6G-180 base non brake motor</td><td rowspan="6">  </td><td>No.</td><td>Name</td></tr>
<tr><td>A</td><td>PE</td></tr>
<tr><td>B</td><td>W</td></tr>
<tr><td>C</td><td>V</td></tr>
<tr><td>D</td><td>U</td></tr>
<tr><td rowspan="8">MS6G-180 base brake motor</td><td rowspan="8">  </td><td>No.</td><td>Name</td></tr>
<tr><td>A</td><td>PE</td></tr>
<tr><td>B</td><td>W</td></tr>
<tr><td>C</td><td>V</td></tr>
<tr><td>D</td><td>U</td></tr>
<tr><td>1</td><td>BK+</td></tr>
<tr><td>2</td><td>BK-</td></tr>
<tr><td rowspan="6">MS6H-180 base non brake motor</td><td rowspan="6">  </td><td>No.</td><td>Name</td></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>
<tr><td rowspan="8">MS6H-180 base brake motor</td><td rowspan="8">  </td><td>No.</td><td>Name</td></tr>
<tr><td>A</td><td>U</td></tr>
<tr><td>B</td><td>V</td></tr>
<tr><td>C</td><td>W</td></tr>
<tr><td>D</td><td>PE</td></tr>
<tr><td>1</td><td>BK+</td></tr>
<tr><td>2</td><td>BK-</td></tr>
</table>

Brake pins:

The cable including pin BK+, BK- is used for the brake motor. The cable of the non-brake motor has no BK pins.

1.4 Selection of other accessories

When the servo motor is driven by the generator mode, the power returns to the servo amplifier side, which is called regenerative power. The regenerated power is absorbed by charging the smooth capacitor of the servo amplifier. After exceeding the rechargeable energy, the regenerative resistance is used to consume the regenerative power.

The situation where the servo generates regenerative power is as follows:

- The deceleration stop period during acceleration and deceleration operation.
- Running vertically and axially.
- When the external load drives the motor to rotate.

Servo driver model	Regenerative resistance connection terminals
DS5L2-□□P□-PTA	(1) Using built-in regenerative resistance, short P + and D terminals, P + and C are disconnected. (2) Use external regenerative resistance, connect regenerative resistance to P + and C terminals, remove P + and D short wiring, P0-25 = power value, P0-26 = resistance value.

The following table is the recommended specifications of external regenerative resistance for each type of motor.

Servo driver model	Built-in brake resistor	Rmin (Not less than this value)	External regenerative resistance (Recommended resistance value)	External regenerative resistance (Recommended power values)
DS5L2-20P1-PTA	/	80Ω	80Ω-100Ω	Above 200W
DS5L2-20P2-PTA	/			
DS5L2-20P4-PTA	/			
DS5L2-20P7-PTA	80W50Ω	50Ω	50Ω-100Ω	Above 600W
DS5L2-21P0-PTA	80W45Ω	35Ω	35Ω-75Ω	Above 800W
DS5L2-21P5-PTA	80W50Ω	30Ω	30Ω-50Ω	Above 1000W
DS5L2-22P3-PTA	80W50Ω			
DS5L2-22P6-PTA	80W50Ω	25Ω	25Ω-50Ω	
DS5L2-41P0-PTA	80W100Ω	120Ω	120Ω-150Ω	Above 800W
DS5L2-41P5-PTA	80W100Ω	75Ω	75Ω-120Ω	Above 1000W
DS5L2-42P3-PTA	80W60Ω	55Ω	55Ω-75Ω	Above 1000W
DS5L2-43P0-PTA	80W60Ω	50Ω	50Ω-75Ω	Above 1200W

Note:

(1) The smaller the resistance is, the faster the discharge will be, but the smaller the resistance is, the easier the breakdown resistance will be. Therefore, please close to the the lower limit but not be less than the lower limit when choosing the type.

(2) When wiring, please use high-temperature flame-retardant wire, and the regenerative resistance surface can not contact with the wire.

2 Installation of servo system

2.1 Servo driver installation

2.1.1 Installation site

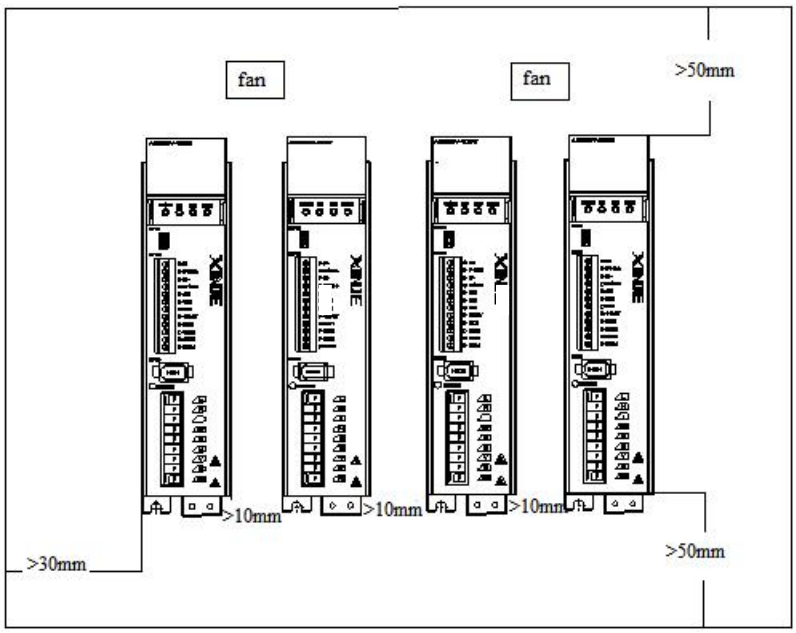
- Please install it in the installation cabinet without sunshine or rain.
- Don't use this product near corrosive and flammable gas environments such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gas, acid, alkali, salt, etc.
- Don't install in high temperature, humidity, dust, metal dust environment.
- No vibration place.

2.1.2 Environment condition

Item	Description
Use ambient temperature	-10~40℃
Use ambient humidity	20~90%RH (no condensation)
Storage temperature	-20~60℃
Storage humidity	20~90%RH (no condensation)
Vibration resistance	Not exceeding 4.9m/s^2
Altitude	Not exceeding 1000m, please reduce the rating for use above 1000m (1% reduction for every 100m height)

2.1.3 Installation standard

Be sure to comply with the installation standard in the control cabinet shown in the figure below. This standard is applicable to the situation where multiple servo drivers are installed side by side in the control cabinet (hereinafter referred to as "when installed side by side").



■ **Servo Drive Orientation**

When installing, please ensure that the front of the servo drive (the actual installation surface of the operator) faces the operator and is perpendicular to the wall. For drivers with brake resistors at the bottom, please pay attention to the heat dissipation of the installation surface to avoid overheating and fire hazards.

■ **Cooling**

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

■ **Side-by-side Installation**

When install servo drives side by side as shown in the figure above, make at least 10mm between and at least 50mm above and below each servo drive. Install cooling fans above the servo drives to avoid excessive temperature rise and to maintain even temperature inside the control panel.

■ **Environmental Conditions in the Control Panel**

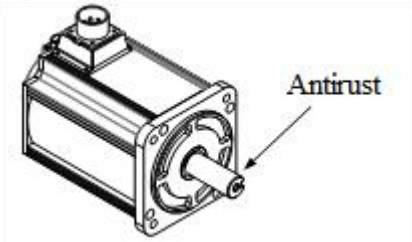
- Servo driver working ambient Temperature: -10~40 ℃
- Humidity: 90%RH or less
- Vibration: 4.9m/s^2
- Condensation and Freezing: None
- Ambient Temperature for Long-term Reliability: 50°C maximum

2.2 Servo motor installation

MS5/MS6 series servomotors can be installed either horizontally or vertically. The service life of the servomotor can be shortened or unexpected problems might occur if it is installed incorrectly or in an inappropriate location. Follow these installation instructions carefully.

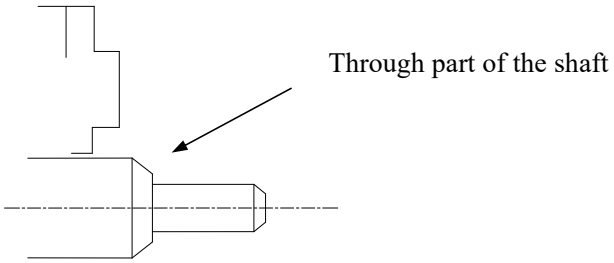
CAUTION

1. The end of the motor shaft is coated with antirust. Before installing, carefully remove all of the paint using a cloth moistened with paint thinner.
2. Avoid getting thinner on other parts of the servo motor.



2.2.1 Environment condition

When used in places with water droplets or oil droplets, the protection effect can be achieved through the treatment of motors. However, in order to seal the through part of the shaft, please specify the motor with oil seal. Connectors should be installed downward.

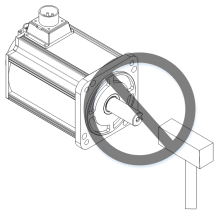
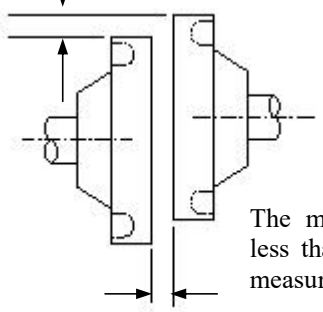


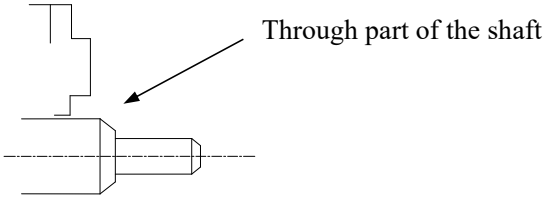
MS series servo motors are for indoor use. Please use them under the following installation conditions:

Item	Description
Use ambient temperature	-10℃~40℃ (no freeze)
Use ambient humidity	20%~90%RH (no condensation)

Storage temperature	-20℃~60℃
Storage humidity	20%~90%RH (no condensation)
Protection level	IP65 (MS5 motor, MS6 non 40/60/80 base motor) IP66 (MS6-40/60/80 base motor) IP67 (MS6-B3/B4, MS6G motor)

2.2.2 Installation cautions

Item	Description
Antirust treatment	◆ Before installation, please wipe the "rust-proof agent" of the extension end of the servo motor shaft, and then do the relevant rust-proof treatment.
Encoder cautions	◆ It is forbidden to impact the extension end of the shaft during installation, otherwise the internal encoder will be broken.  ◆ When the pulley is installed on the servo motor shaft with keyway, the screw hole is used at the end of the shaft. In order to install the pulley, the double-headed nails are inserted into the screw holes of the shaft, the washer is used on the surface of the coupling end, and the pulley is gradually locked with the nut. ◆ For the servo motor shaft with keyway, use the screw hole at the end of the shaft to install. For shaft without keyway, friction coupling or similar methods are used. ◆ When the pulley is dismantled, the pulley mover is used to prevent the bearing from being strongly impacted by the load. ◆ To ensure safety, protective covers or similar devices, such as pulleys installed on shaft, are installed in the rotating area.
Centering	◆ When installing the servo motor, make it conform to the centering accuracy requirement shown in the picture below. If the centering is inadequate, vibration will occur, and sometimes the bearing and encoder may be damaged. When installing the coupling, please don't directly impact the motor shaft, otherwise the encoder installed on the opposite side of the load shaft will be damaged. The maximum and minimum deviations are less than 0.03mm (rotated with the coupling) measured at four locations in a circle.  The maximum and minimum deviations are less than 0.03mm (rotated with the coupling) measured at four locations in a circle.
Installation direction	◆ Servo motor can be installed in horizontal or vertical direction.

Oil and water solutions	When using in places where water droplets are dropping, please use it on the basis of confirming the protection level of servo motor. (except for the shaft-through part) When oil droplets will drip into the shaft-through part, please specify the servo motor with oil seal. Conditions for use of servo motors with oil seals: ◆ Make sure the oil level is below the lip of the oil seal when using. ◆ Please use the oil seal to keep the splash of oil droplets in good condition. ◆ When the servo motor is installed vertically upward, please pay attention not to oil accumulation on the lip of the oil seal. 
Stress state of cable	◆ Don't "bend" or apply "tension" to the wire, especially the core of the signal line is 0.2mm or 0.3mm, very thin, so when wiring (using), don't make it too tight.
Processing of Connector Part	For the connector part, please pay attention to the following items: ◆ When connecting the connector, please make sure that there is no foreign matter such as garbage or metal sheets in the connector. ◆ When connecting the connector to the servo motor, it is necessary to connect the connector from the side of the main circuit cable of the servo motor first, and the grounding wire of the main cable must be connected reliably. If one side of the encoder cable is connected first, the encoder may fail due to the potential difference between PE. ◆ When wiring, please make sure that the pins are arranged correctly. ◆ Connectors are made of resin. Don't apply shock to avoid damaging the connector. ◆ When carrying out the operation under the condition that the cable remains connected, it is necessary to grasp the main body of the servo motor. If only the cable is seized for handling, it may damage the connector or pull the cable off. ◆ If bending cable is used, full attention should be paid to the wiring operation and stress should not be applied to the connector part. If the stress is applied to the connector part, the connector may be damaged.

2.2.3 Installation environment

- Don't use this product near corrosive and flammable gas environments such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gas, acid, alkali, salt, etc.
- In places with grinding fluid, oil mist, iron powder, cutting, etc., please choose motor with oil seal.
- A place away from heat sources such as stoves.
- Don't use motor in enclosed environment. Closed environment will lead to high temperature and shorten service life of motor.

2.3 Servo cable installation

DS5 series servo motor adopts communication encoder, which may cause uncertain influence due to improper use and environmental factors. When installing power cable and encoder cable, please pay attention to the following instructions.

2.3.1 Cable selection

Our regular cable materials include ordinary cable and high flexible cable. The adapter cable connector for motors with 80 flange or less is divided into aviation plug and amp plug. the adapter cable connector for motors with 80 flange or more is aviation plug.
The cable selected by the customer needs to define the operating conditions on site.
If the cable is used **in normal occasions**, please select the cable from other manufacturers (2.3.2 Xinje cable specification) in strict accordance with the specifications given by Xinje. If the cable is used **in unconventional occasions**, please select the cable according to the actual working conditions to be superior to the existing specifications of Xinje.

1. **In normal situations**, the following points should be noted:

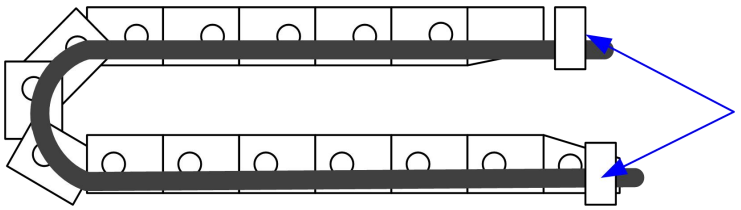
- For pulse command signal cable, please ensure wiring less than 3m.
- The encoder cable shall be within 20 meters. It is recommended to select special cable if it is more than 20 meters. The wire diameter of encoder cable depends on the length of encoder cable used on site. The longer the cable is, the greater the wire resistance is, and the more severe the voltage attenuation or signal distortion is, which is likely to cause pulse loss or no signal can be detected. Therefore, in general, the customized special cable should be selected if it is more than 20 meters.
- The power cable diameter depends on the current condition of the motor. Generally, the wire diameter is 1/10 of the maximum current of the motor. For example, the maximum current of the motor is 60A, and the wire diameter of 6mm² is selected.
- In case of interference, it is necessary to separate strong and weak current. It is recommended to separate power cable from encoder cable and signal cable.
- Ensure the correct grounding of servo driver and servo motor. The grounding resistance isn't more than 4Ω, and the grounding depth is more than 2m. It is recommended to use 4*40 angle galvanized steel or 40mm diameter galvanized steel pipe.
- If the customer makes the wire by himself, the cable specification (please refer to2.3.2 Xinje cable specification), the welding reliability shall be ensured when making the wire to avoid false welding, bridge connection, wrong welding, missing welding, etc., and the continuity of both ends of the cable can be tested after the welding is completed.

2. **In unconventional occasions**, the following items shall be noted:

(1) Occasions of dragging and bending cables

- Don't bend the cable or bear the tension. As the core diameter of signal cable is only 0.2mm or 0.3mm, it is easy to break, please pay attention to it when using.
- When the cable needs to be moved, please use flexible cable. Ordinary cable is easy to be damaged after long-term bending. Small power motor (motor below 80 flange) with its own cable can not be used for cable movement.
- When using cable protection chain, please ensure that:

① The bending radius of the cable is more than 10 times of the outer diameter of the cable.
② The wiring in the cable protection chain shall not be fixed or bundled, only the two immovable wires end in the cable protection chain shall be bound and fixed.
③ Don't twist the cable.
④ The duty cycle in the cable protection chain shall be less than 60%.
⑤ Don't mix the cables with too big difference in appearance. The thin wire will be broken by the thick wire. If it is necessary to mix the wiring, partition device is arranged in the middle of the cable.



(2) Greasy and humid occasions

- It is recommended to select cable with aviation plug as connector instead of AMP interface cable.
- It is necessary to make corresponding protection (glass glue / insulating cloth binding, etc.) for the used AMP interface cable on site.
- Use special cable.

(3) Interference, high current / high power occasions (such as welding equipment)

- The motor is properly grounded.
- High current equipment shall be grounded separately.
- Reasonable wiring. Such as separation of strong and weak current cables.
- Use metal shielding layer to shield, add magnetic ring to the encoder cable to resist interference.

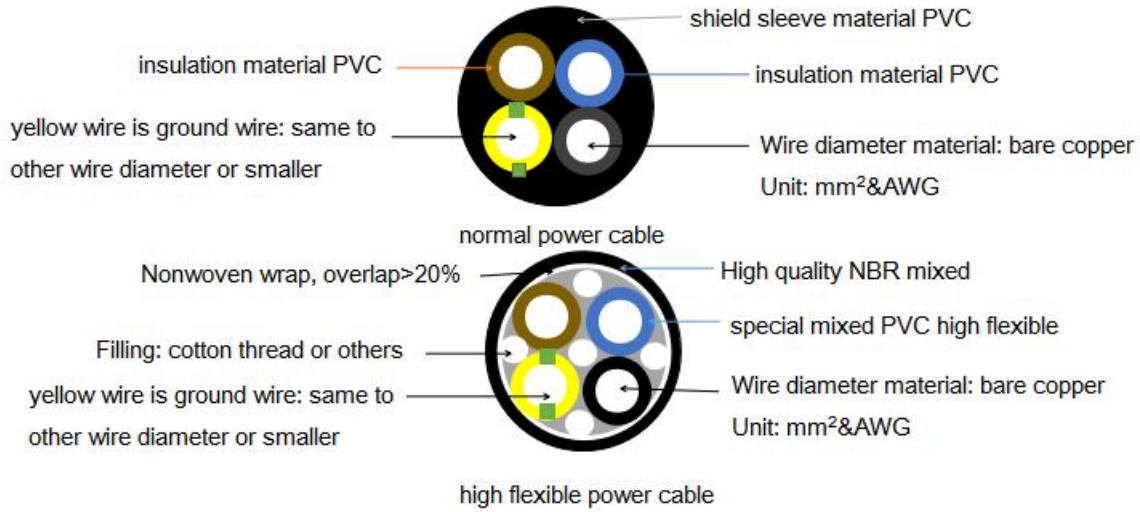
(4) Low / high temperature

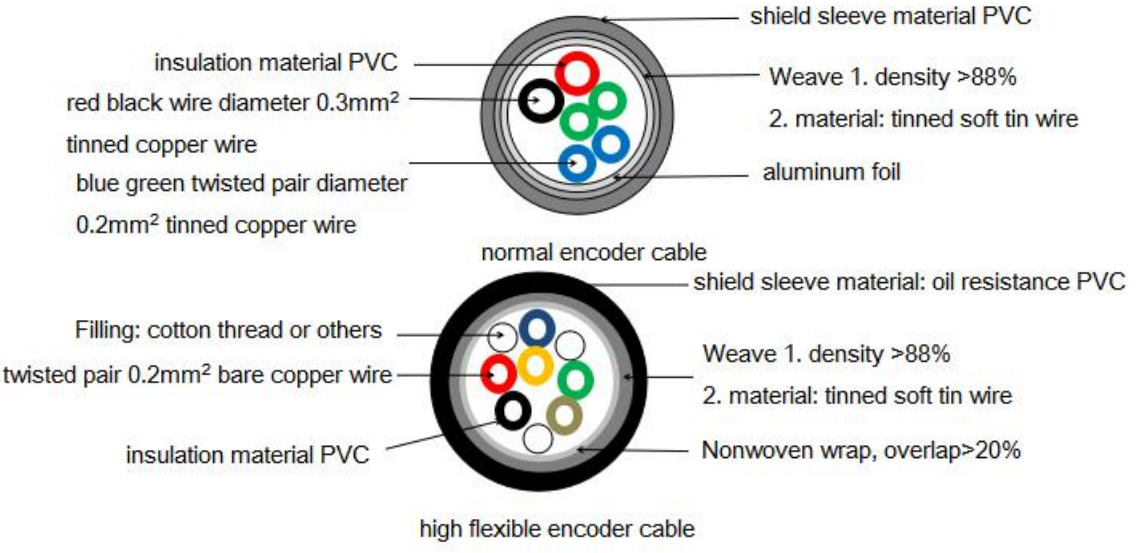
- Select cables (special cables) that meet the use conditions.

2.3.2 Xinje cable specification

1. Material composition of Xinje cable

Cross section of cable (encoder, power cable), corresponding introduction of wire skin material, wire diameter, wire core material shielding material, etc.





2. Cable diameter specification

Length	Base	Encoder cable diameter			Power cable diameter		
		Type	Whole cable diameter (mm)	Single cable diameter ($mm^{2)}$)	Type	Whole cable diameter (mm)	Single cable diameter ($mm^{2)}$)
20m and below	80 and below	Normal without battery box/with battery box	5.8/6.4	3P*0.2mm²	Normal / High flexibility	7.2/7.0	4*0.75mm²
	110, 130		6.2/6.2		Normal / High flexibility	9.4/9.6	4*1mm²
	180 base 2.9KW, 3KW	High flexibility	6.2		Normal / High flexibility	11.4/11.9	4*2mm²
	180 base above 3KW				Normal / High flexibility	14.5/15.6	4*6mm²
	220 base 22KW and below	High flexibility	7.9	4P*0.2mm²	Normal	19.8	4*10mm²
	32KW				Normal	20	3*12mm²+1*4mm²
	45KW				Normal	29	3*30mm²+1*16mm²
25m, 30m	180 base and below	Normal / High flexibility	7.8/6.8	2P*0.2mm²+1P*0.34mm²	/	/	/
	220 base	High flexibility	7.9	3P*0.2mm²+1P*0.4mm²	/	/	/

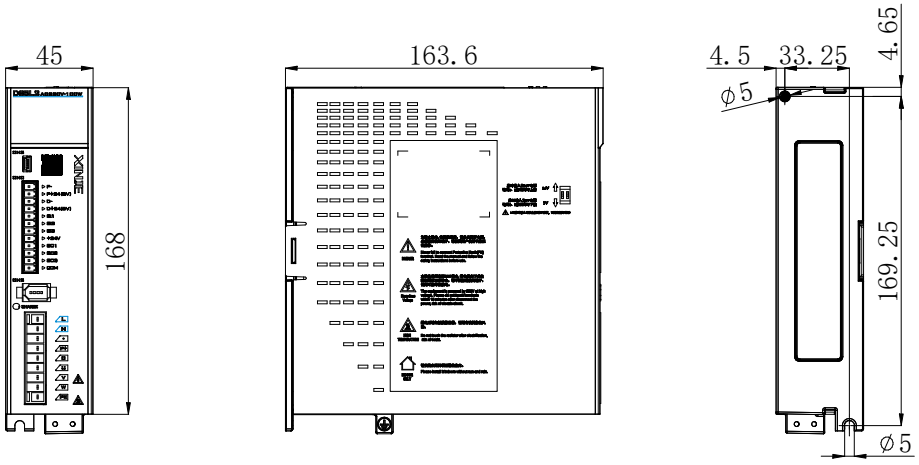
3. Cable performance specification

Performance		Normal cable	High flexible cable
Ordinary temperature resistance		-20℃~80℃	-20℃~80℃
Encoder cable withstand voltage		1000V/min	1000V/min
Power cable withstand voltage		3000V/min	3000V/min
Mobile installation	Bending radius	Travel ＜10m，7.5*D. Travel ≥10m，10*D.	Travel ＜10m，7.5*D. Travel ≥10m，10*D.
	Bending resistance times	Travel ＜10m, ≥1 million times. Travel ≥10m, ≥2 million times.	Travel ＜10m, ≥3 million times. Travel ≥10m, ≥5 million times.
Fixed installation	Bending radius	5*D	5*D

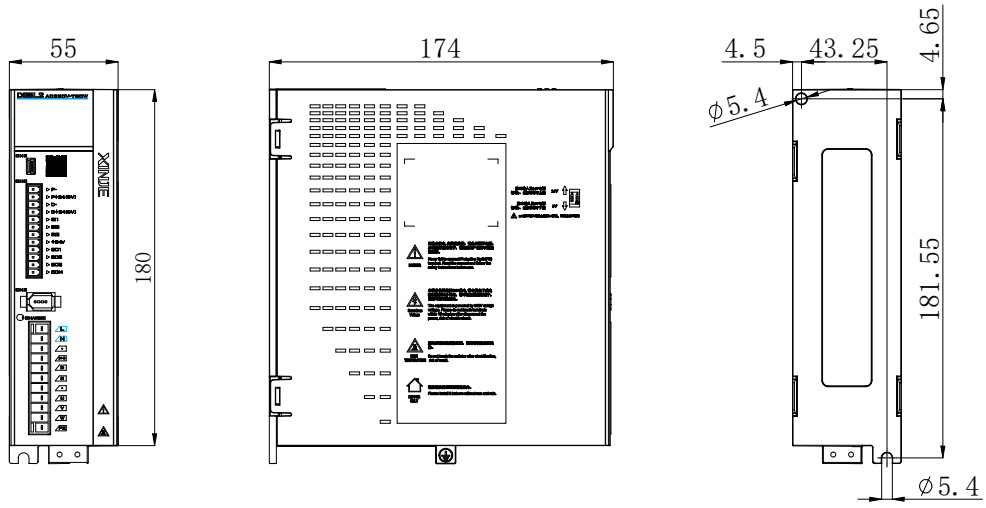
Note: D represents the finished product cable diameter.

2.4 Servo driver dimension

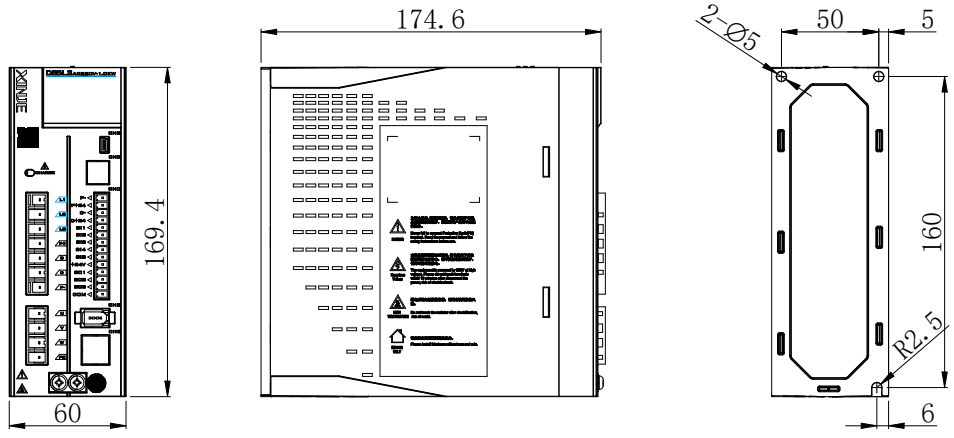
■ DS5L2-20P1-PTA, DS5L2-20P2-PTA, DS5L2-20P4-PTA Unit: mm



■ DS5L2-20P7-PTA Unit: mm

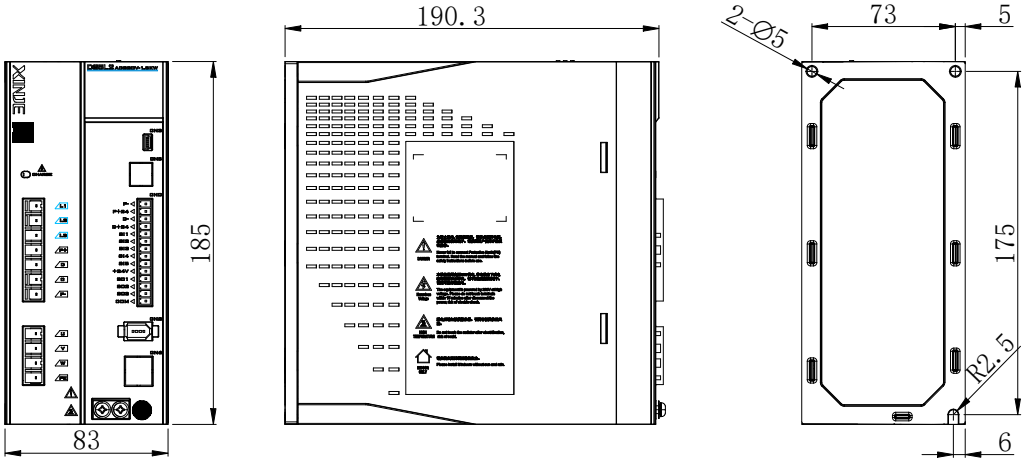


■ DS5L2-21P0-PTA, DS5L2-41P0-PTA, DS5L2-41P5-PTA Unit: mm



- DS5L2-21P5-PTA, DS5L2-22P3-PTA, DS5L2-22P6-PTA, DS5L2-42P3-PTA, DS5L2-43P0-PTA

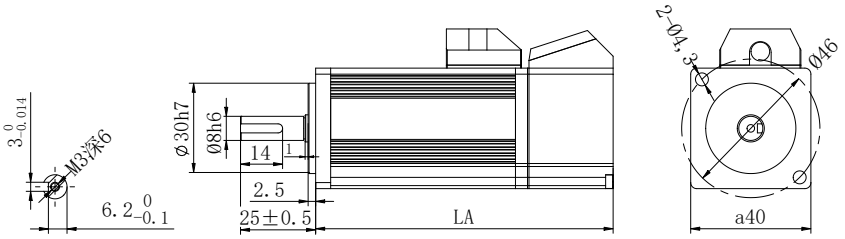
Unit: mm



2.5 Servo motor dimension

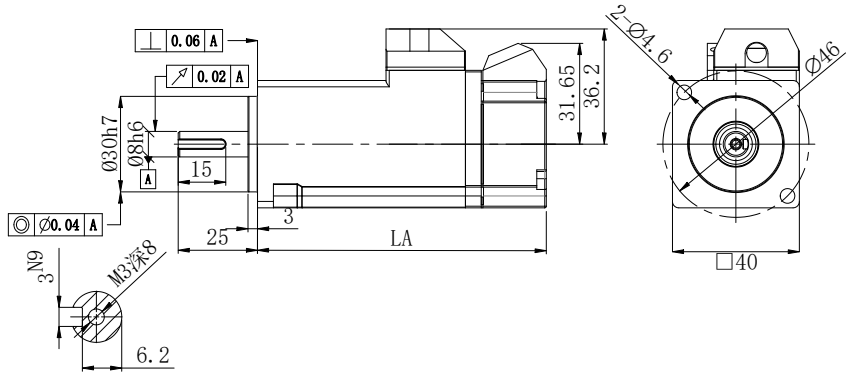
■ 40 series motor installation dimensions Unit: mm

◆ MS5 motor

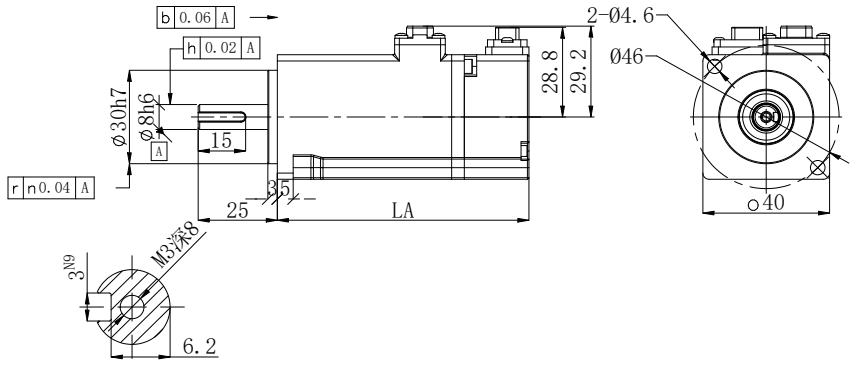


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-40STE-C□0030□□-20P1-S01/S02	89.5	119	Low inertia

◆ MS6 motor

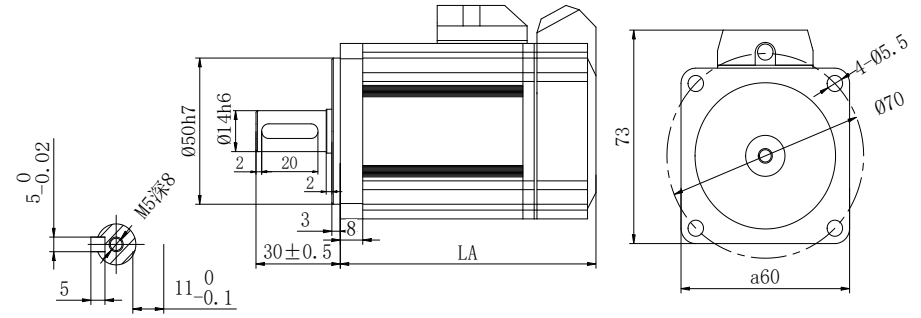


Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-40C□30B□1-20P1	91	122.9	High inertia

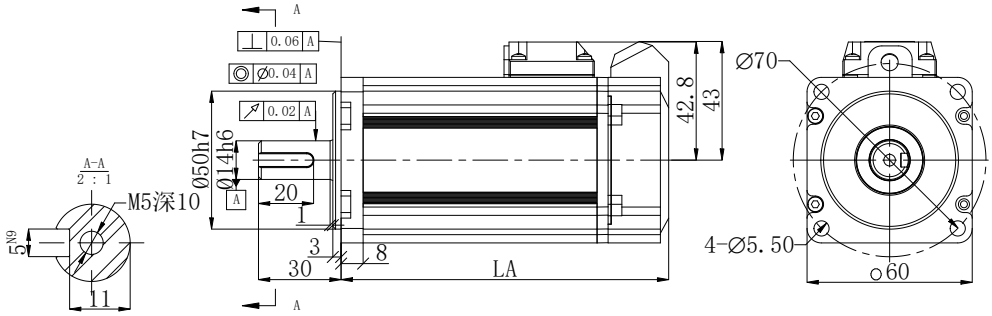


Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-40□□30B□3-20P1	79.4	112	High inertia

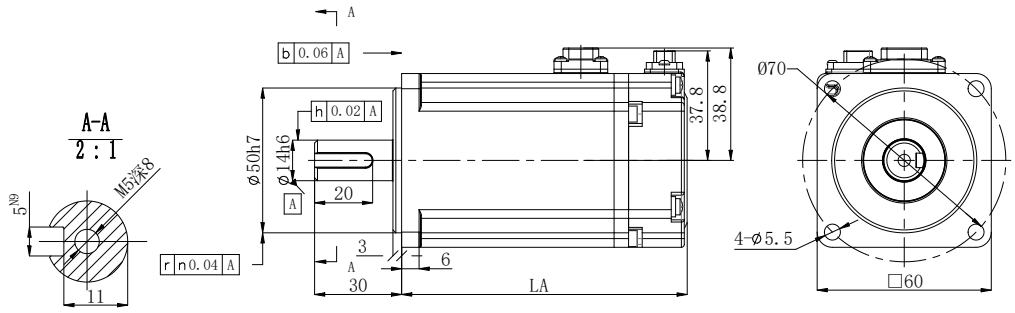
■ 60 series motor installation dimensions Unit: mm



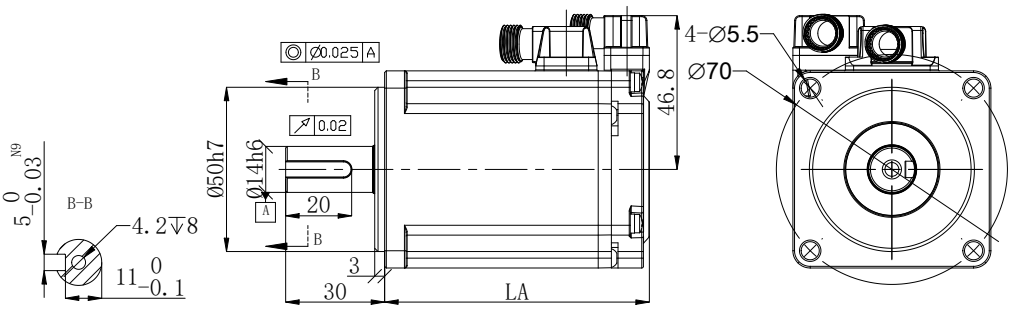
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-60STE-C□00630B□-20P2-S01/S02	79	114	Low inertia
MS5S-60STE-C□01330B□-20P4-S01/S02	99	134	
MS5H-60STE-C□00630B□-20P2-S01/S02	91	126	High inertia
MS5H-60STE-C□01330B□-20P4-S01/S02	111	146	
MS-60STE-T01330-20P4-D01	145	189	-



Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-60C□30B□□-20P4	119	151	High inertia
MS6S-60C□30B□□-20P4	107	139	Low inertia
MS6H-60C□30B□□-20P2	90	121	High inertia



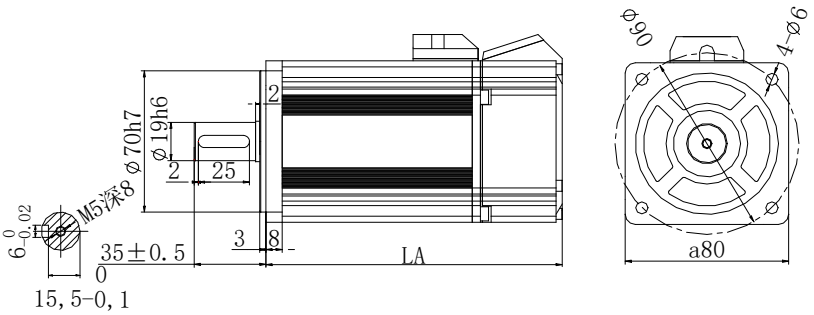
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-60□□30B□3-20P2	76.4	99.15	High inertia
MS6S-60□□30B□3-20P4	98.4	121.15	Low inertia
MS6H-60□□30B□3-20P4	98.4	121.15	High inertia



Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-60CM30B□4-20P4	80.2	106.95	High inertia

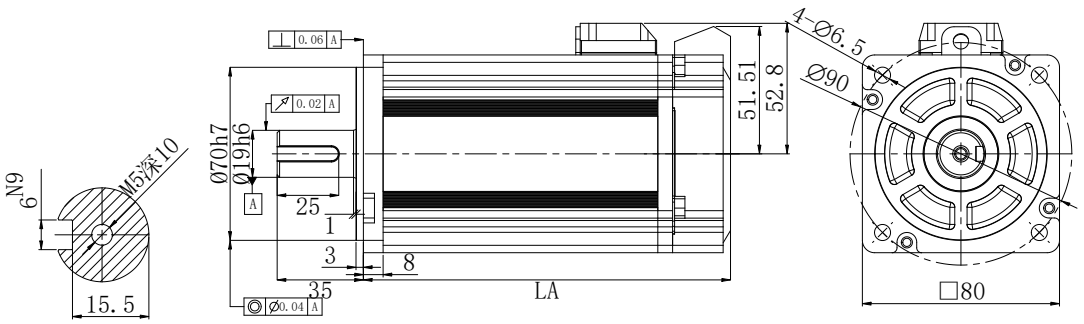
■ 80 series motor installation dimensions Unit: mm

◆ MS5/MS motor

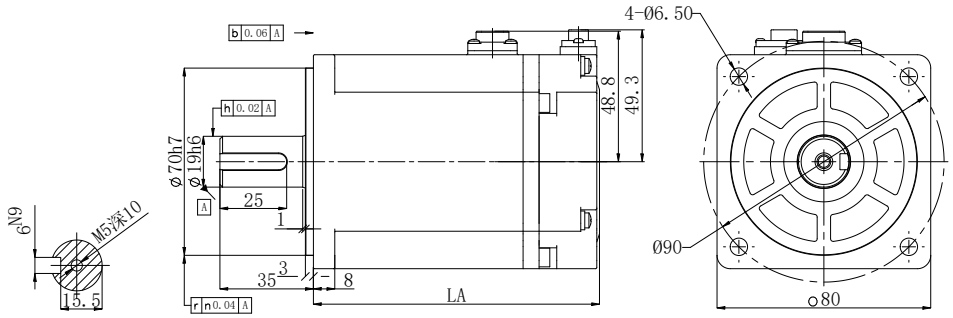


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-80STE-C□02430B□-20P7-S01/S02	107	144	Low inertia
MS5S-80STE-C□03230B□-21P0-S01/S02	128	165	
MS5H-80STE-C□02430B□-20P7-S01/S02	119	156	High inertia
MS5H-80STE-C□03230B□-21P0-S01/S02	140	177	
MS-80ST-T02430B□-20P7	151	199	-
MS-80ST-T03520B□-20P7	179	219	

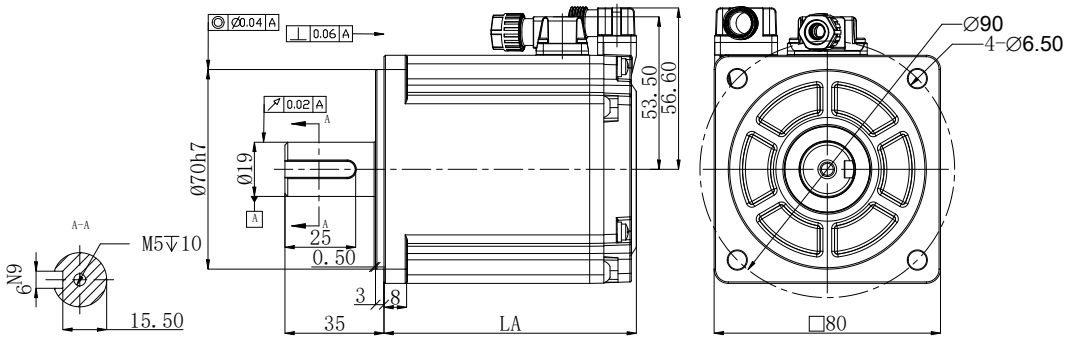
◆ MS6 motor



Motor model	LA±1		Inertia level
	Normal	With brake	
MS6S-80C□30B□□1/2-20P7	117	150	Low inertia
MS6S-80C□20B□□1/2-20P7	127	160	
MS6H-80C□30B□□1/2-20P7	124	157	High inertia
MS6H-80C□20B□□1/2-20P7	149	182	
MS6S-80TL30B1-20P7	117	-	Low inertia

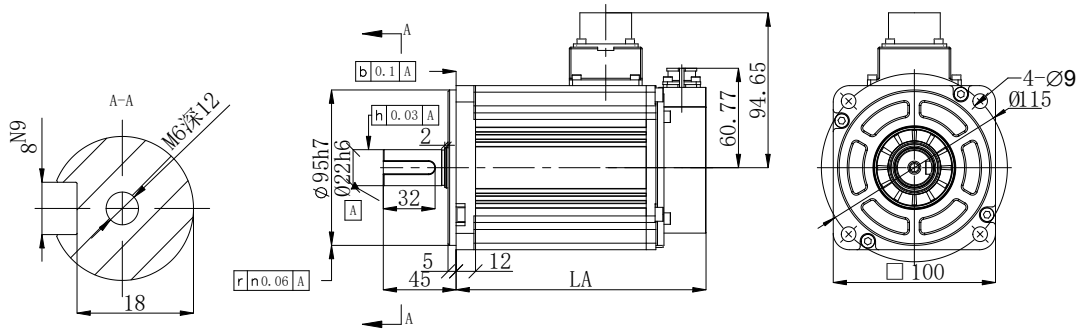


Motor model	LA±1		Inertia level
	Normal	With brake	
MS6S-80C□30B□3-20P7	107.1	132.1	Low inertia
MS6H-80C□30B□3-20P7	107.1	132.1	High inertia
MS6S-80C□30B□3-21P0	117.6	142.6	Low inertia
MS6H-80C□30B□3-21P0	134	159	High inertia



Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-80CM30B□4-20P7	89.2	121.1	High inertia

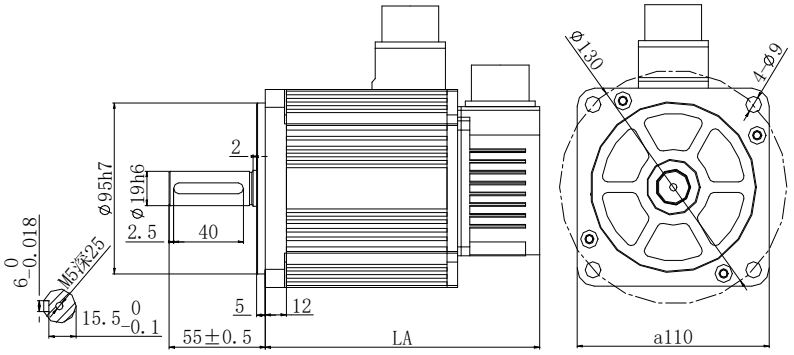
■ 100 series motor installation dimensions Unit: mm



Motor model	LA±1		Inertia level
	Normal	With brake	
MS6S-100C□30B2-21P5	154.5	183	Low inertia
MS6S-100C□30B□2-21P0	138.5	164	
MS6S-100TL30B□2-21P0	144.2	169.7	

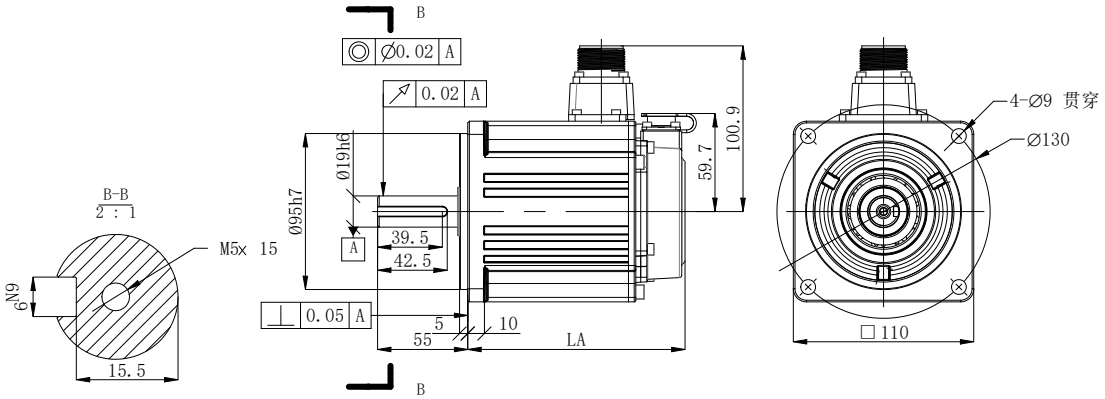
■ 110 series motor installation dimensions Unit: mm

◆ MS5/MS motor



Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-110ST-C□03230B□-21P0-S01	157	205	Low inertia
MS5S-110ST-TL03230B□-21P0-S01	157	205	
MS5S-110ST-C□04830B□-21P5-S01	166	214	
MS5S-110ST-TL04830B□-21P5-S01	166	214	
MS5S-110ST-C□06030B□-21P8-S01	181	229	
MS-110ST-TL06030B□-21P8-S01	181	229	-
MS-110ST-T04030B-21P2	157	205	
MS-110ST-T05030B-21P5	166	214	

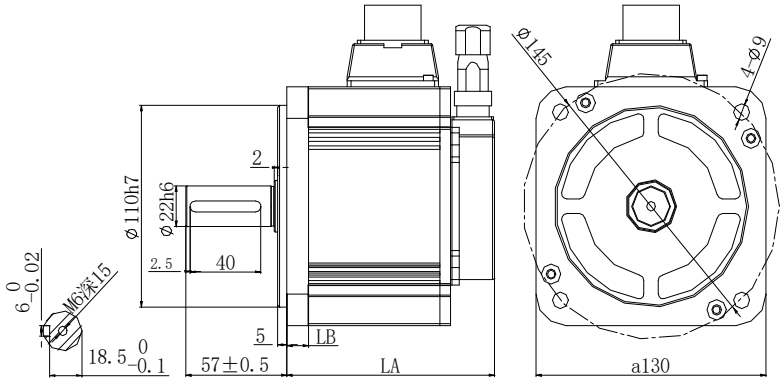
◆ MS6 motor



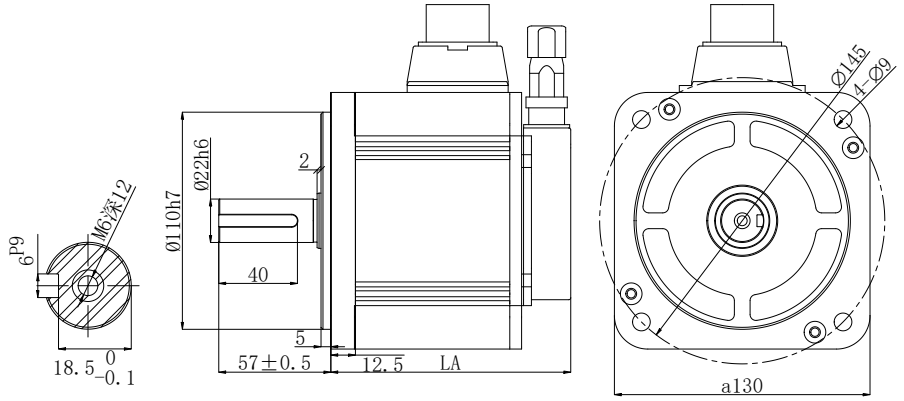
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6G-110C□30B□2-21P5	132.5	-	Medium inertia
MS6G-110TL30B2-□1P5	149	-	

■ 130 series motor installation dimensions Unit: mm

◆ MS5/MS motor

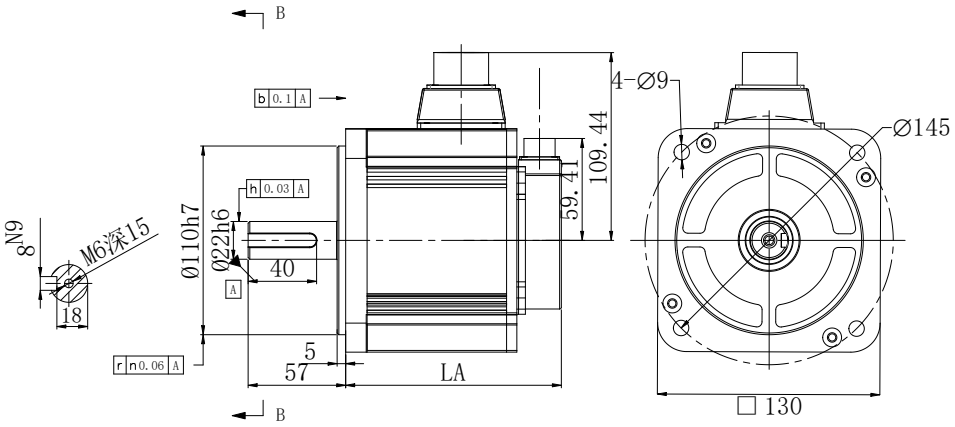


Motor model	LA±1		LB	Inertia level
	Normal	With brake		
MS5G-130STE-C□05415B□-20P8-S01	117.5	147	12.5	Medium inertia
MS5G-130STE-TL05415B□-20P8-S01	134.5	164.5		
MS5G-130STE-C□07220B□-21P5-S01	133.5	162.5		
MS5G-130STE-C□07220B□-41P5-S01	133.5	162.5		
MS5G-130STE-TL07220B□-21P5-S01	149.5	179.5		
MS5G-130STE-TL07220B□-41P5-S01	149.5	179.5		
MS5G-130STE-C□11515B□-21P8-S01	159.5	189.5		
MS5G-130STE-C□11515B□-41P8-S01	159.5	189.5		
MS5G-130STE-TL11515B□-21P8-S01	176.5	206.5		
MS5G-130STE-TL11515B□-41P8-S01	176.5	206.5		
MS5G-130STE-C□14615B□-22P3-S01	180.5	210.5		
MS5G-130STE-C□14615B□-42P3-S01	180.5	210.5		
MS5G-130STE-TL14615B□-22P3-S01	197.5	227.5		
MS5G-130STE-TL14615B□-42P3-S01	197.5	227.5		
MS5G-130STE-C□07330B□-22P4-S01	133.5	163.5		
MS5G-130STE-TL07330B□-22P4-S01	149.5	179.5		
MS5G-130STE-C□10025B□-22P6-S01	159.5	189.5		
MS-130ST-T06025B□-21P5	179	238	14	-
MS-130ST-T10015B□-21P5	205	264		
MS-130STE-T15015G□-22P3	235	294		
MS-130STE-T07730B□-22P4	205	264		
MS-130ST-T10025B□-22P6	209	290		
MS-130ST-TL10030□□-43P0	225	284	15	

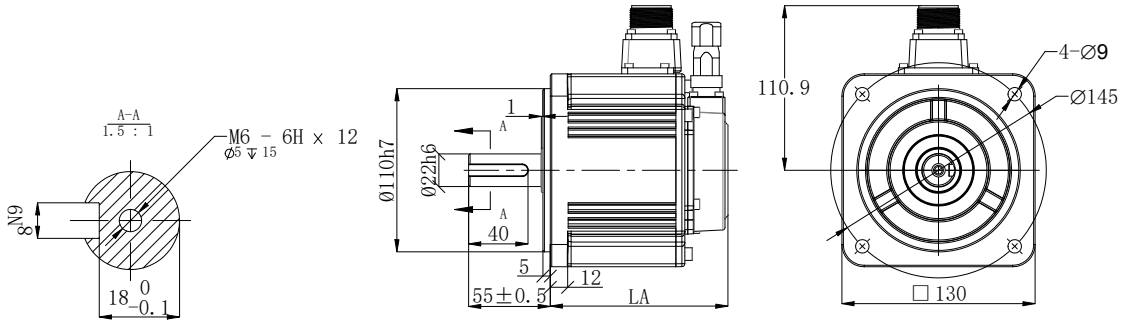


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-130STE-C□06025B□-21P5-S01	123.5	153.5	Medium inertia
MS5G-130STE-C□10015B□-21P5-S01	146.5	176.5	

◆ MS6 motor

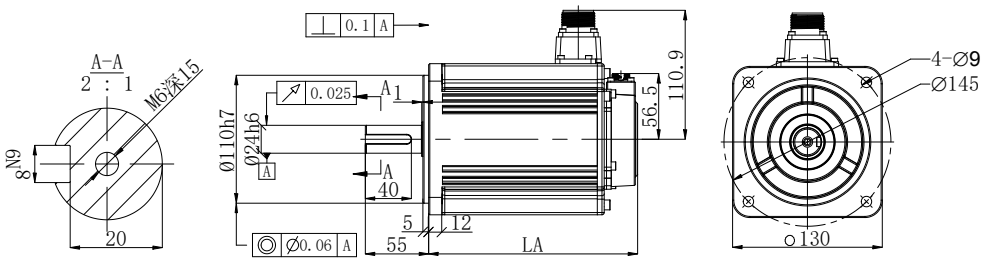


Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-130C□15B□2-20P8	126	156	High inertia
MS6H-130C□15B□2-40P8	126	156	
MS6H-130TL15B□2-20P8	142	172	
MS6H-130TL15B□2-40P8	142	172	
MS6H-130C□15B□2-41P3	148	178	
MS6H-130TL15B□2-41P3	164	194	
MS6H-130C□20B□2-21P5	148	178	
MS6H-130TL20B□2-21P5	164	194	
MS6H-130C□15B□2-21P8	175	205	
MS6H-130C□15B□2-41P8	175	205	
MS6H-130TL15B□2-21P8	191	221	
MS6H-130TL15B□2-41P8	191	221	
MS6H-130C□15B□2-22P3	195.6	225.6	
MS6H-130C□15B□2-42P3	195.6	225.6	
MS6H-130TL15B□2-22P3	211.6	241.6	
MS6H-130TL15B□2-42P3	211.6	241.6	



Motor model	LA±1		Inertia level
	Normal	With brake	
MS6G-130C□25B□2-□1P0	119.5	148.5	Medium inertia
MS6G-130TL25B□2-□1P0	136	165	
MS6G-130C□20B□2-□1P5	133.5	162.5	
MS6G-130TL20B□2-□1P5	150	179	
MS6G-130C□15B□2-□1P5	151.5	180.5	

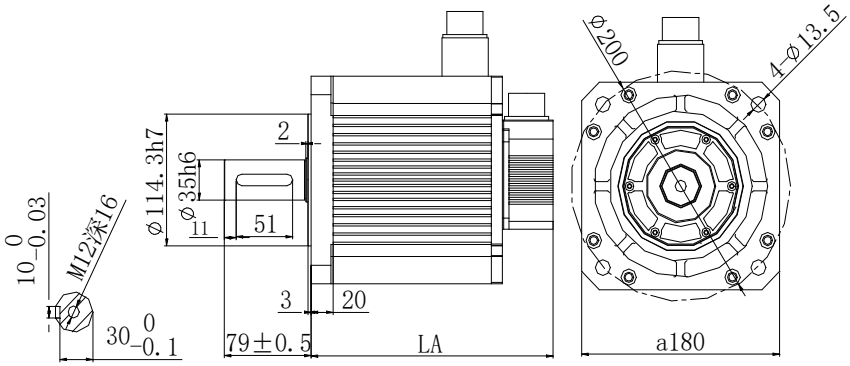
MS6G-130TL15B□2-□1P5	168	197	
MS6G-130C□15E□2-□2P3	181.5	210.5	
MS6G-130TL15E□2-□2P3	198	227	



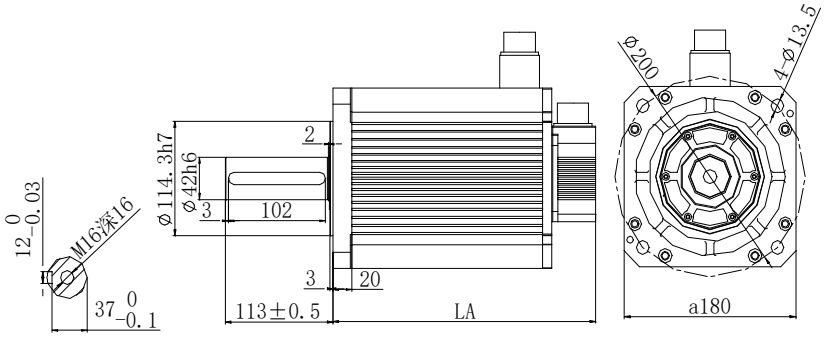
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6G-130C□15B□2-□2P3	181.5	210.5	Medium inertia
MS6G-130TL15B□2-□2P3	198	227	

■ 180 series motor installation dimensions Unit: mm

◆ MS5 motor

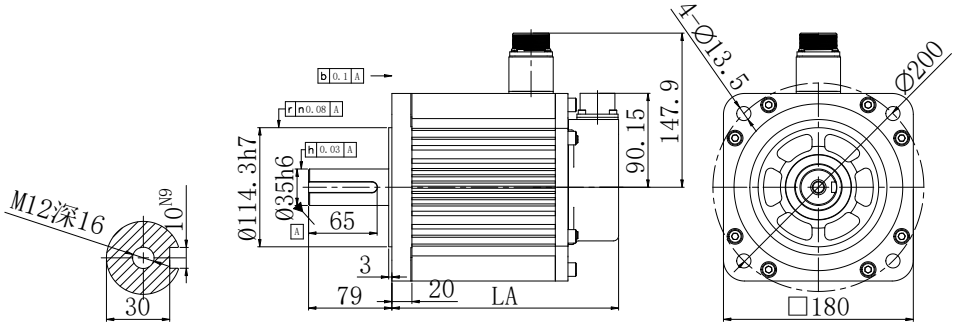


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-180ST-TL19015□□-42P9-S01	221	303	Medium inertia
MS5G-180ST-TL28015□□-44P4-S01	247	329	

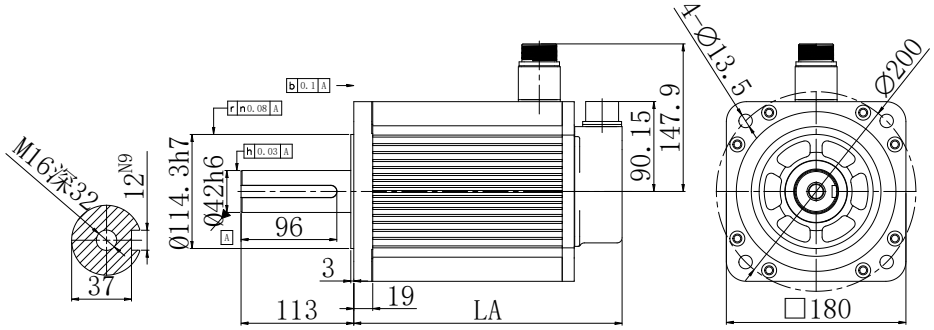


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-180ST-TL35015□□-45P5-S01	277	359	Medium inertia
MS5G-180ST-TL48015□□-47P5-S01	308	390	

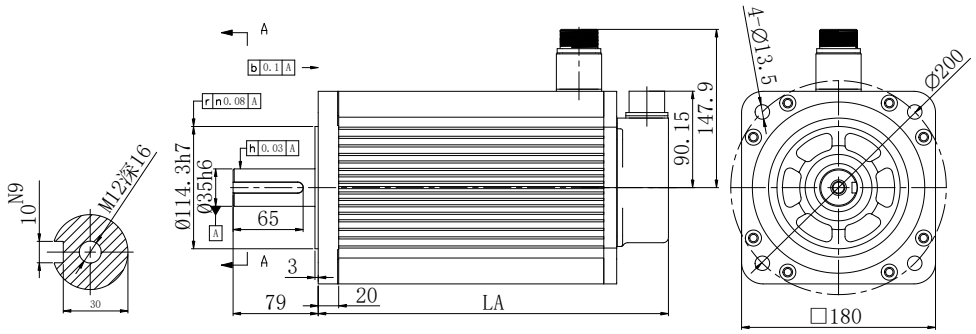
◆ MS6 motor



Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-180C□15B□2-43P0	215	255	High inertia
MS6H-180TL15B□2-43P0	215	255	
MS6H-180C□15B□2-44P4	247	287	
MS6H-180TL15B□2-44P4	247	287	



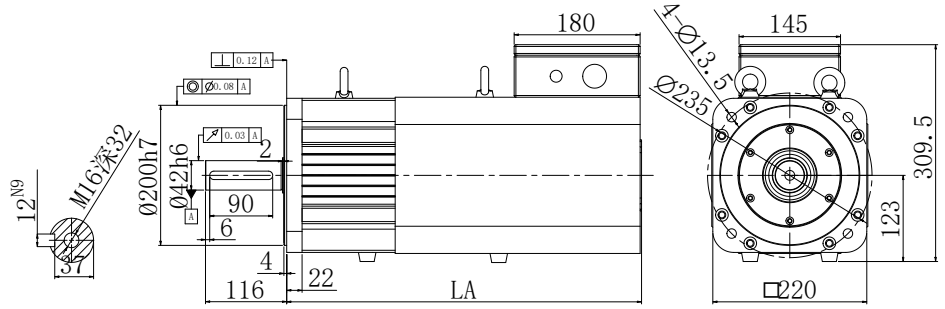
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-180C□15B□2-45P5	269	309	High inertia
MS6H-180TL15B□2-45P5	269	309	
MS6H-180C□15B□2-47P5	325	365	
MS6H-180TL15B□2-47P5	325	365	



Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-180CS/CM15E□2-45P5	269	309	High inertia
MS6H-180CS/CM15E□2-47P5	325	365	

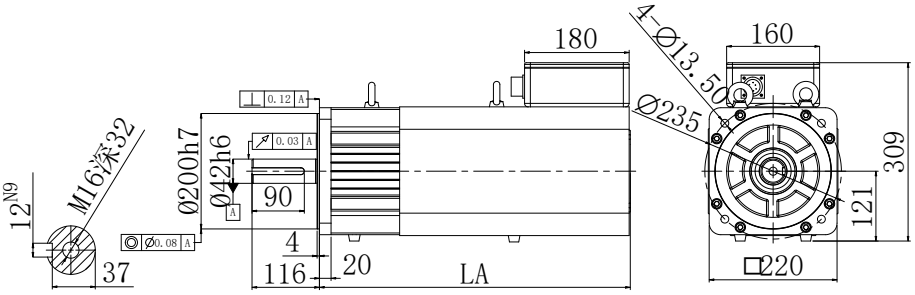
■ 220 series motor installation dimensions Unit: mm

◆ MS motor



Motor model	LA±1		Inertia level
	Normal	With brake	
MS-220STE-TL70015B□-411P0-XJ	454	549	-
MS-220STE-TL96015B□-415P0-XJ	507	602	

◆ MS5G motor



Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-220STE-□□40015B-422P0-S01	535	-	Medium inertia

3 Servo system wiring

Servo driver interface wiring recommended wire, as shown in the following table:

Driver model	Power cable diameter mm²	Power cable diameter mm²	Encoder cable diameter mm²	Ground cable ⏚-diameter mm²
DS5L2-20P1-PTA	0.75	0.75	0.2 (7-core)	0.75
DS5L2-20P2-PTA	0.75	0.75	0.2 (7-core)	0.75
DS5L2-20P4-PTA	0.75	0.75	0.2 (7-core)	0.75
DS5L2-20P7-PTA	0.75	0.75	0.2 (7-core)	0.75
DS5L2-21P0-PTA	2.0	1.5	0.2 (7-core)	1.5
DS5L2-21P5-PTA	2.0	1.5	0.2 (7-core)	1.5
DS5L2-22P3-PTA	2.0	1.5	0.2 (7-core)	1.5
DS5L2-22P6-PTA	2.0	1.5	0.2 (7-core)	1.5
DS5L2-41P0-PTA	2.0	1.5	0.2 (7-core)	1.5
DS5L2-41P5-PTA	2.0	1.5	0.2 (7-core)	1.5
DS5L2-42P3-PTA	2.0	1.5	0.2 (7-core)	1.5
DS5L2-43P0-PTA	2.0	2.5	0.2 (7-core)	2.5

Note:

(1) Please don't cross power wires and signal wires from the same pipeline, nor tie them together. When wiring, please keep the power wire and signal wire more than 30 cm apart.

(2) For the signal wire and the feedback wire of the encoder (PG), please use the multi-stranded wire and the multi-core stranded integral shielding wire.

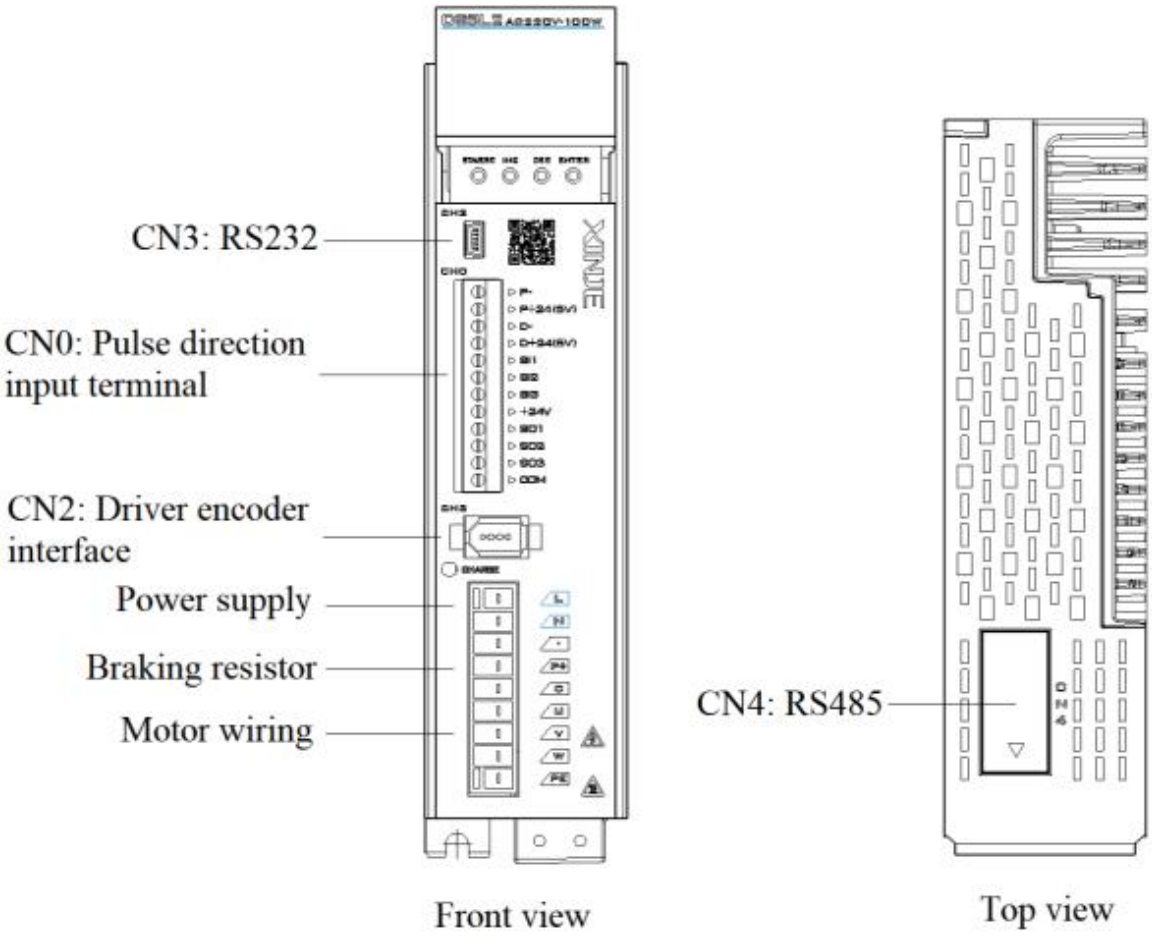
(3) For wiring length, the longest instruction input wire is 3m and the longest PG feedback wire is 20m.

(4) Even if the power supply is off, there may still be a high voltage in the servo unit. Please don't touch the power terminal temporarily (10 minutes).

(5) Don't turn ON/OFF power frequently. When the ON or OFF power supply needs to be repeatedly connected, please control it less than once in 2 minutes. Because of the capacitance in the power supply of the servo driver, a large charging current (charging time of 0.2 seconds) will flow through when the power supply is ON. Therefore, if the ON/OFF power supply is frequently used, the performance of the main circuit components in the servo driver will be degraded.

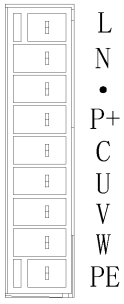
3.1 Main circuit wiring

3.1.1 Servo driver terminal arrangement



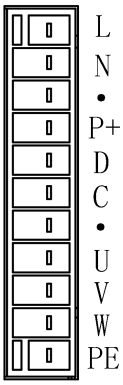
3.1.2 Main circuit terminal

■ DS5L2-20P1-PTA, DS5L2-20P2-PTA, DS5L2-20P4-PTA



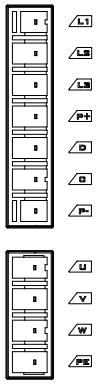
Terminal	Function	Explanation
L/N	Power supply input of main circuit	Single phase AC 200~240V, 50/60Hz
●	Vacant terminal	-
U, V, W, PE	Motor terminals	Connect the motor Note: The ground wire is on the terminal, please check it before power on.
P+, C	External regenerative resistor	Connect regenerative resistor between P+ and C, P0-25= power value, P0-26= resistor value

■ DS5L2-20P7-PTA



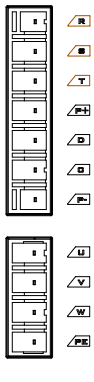
Terminal	Function	Explanation
L/N	Power supply input of main circuit	Single phase AC 200~240V, 50/60Hz
●	Vacant terminal	-
U, V, W, PE	Motor terminals	Connect the motor Note: the ground wire is on the terminal, please check it before power on!
P+, D, C	Internal regenerative resistor	Short P+ and D, disconnect P+ and C
	External regenerative resistor	Connect regenerative resistor between P+ and C, disconnect P+ and D, P0-25= power value, P0-26= resistor value

■ DS5L2-21P0-PTA, DS5L2-21P5-PTA, DS5L2-22P3-PTA, DS5L2-22P6-PTA



Terminal	Function	Explanation
L1, L2, L3	Power supply input of main circuit	Single phase/three phase AC 200~240V, 50/60Hz (If single-phase 220V power supply is used, please connect to L1 and L3, otherwise power failure will affect parameter memory)
P+, D, C	Internal regenerative resistor	Short P+ and D, disconnect P+ and C
	External regenerative resistor	Connect regenerative resistor between P+ and C, disconnect P+ and D, P0-25= power value, P0-26= resistor value
P+, P-	Bus terminal	Real time voltage of the busbar can be measured, please be aware of the danger
U, V, W, PE	Motor connection terminals	Connect the motor

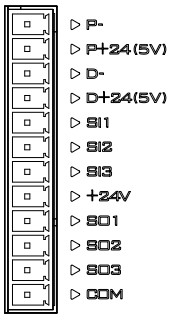
■ DS5L2-41P0-PTA, DS5L2-41P5-PTA, DS5L2-42P3-PTA, DS5L2-43P0-PTA



Terminal	Function	Explanation
R, S, T	Power supply input of main circuit	Three phase AC380~440V, 50/60Hz
P+, D, C	External regenerative resistor	Connect regenerative resistor between P+ and C, disconnect P+ and D, P0-25= power value, P0-26= resistor value
P+, P-	Bus terminal	Real time voltage of the busbar can be measured, please be aware of the danger
U, V, W, PE	Motor connection terminals	Connect the motor

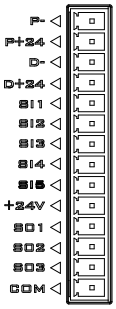
3.1.3 CN0, CN2 terminal

3.1.3.1 CN0 terminal



■ Terminal description for CN0 (750W and below, 3 IN and 3 OUT)

Terminal	Name	Terminal	Name
P-	Pulse input PUL-	SI3	Input terminal 3
P+24	Open collector input	+24V	Input +24V
D-	Direction input DIR-	SO1	Output terminal 1
D+24	Open collector input	SO2	Output terminal 2
SI1	Input terminal 1	SO3	Output terminal 3
SI2	Input terminal 2	COM	Output terminal ground

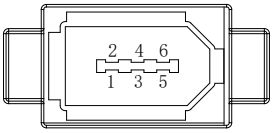


■ Terminal description for CN0 (1KW and above, 5 IN, 3 OUT)

Terminal	Name	Terminal	Name
P-	Pulse input PUL-	SI4	Input terminal 4
P+24	Open collector input	SI5	Input terminal 5
D-	Direction input DIR-	+24V	Input +24V
D+24	Open collector input	SO1	Output terminal 1
SI1	Input terminal 1	SO2	Output terminal 2
SI2	Input terminal 2	SO3	Output terminal 3
SI3	Input terminal 3	COM	Output terminal ground

3.1.3.2 CN2 terminal

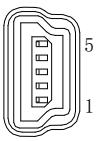
The terminals of the CN2 connector are arranged as follows (faced solder plates):



No.	Definition
1	5V
2	GND
3	/
4	/
5	485-A
6	485-B

3.1.4 Communication port

■ CN3 (RS-232 communication)



Driver side-5-pin trapezoidal interface

Pin	Name	Description
1	TXD	RS232 send
2	RXD	RS232 receive
3	GND	RS232 signal ground

Note: Please use the dedicated cable provided by XINJE company.

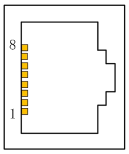
RS232 port default communication parameters: baud rate 19200bps, data bit is 8-bit, stop bit is 1-bit, even parity.

Please use the dedicated cable provided by Xinje Company for communication. RS232 communication is full duplex communication, and the TXD (pin 1) of the driver 232 communication port needs to be connected to the RX pin of the USB converter, while the RXD (pin 2) of the port needs to be connected to the TX pin of the USB converter.

Modbus station no.

Parameter	Function	Default setting	Range	Modification	Effective
P7-10	Modbus station no.	1	1~255	Servo OFF	Immediately

■ CN4 (RS-485 communication)



LAN port (On the drive)

Pin	Name
4	485-A
5	485-B
6	485-GND
Other	Reserved

RS485 port default communication parameters: baud rate 19200bps, data bit is 8-bit, stop bit is 1-bit, even parity.

Modbus station no.

Parameter	Function	Default setting	Range	Modification	Effective
P7-00	Modbus station no.	1	0~100	Servo OFF	Immediately

Note:

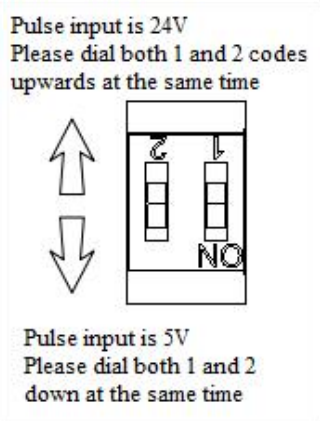
(1) It supports standard Modbus RTU protocol and is used as a Modbus RTU slave station.

(2) RS232 and RS485 communication ports can be used at the same time.

3.2 Classification and function of signal terminals

3.2.1 DIP switch

Note: A driver with a dip switch that supports collector 24V and differential 5V functions.



Dial 1 represents pulse input voltage switching.
Dial 2 represents the switching of pulse direction voltage.
Default DIP 1 and DIP 2 are both set to OFF, corresponding to an input pulse of 24V collector.
Both DIP 1 and DIP 2 are set to ON, corresponding to a differential 5V input pulse.

Note: Don't dial to 5V system when 24V pulse input. Otherwise, it will damage the drive.

- When both dip switches 1 and 2 are turned on, it represents a 5V input. If 24V input is supplied at this time, it will cause the current limiting resistor to burn out.
- When both dip switches 1 and 2 are turned off, it represents a 24V input. If a 5V input is provided at this time, it will result in the inability to receive pulses.

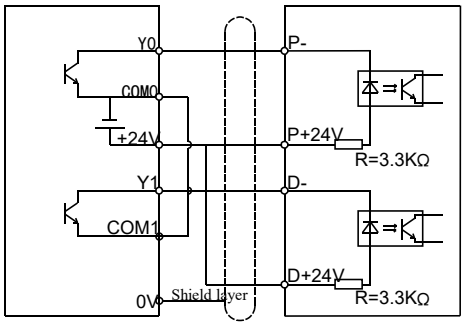
3.2.2 Pulse signal

Instruction form	Option	Meaning	P-input signal	D-input signal	Chapter
P0-10 xxx□	0	CW/CCW dual-pulse mode	CW	CCW	5.4.2.2
	1	AB phase mode	A phase	B phase	
	2	Pulse+direction mode	pulse	Direction	
Collector open circuit type (24V voltage) input signal is P+ 24V/D+ 24V Differential mode (5V voltage) input signal is P+5V/D+5V					

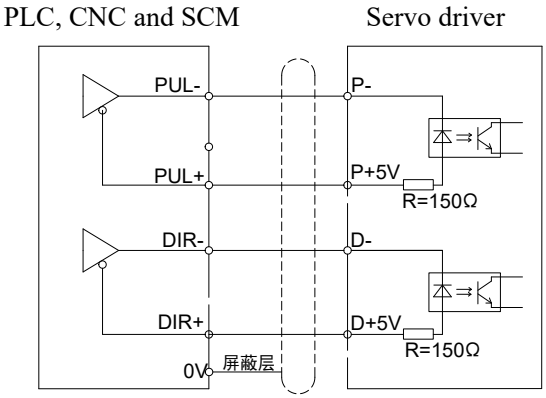
The wiring diagram of P + D, CW, CCW and AB phase interface circuit is as follows:

Open collector (24V voltage)

PLC, CNC and SCM　　Servo driver



Differential mode (5V voltage)



Adjusting the dial switch can switch the pulse signal voltage. The default system at the factory is 24V. If you need to replace the 5V system, please dial both dial 1 and 2 to ON simultaneously.
When replacing the DIP switch to a 5V system, the terminal P+24V is P+5V, and D+24V is D+5V.

Note:
(1) The power supply voltage range of P-/P+ 24V and D-/D+ 24V is 18V~25V. The power supply voltage range of P-/P+5V, D-/D+5V is 3.3V~5V. There may be abnormal pulse and direction if the voltage is lower than 18V/3.3V.
(2) Servo pulse input port is ON at 10mA.
(3) In order to resist interference, twisted-pair shielding wire must be used. And the instruction signal cable is recommended to be within 3 meters. It is recommended to shield the 0V of the controller and ensure good grounding of the controller.
(4) If the controller is Xinje PLC, the rated current of the pulse output port is 50mA. According to this data, it can be judged that one pulse theoretically can drive at most five servos. It is recommended not to exceed 3.
(5) If the pulse frequency of P+D sent by the controller is greater than 100kHz, a 500Ω 2W pull-up resistor needs to be connected in parallel at the PLC pulse output terminal, or a 2KΩ 1W pull-up resistor needs to be connected in parallel at the servo pulse receiving terminal.

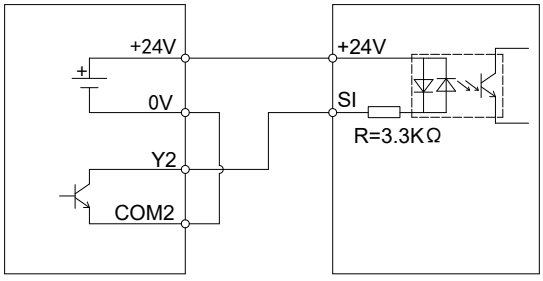
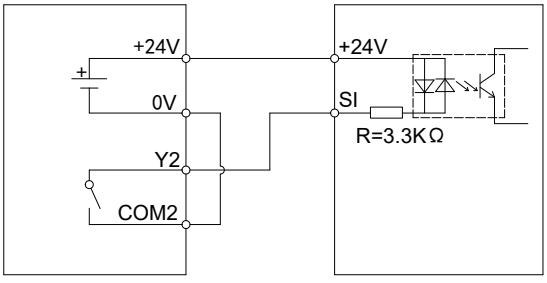
3.2.3 SI input signal

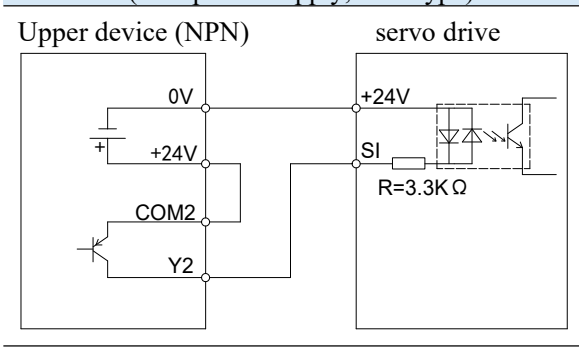
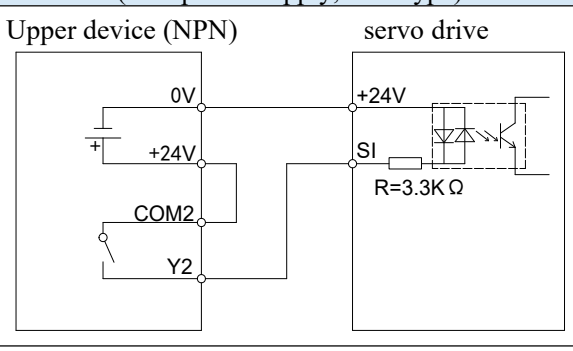
Please use a relay or an open collector transistor circuit to connect. When using relay connection, please select the relay for small current. If the relay isn't small current, it will cause bad contact.

Type	Input terminal	Function
Digital input	SI1~SI5	Multifunctional input signal terminal

Defaulted assignment of input terminals

Terminal	SI1	SI2	SI3	SI4	SI5
Function	S-ON/enable	ALM-RST/alarm reset	P-OT/forward run prohibition	N-OT/reverse run prohibition	Not distributed

Open collector type (24V power supply, PNP type)	Relay type (24V power supply, PNP type)
Upper device (NPN) servo drive	Upper device (NPN) servo drive
	

Open collector type (24V power supply, PNP type)	Relay type (24V power supply, PNP type)
	

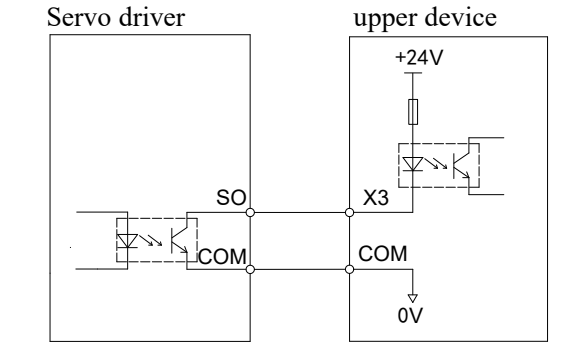
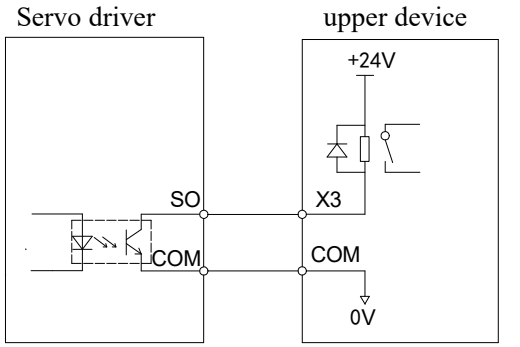
Note: The maximum allowable voltage and current capacity of collector open circuit output circuit are as follows:
Voltage: DC 30V (maximum)
Current: DC 50mA (maximum)

3.2.4 SO output signal

Type	Output terminal	Function
Optocoupler output	SO1~SO3	Multifunctional output terminal

Defaulted assignment of output terminals

Terminal	SO1	SO2	SO3
Function	COIN/positioning completion	ALM/alarm	Not distribute

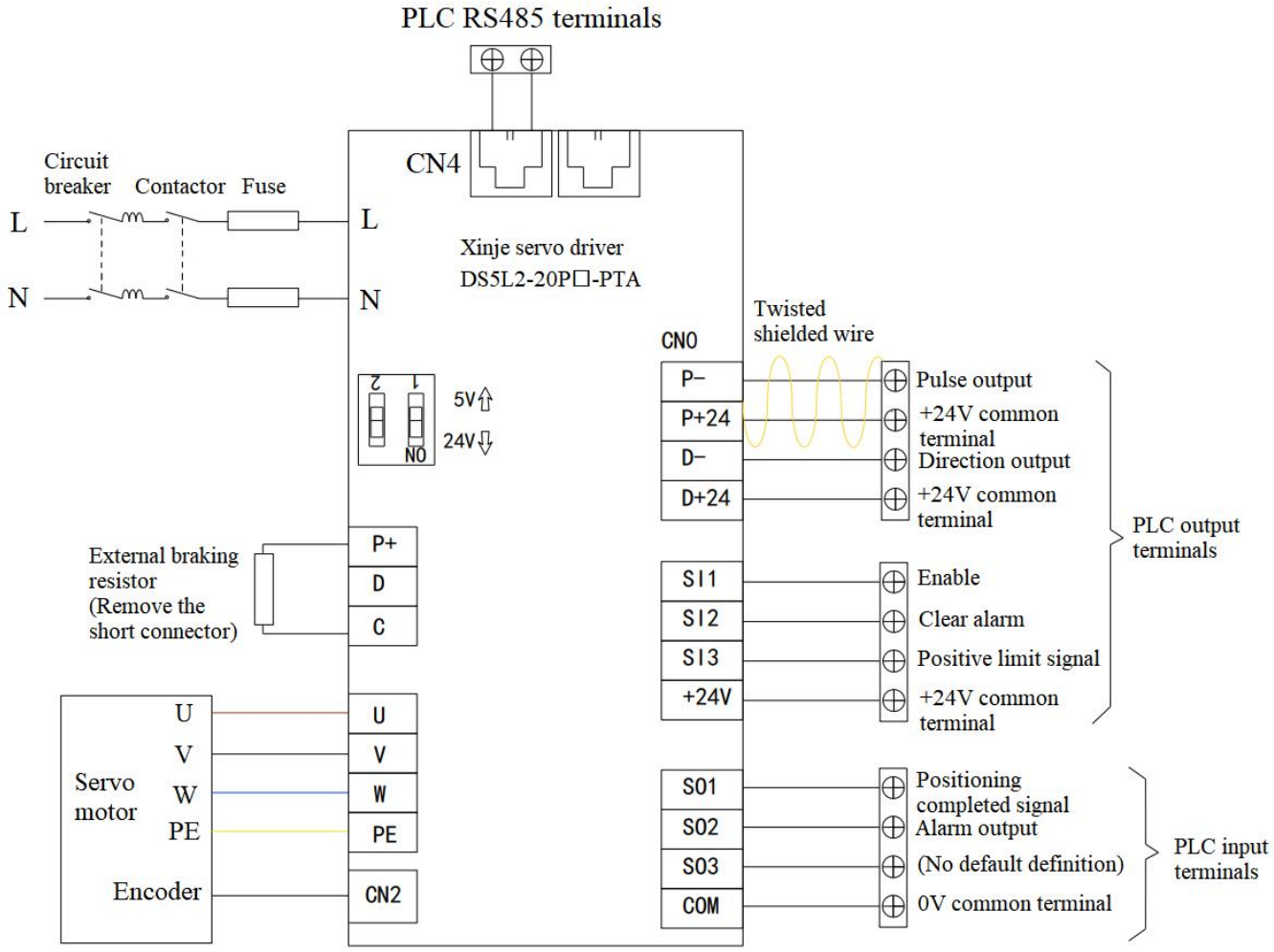
Optocoupler type	Relay type
	

Note:
(1) Maximum load current:

- 400W and below: SO1 DC 500mA (maximum). SO (other) DC 50mA (maximum). Due to the large current required for the brake, when controlling the brake motor through SO, please use SO1 terminal control and set the brake parameter P5-44=n.0001
- 750W and above: SO (all) DC 50mA (maximum). The maximum voltage should not exceed 30VDC. Due to the large current required for the brake, please use an intermediate relay when controlling the brake motor through SO.

(2) Maximum allowable voltage: DC30V.

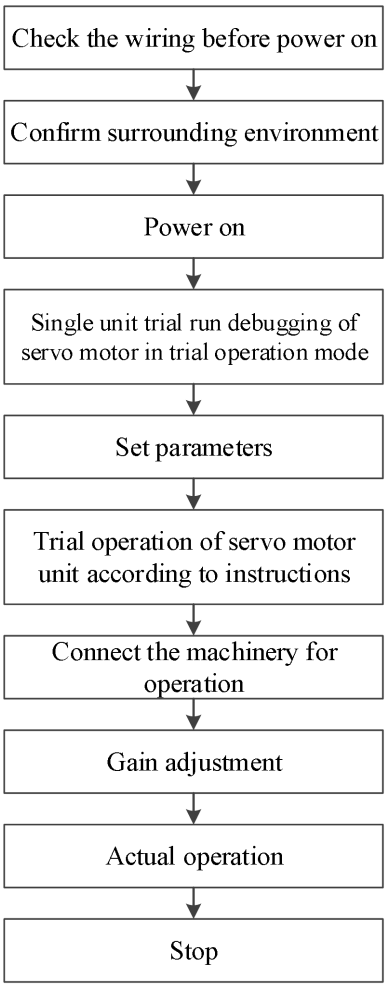
3.3 Conventional electrical wiring diagram for servo system



4 Operate panel

4.1 New servo debugging process

The debugging sequence of the new machine is shown in the following flowchart:



4.1.1 Wiring inspection before power on and confirmation of surrounding environment

1. Confirm whether the power cables, encoder cables, and motor of the servo driver and servo motor are connected properly, and whether there is a short circuit in the power supply. The cable is partially not subjected to excessive external force, and its bending degree is within a tolerable range.
2. Is the motor installed correctly.
3. Is there any displacement between the motor and mechanical parts.
4. There are no foreign objects such as metal shavings that can cause short circuits in signal and power cables in the on-site environment.

4.1.2 Power on

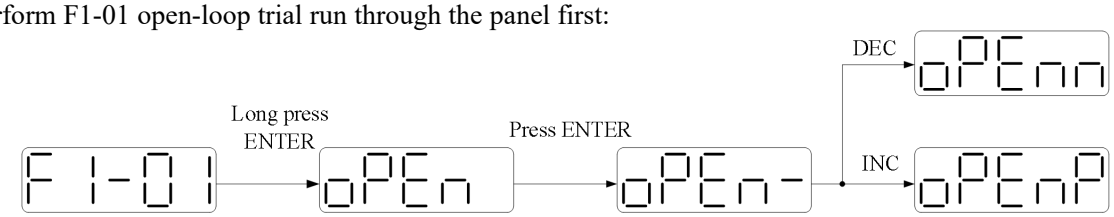
Confirm if the servo power supply voltage is within the specified voltage range:
The voltage range specified for 220V is 200V~240V.
The voltage range specified for 380V is 380V~440V.

4.1.3 Empty shaft trial operation and debugging

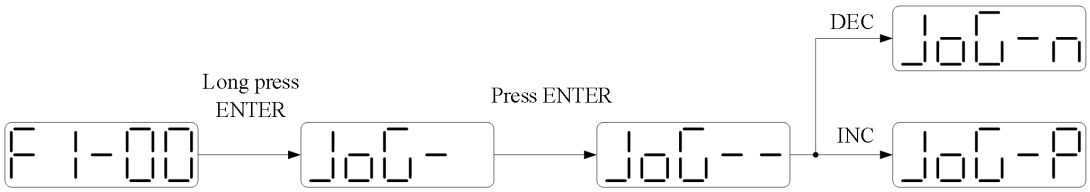
When the servo motor is separated from the machinery, try to use trial operation mode at low speed to confirm whether the servo motor rotates correctly. It can be operated through panel speed mode for open-loop and closed-loop jog, or through servo upper computer software **XinjeServo Tuner** for jog.

■ Panel speed jog

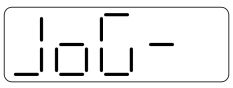
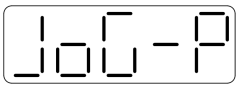
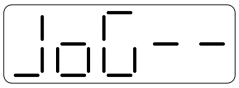
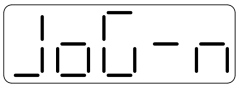
The following can only take effect when the servo isn't enabled (i.e. the panel is bb).
Perform F1-01 open-loop trial run through the panel first:



Similarly, perform F1-00 jog operation through the panel.



Short press the Enter key to enable the motor. In the enabled state, press INC for forward jog operation and DEC for reverse jog operation. Press START/ESC to end the enable and exit the jog state.

Status	Panel display	Status	Panel display
Idle display		Forward run	
Enable display		Reverse run	

Related parameters

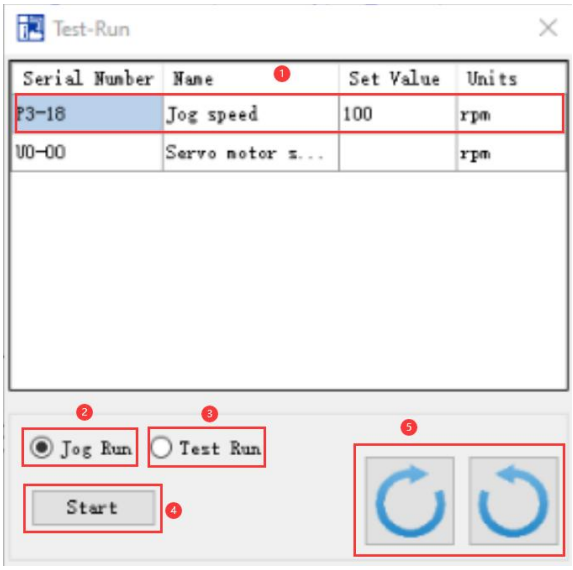
Parameter	Meaning	Default setting	Unit	Setting range	Modify	Take effect
P3-18	JOG speed	100	1rpm	0~1000	Servo bb	At once

P3-18 is the speed configured for closed-loop jog operation, which only takes effect in two jog modes, and the other normal control modes are invalid.

■ Servo software XinjeServo Tuner speed jog

Open the servo upper computer software XinjeServo Tuner, set the P3-18 jog speed value, select the [Test Run] / [Jog Run] button, click [Start], and use the forward and reverse buttons on the interface to achieve the jog forward and reverse operation function.

Click on "Test Run" in the menu bar, and the following screen will pop up:

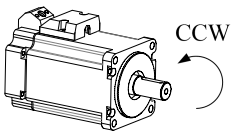
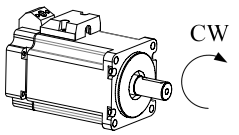
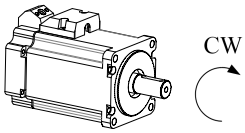
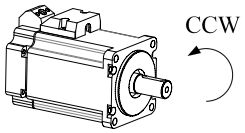


The screen is mainly divided into 5 setting modules:
① Jog speed P3-18: Determine the operating speed of the motor in the jog mode.
② Jog run: closed-loop jog operation.
③ Test run: open-loop jog operation.
④ Start: Enable the jog mode.
⑤ Forward/Reverse: Make the motor rotate forward or reverse.

4.1.4 Confirmation of motor rotation direction

Observe the running direction of the servo motor. If it is opposite to the actual need, turn off the servo, set parameter P0-05 to 0 or 1, and then power on again to make the change effective.

Users can change the rotation direction of the servo motor through parameter P0-05. The forward rotation of the motor is defined as counterclockwise rotation, and the reverse rotation is defined as clockwise rotation. (All viewed facing the motor shaft)

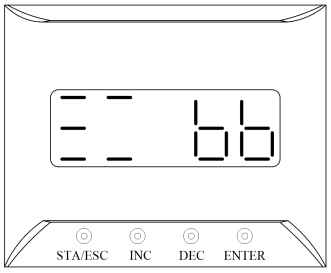
Mode	Forward	Reverse	P0-05
Standard settings CCW is forward rotation			P0-05=0
Reverse mode CW is forward rotation			P0-05=1

Related parameters

Parameter	Meaning	Default setting	Unit	Setting range	Modify	Effective
P0-05	Definition of rotation direction 0: Positive mode 1: Reverse mode	0	-	0~1	Servo bb	Power on again

4.2 Basic operation

4.2.1 Operating panel description



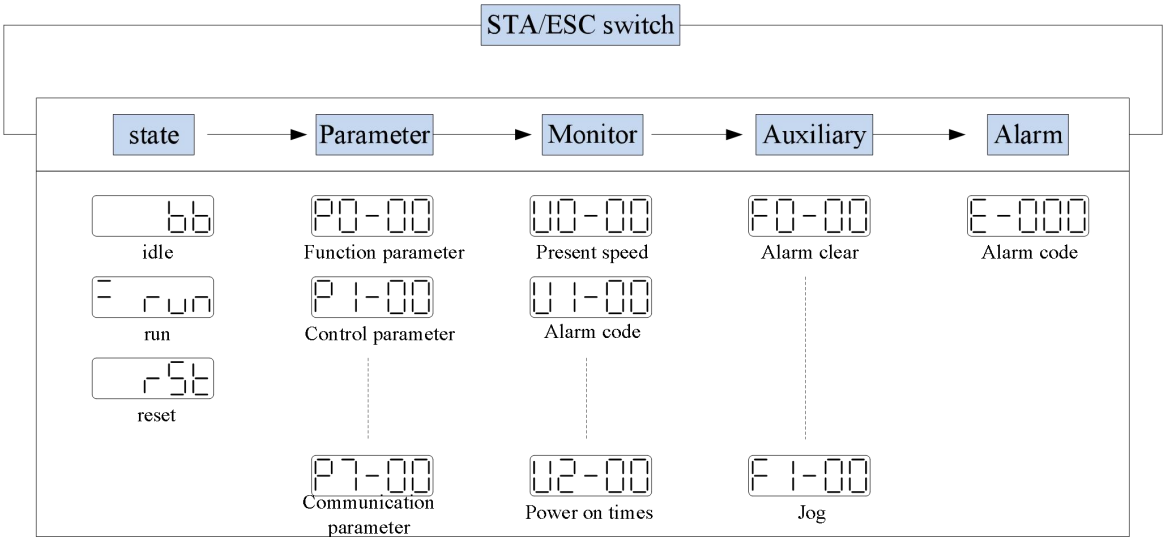
Button	Operation
STA/ESC	Short press: state switch, state return
INC	Short Press: The display data increases Long press: The display data increases continuously
DEC	Short Press: The display data decreases Long press: The display data decreases continuously
ENTER	Short press: shift. Long press: Set and view parameters.

The panel will be self-checked, and all the display digital tubes and five decimal points will be lit for one second at the same time.

4.2.2 Button operation

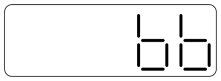
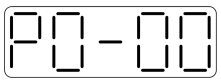
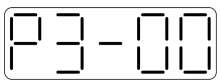
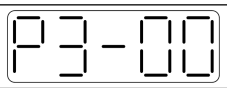
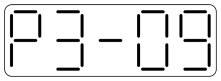
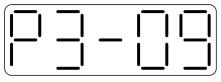
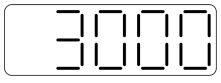
By switching the basic state of the panel operator, it can display the running state, set parameters, run auxiliary functions and alarm state. After pressing the STA/ESC key, the states are switched in the order shown in the following figure.

State: BB indicates that the servo system is idle. run indicates that the servo system is running. RST indicates that the servo system needs to be re-energized.



- Parametric setting Px-xx: The first X represents the group number, and the last two X represents the parameter serial number under the group.
- Monitor status Ux-xx: The first X represents the group number, and the last two X represents the parameter number under the group.
- Auxiliary function Fx-xx: The first X denotes the group number, and the last two X denotes the parameter number under the group.
- Alarm state E-xx□: XX represents the alarm category, □ represents the subcategory under the category.

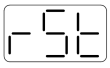
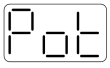
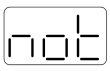
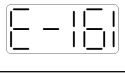
Taking the modification of P3-09 as an example:.

Step	Panel display	Used buttons	Operations
1		STA/ESC INC DEC ENTER	No operation
2		STA/ESC INC DEC ENTER	Press the STA/ESC key once to enter the parameter setting function
3		STA/ESC INC DEC ENTER	Press the INC key, press it once to add 1, add the parameter to 3, and display P3-00
4		STA/ESC INC DEC ENTER	Press the ENTER key briefly, and the last 0 on the panel will flash
5		STA/ESC INC DEC ENTER	Press INC for 9 times
6		STA/ESC INC DEC ENTER	Press and hold the ENTER key to enter P3-09 for numerical changes
7		STA/ESC INC DEC ENTER	Press INC, DEC, ENTER to increase decrease or shift, after changing, long press ENTER to confirm
8	END		

Note: When the setting parameter exceeds the range that can be set, the driver will not accept the setting value, and the driver will report E-021 (parameter setting exceeds the limit). The parameter setting overrange usually occurs when the upper computer writes parameters to the driver through communication.

4.2.3 Status display content

Panel simplified code display content:

Short code	Display contents
	Standby status Servo OFF status. (The motor is in a non-electrified state)
	In operation Servo enabling state. (The motor is on-line)
	Need reset status Servo needs to be re-energized
	Forbidden forward drive state P-OT ON status.
	Forbidden reversal drive state N-OT ON status.
	Control mode 2 is vacant.
	At this point, the panel is in an alarm state and needs to be cleared first. Please refer to 7.1 for specific alarm information.

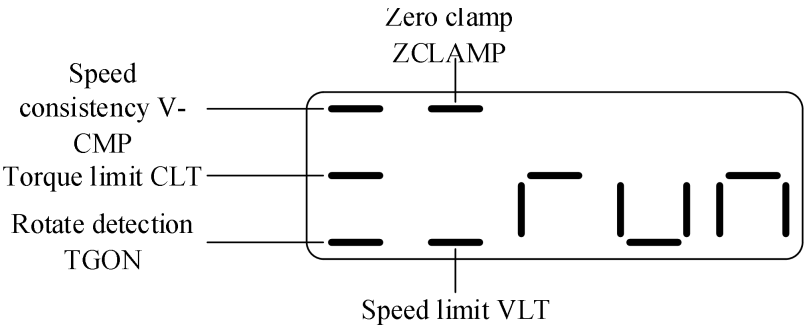
4.2.4 Status display in each operation mode

When powered on, the panel displays according to the P8-25 parameter settings.

Parameter	Name	Default setting	Suitable mode	Meaning	Modify	Take efect
P8-25	Panel display setting	0	All	0: Normal display, power on displays 'bb' or 'run' 1: Panel display U0-00 value when	At once	Power on again

				power on, speed feedback, unit rpm 2: Panel display U0-07 value when power on, torque feedback, unit%		

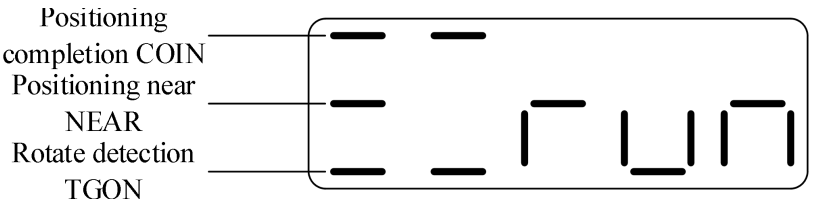
■ Speed torque control mode



Digit display contents

Digit data	Display contents
P5-39 Same speed detection (/V-CMP)	When the actual speed of the motor is the same as the command speed, turn on the light. Detection Width of Same Speed Signal: P5-04 (Unit: rpm)
P5-42 Torque limit(/CLT)	When the speed is controlled, when the torque exceeds the set value, turn on the light. Internal Forward Torque Limitation: P3-28 Internal Reverse Torque Limitation of: P3-29
P5-40 Rotate detection(/TGON)	P5-03 (Unit: rpm) When the motor speed is higher than the rotating speed, turn on the lamp. Rotation detection speed: P5-03 (unit: rpm)
P5-31 Zero clamp(/ZCLAMP)	When the zero clamp signal starts to operate, turn on the light.
P5-43 Speed limit(/VLT)	When the speed exceeds the set value in torque control mode, turn on the light. Forward speed limit in torque control: P3-16. reverse speed limit: P3-17.

■ Position control mode

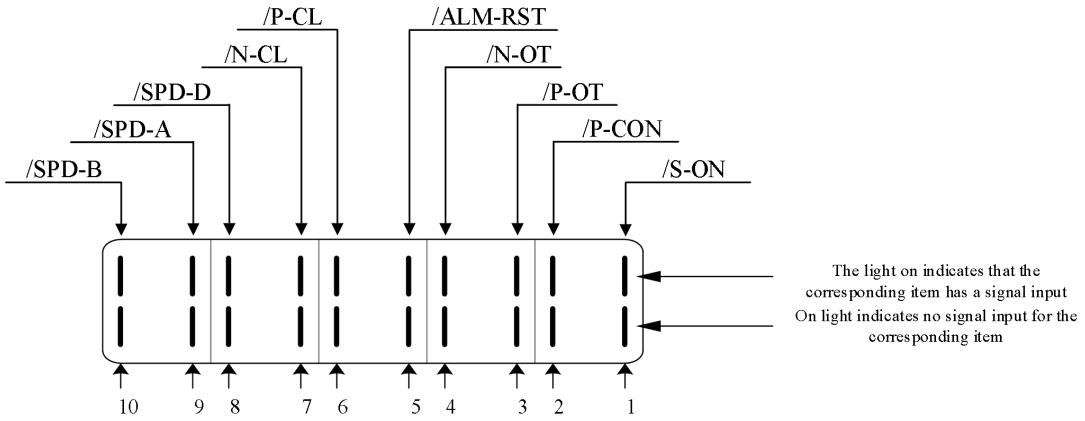


Digit display contects

Digit data	Display contents
P5-38 Positioning completion (/COIN)	In position control, when the given position is the same as the actual position, turn on the light. Location Completion Width: P5-00 (Unit: Instruction Pulse)
P5-46 Near (/NEAR)	In position control, when the given position is the same as the actual position, turn on the light. Near signal width: P5-06
P5-40 Rotate detection(/TGON)	When the motor speed is higher than the rotating speed, turn on the lamp. Rotation detection speed: P5-03 (unit: rpm)

4.2.5 Group U monitor parameter

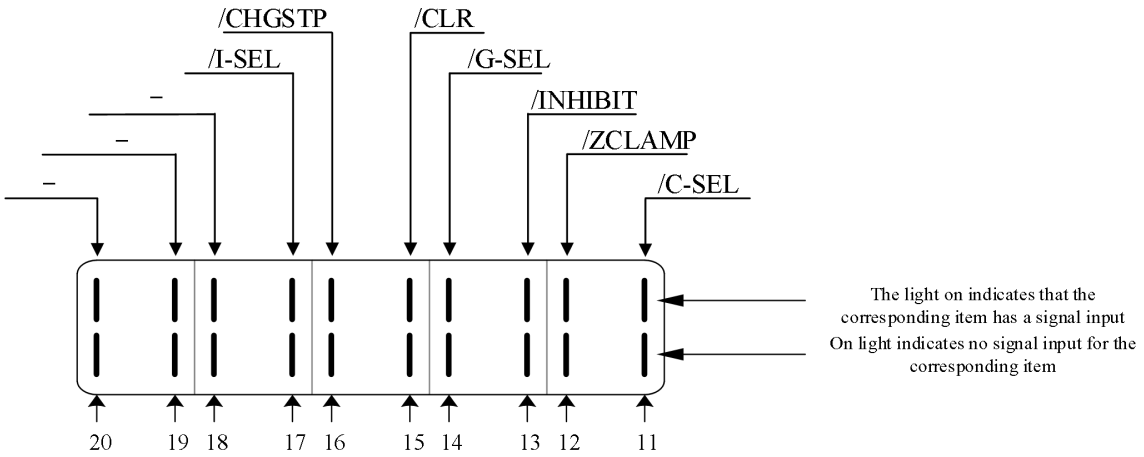
■ U0-21 input signal status



■ U0-21 input signal 1 distribution

Segment code	Description	Segment code	Description
1	/S-ON servo enable	2	/P-CON proportion action instruction
3	/P-OT prohibition of forward drive	4	/N-OT prohibition of reverse drive
5	/ALM-RST alarm reset	6	/P-CL forward side external torque limit
7	/N-CL reverse side external torque limit	8	/SPD-D internal speed selection
9	/SPD-A internal speed selection	10	/SPD-B internal speed selection
Note: When reading through communication, the binary numbers read from right to left correspond to the position of /S-ON, /P-CON, 0 means that the position signal isn't input, 1 means that the position signal has input. Example: 0x0001 means /S-ON has input, 0x0201 means /S-ON and /SPD-B has input.			

■ U0-22 input signal status

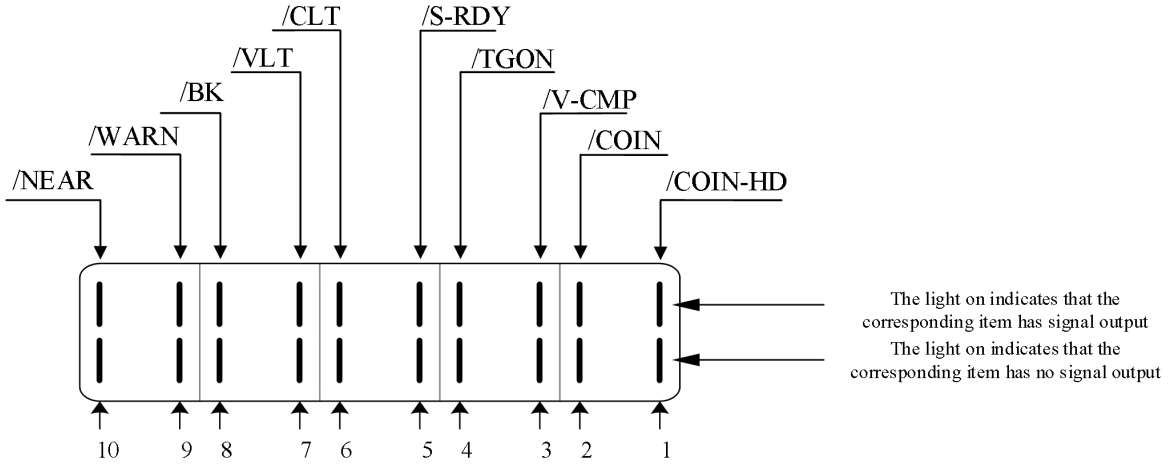


■ U0-22 input signal 2 distribution

Segment code	Description	Segment code	Description
11	/C-SEL control mode selection	12	/ZCLAMP zero clamp
13	/INHIBIT instruction pulse prohibition	14	/G-SEL gain switch

15	/CLR pulse clear	16	/CHGSTP change step
17	/I-SEL inertia switching	18	-
19	-	20	-
Note: 1.When reading through communication, the binary numbers read from right to left correspond to the position of /C-SEL, /ZCLAMP, 0 means that the position signal isn't input, 1 means that the position signal has input. Example: 0x0001 means /C-SEL has input, 0x0009 means /C-SEL and /I-SEL have input. 2."-" is reserved for display purposes and doesn't represent any signal. This status bit remains at 0.			

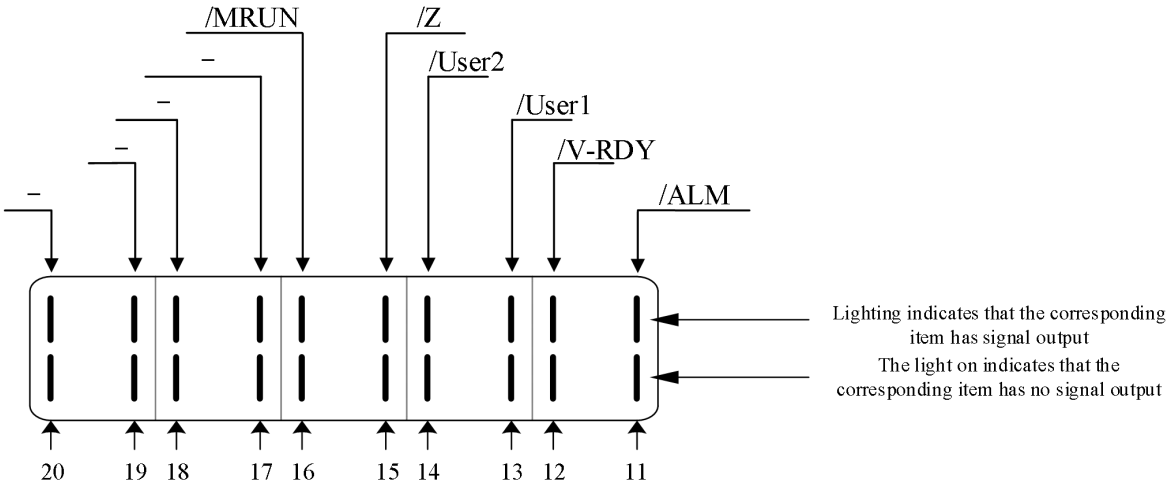
■ U0-23 output signal status



■ U0-23 output signal 1 distribution

Segment code	Description	Segment code	Description
1	Positioning completion hold (/COIN_HD)	2	Positioning completion (/COIN)
3	Same speed detection (/V-CMP)	4	Rotate detection (/TGON)
5	Ready (/S-RDY)	6	Torque limit (/CLT)
7	Speed limit detection (/VLT)	8	Break lock (/BK)
9	Warn (/WARN)	10	Output near (/NEAR)
Note: When reading through communication, the binary numbers read from right to left correspond to the position of /COIN_HD, /COIN, 0 means that the position signal isn't output, 1 means that the position signal has output. Example: 0x0001 means /COIN_HD has output, 0x0201 means /COIN_HD and /NEAR has output.			

■ U0-24 output signal status



■ U0-24 output signal 2 distribution

Segment code	Description	Segment code	Description
11	Alarm (/ALM)	12	Speed arrived (/V-RDY)
13	Customized output 1	14	Customized output 2
15	/Z phase	16	/MRUN
17	Reserved	18	Reserved
19	Reserved	20	Reserved
Note: 1.When reading the status through communication, the binary numbers read correspond to the/ALM and "-" positions from right to left. 0 represents that the signal at that position isn't output, and 1 represents that the signal at that position is output. Example: 0x0001 indicates that/ALM has output, 0x0041 indicates that/ALM and/custom output 2 have output. 2.Reserved for display purposes, doesn't represent any signal, this status bit remains 0.			

■ U4-18 input signal status

SI1	SI2	SI3	U4-18 display
1	0	0	0x0001
0	1	0	0x0002
1	1	0	0x0003
0	0	1	0x0004
...	...	...	...
Note: U4-18 displays the software effective status of the SI terminal, which means that only after the corresponding terminal's function is set, the input high level of the terminal will be displayed on U4-18. For example, SI1 doesn't have any functional allocation, and even if the hardware sets SI1 to the high-level, the 0^{th} bit of U4-18 will not display 1 (firmware 3790 and higher supported). The display mode for firmware versions 3800 and above is consistent with U0-21/22.			

■ U4-19 output signal status

SO1	SO2	SO3	U4-19 display
1	0	0	0x0001
0	1	0	0x0002
1	1	0	0x0003
0	0	1	0x0004
...	...	...	...
Note: U4-19 displays the software effective status of the SO terminal, which means that only after the corresponding terminal's function is set, the output high level of the terminal will be displayed on U4-19. For example, SO1 doesn't have any functional allocation, and even if the hardware sets SO1 to the high-level, the 0^{th} bit of U4-19 will not display 1 (firmware 3790 and higher supported). The display mode for firmware versions 3800 and above is consistent with U0-23/24.			

4.2.6 Group F auxiliary function parameters

A. F0-XX

Function code	Description
F0-00	Alarm clear
F0-01	Resume to default settings
F0-02	Clear the position offset

1. Alarm clear(F0-00)

When a fault occurs, the E-XXX alarm state automatically pops up, displaying the alarm number. The alarm state isn't visible when there is no fault.

In the alarm state, writing 1 to F0-00 through panel operation can reset the fault.

When an alarm occurs, first eliminate the cause of the alarm, and then clear the alarm. If the servo alarm is triggered due to the servo power being turned off, there is no need to clear the alarm.

2. Resume to default setting(F0-01)

First, turn off the servo, and then perform the factory reset operation as follows:

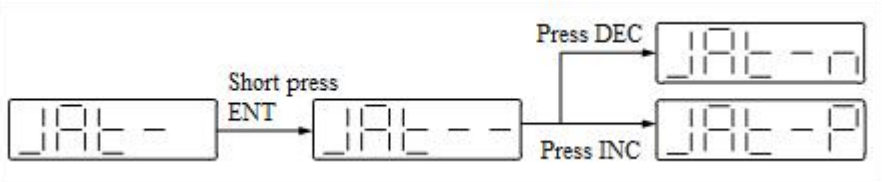
Set F0-01=1, press ENTER to confirm, and the parameter reset to factory has been completed without the need to power off again.

3. Panel inertia identification (F0-07)

Before inertia identification, please use the F1-00 jog function to confirm the servo rotation direction. At the beginning of inertia identification, INC or DEC determines the initial direction of servo operation!

If the servo shakes under the adaptive default parameters, please switch to the adaptive high inertia mode (P2-03.3=1) first to ensure the basic smooth operation of the servo before performing inertia identification!

When the servo is in the bb state, enter parameter F0-07 and display:



Detailed steps reference 6.2.4.

4. Panel external instruction auto-tuning(F0-08)

Detailed steps reference 6.4.5.

5. Panel internal instruction auto-tuning(F0-09)

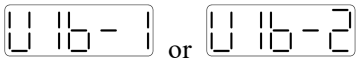
Detailed steps reference 6.4.4.

6. Panel vibration suppression (F0-10, F0-11)

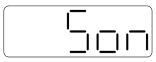
Vibration suppression mode	Display	Changed parameters
Mode 1	vib-1	Only change vibration suppression related parameters
Mode 2	Vib-2	Will change vibration suppression related parameters and speed loop gain

The following provides an explanation of the operational steps:

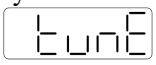
a. When entering parameter F0-10 in self-tuning mode, the panel displays Vib-1, or when entering F0-11, the panel displays Vib-2.



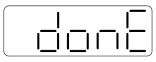
b. Short press the ENTER key, and the panel will display Son and flash. At this point, you need to manually enable it.



c. After enabling the servo, the panel displays tune and flashes, entering the tuning state.



d. The upper device starts sending pulse commands to run until 'done' is displayed and flashes to complete vibration suppression.

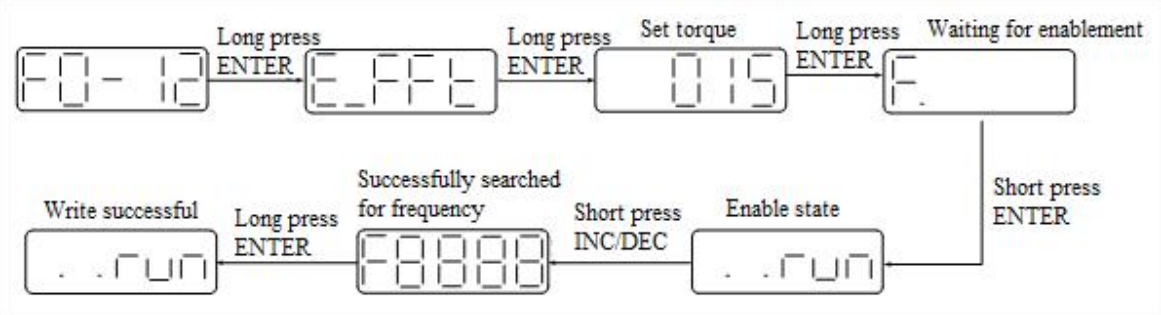


e. Short press the STA/ESC key to exit.

The vibration suppression parameters will be automatically written into the second and first notch filters (the second notch filter will be prioritized when there is only one vibration point). The relevant parameters are detailed in 6.7.7 notch filter.

7. Panel vibration suppression (fast FFT) (parameter F0-12)

This function can perform mechanical characteristic analysis on the servo control panel through the F0-12 parameter, identify the mechanical resonance frequency, and achieve vibration suppression.

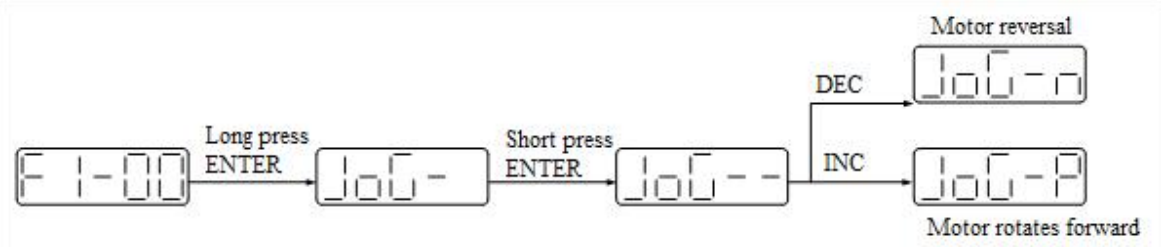


B. Group F1

Function code	Description	Function code	Description
F1-00	Jog run	F1-05	Software enable
F1-01	Test run	F1-06	Reset turns of absolute encoder
F1-02	Current Sampling Zero-correction		

1. Jogging operation (F1-00)

Before entering jog mode, please confirm that the motor shaft isn't connected to the machine and the driver is in the idle state of bb!



During jog operation, parameters such as gain will participate in control, and the appropriateness of parameter settings can be determined based on the operating conditions.

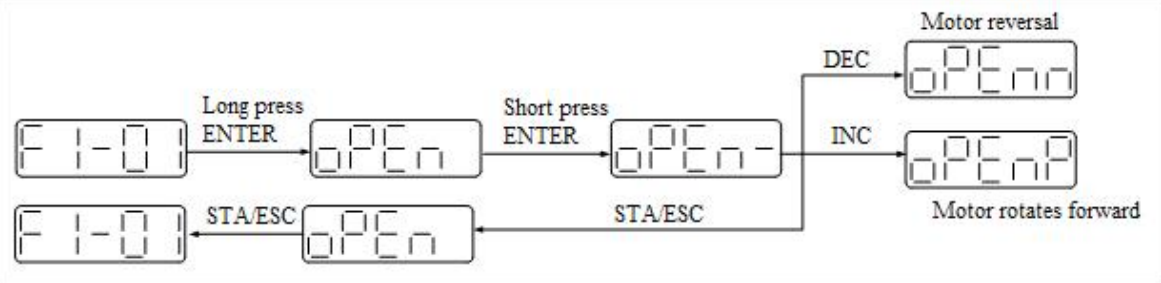
P3-18	JOG jog speed					
	Set Unit	Factory setting	Setting range	Applicable mode	Modify	Take effect
	1rpm	100	0~1000	JOG micro motion	Servo OFF	At once

2. Test run (F1-01)

Please confirm that the motor shaft isn't connected to the machine before entering the trial operation mode!

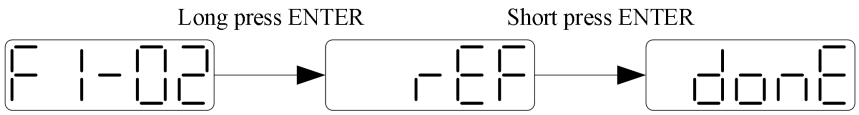
When the servo drive is connected to a non original encoder or power line, it should first enter the trial operation mode to verify that the encoder terminal or power terminal is connected correctly.

The trial operation mainly checks the power line and encoder feedback line to determine if the connection is normal. The motor can achieve normal forward and reverse rotation by following the following steps. If the motor shaft shakes or prompts an alarm, immediately disconnect the power and recheck the wiring.



3. Current sampling zero-correction (F1-02)

When the servo drive has completed self updating or the motor runs unstably for a long time, it is recommended that the user automatically adjust the current detection offset and perform the following operations while the drive is in the idle state.



Press the STATUS/ESC button to exit this function, you need to power on again.

4. Forced enable (F1-05)

Parameter	Signal name	Setting	Meaning	Change	Effective
P0-03	Enable mode	0	Not enable	Servo bb	At once
		1 (default)	I/O enable /S-ON		
		2	Software enable (F1-05 or communication)		
		3	Fieldbus enable (The model which supports motion bus)		
Set P0-03=2 F1-05 = 0: cancel enable, enter bb status. F1-05 = 1: forced enable, servo is in RUN status.					

Note:

(1) Forcefully enabling after re powering on will fail.
(2) If it needs to enable when power on and still enable after re-power on, P0-03 should be set to 1 and P5-20 to n.0010.

5. Reset turns of absolute encoder (F1-06)

First, turn off the servo, and then perform the absolute value encoder clearing operation. The operation is as follows:
Writing 1 to F1-06 through panel operation can clear the absolute value encoder turns.
By writing 1 to the hexadecimal address 0x2106 through Modbus Rtu, the number of turns can be cleared (the servo bb state takes effect, and after clearing, 0x2106 is written to 0).

5 Operation of servo system

5.1 Control mode selection and switching

5.1.1 Control mode selection

Servo can combine two control modes and switch between them. By switching freely between mode 1 and mode 2 through the / C-SEL signal, more complex control requirements can be satisfied.

User parameter		Control mode	Reference
P0-01 Submode 1	1	Torque control (internal setting)	5.5.1
	3	Speed control (internal setting)	5.4.2
	5	Position control (internal position instruction)	5.4.3
	6 (default)	Position control (external pulse instruction)	5.4.2
	7	Speed control (pulse frequency instruction)	5.4.3
P0-02 Submode 2	1	Torque control (internal setting)	5.5.1
	3	Speed control (internal setting)	5.4.2
	5	Position control (internal position instruction)	5.4.3
	6 (default)	Position control (external pulse instruction)	5.4.2
	7	Speed control (pulse frequency instruction)	5.4.3

Position control is to input the pulse train command into the servo unit and move it to the target position. The position instruction can be given by the combination of external pulse input, the total number of internal position instructions and speed limit. The position is controlled by the number of input pulses, and the speed is controlled by the frequency of input pulses. It is mainly used in the occasions requiring positioning control, such as manipulator, grinder, engraving machine, CNC machine, etc.

Speed control is to control the speed of machinery by speed command. The servo driver can control the mechanical speed quickly and accurately by the speed command given by digital, analog voltage or communication.

Torque control is to control the output torque of motor by torque command. Torque command can be given by digital, analog voltage or communication. The current of servo motor is linear with torque, so the control of current can realize the control of torque. The torque control mode is mainly used in the devices with strict requirements on the stress of materials, such as some tension control occasions such as winding and unwinding devices. The torque setting value should ensure that the stress of materials isn't affected by the change of winding radius.

5.1.2 Control mode switching

Control mode switching means that when the servo is enabled, that is, when the servo panel displays run, the working mode of the servo driver can be switched between mode 1 and mode 2 through the external input signal /C-CEL.

■ Related parameter

Parameter	Name	Default setting	Suitable mode	Meaning	Change	Effective
P5-30	/C-SEL	n.0000	All	To switch the control mode	Anytime	At once
Parameter range n.0000-001A, can be distributed to other input terminal through P5-30. If the control mode needs to be switched through SI2 input signal, P5-30 can be set to n.0002/0012. Refer to 3.2.3 for hardware wiring details.						

Parameter setting	Signal/C-SEL terminal input status	Signal /C-SEL terminal logic	Control mode
P5-30=n.0000	No need external terminal input	Invalid	The control mode set by P0-01 Refer to chapter 5.1.1
P5-30=n.000□	SI□ terminal no signal input		
P5-30=n.001□	SI□ terminal has signal input		
P5-30=n.0010	No need external terminal input	Valid	The control mode set by P0-02 Refer to chapter 5.1.1
P5-30=n.000□	SI□ terminal has signal input		
P5-30=n.001□	SI□ terminal no signal input		

5.2 Basic function setting

5.2.1 Jog operation

Inching operation needs to be completed after the power supply is connected and before the online commissioning operation. Its purpose is to ensure that the servo system can operate normally without abnormal vibration, abnormal sound and other problems. Inching operation can be carried out by panel group F parameters or our upper computer debugging software Xinje servo tuner.
Inching operation can be divided into two modes: inching operation and trial operation. Inching operation is closed-loop control, trial operation is open-loop control, and general steps are trial operation first, and then inching operation. Both operations can take effect only when the servo isn't enabled (i.e. the panel is BB).

■ Related parameter

parameter	Meaning	Default setting	Unit	Range	Modify	Take effect
P3-18	JOG speed	100	1rpm	0~1000	Servo bb	At once

P3-18 is the speed for closed-loop inching operation, which only takes effect in two inching modes, and the rest normal control modes are invalid.

(1) Jog by panel

■ Related parameter

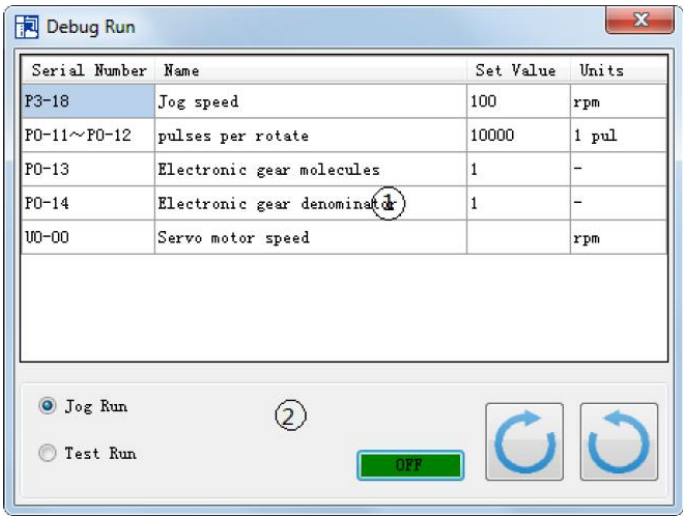
Function code	Meaning	Explanation
F1-00	Jog operation	Closed loop jog operation
F1-01	Trial operation	Open loop trial operation

The steps of jog operation through panel

Make sure the F1-01 open loop operation has no problem, then do F1-00 closed loop operation. See 4.2.1 for the specific operation of the panel.

(2) Jog operation through XinjeServo Tuner software

Click test run button in the menu:



Jog speed P3-18: the motor speed in jog mode.
Jog run: closed loop inching operation.
Test run: open loop inching operation.
ON/OFF: enable the jog mode.


: forward run and reverse run.

The steps of inching through Xinje servo tuner

Open the software XinjeServo Tuner, set the jog speed P3-18, select [test run] / [jog run] button, click [ON]. Then click forward or reverse button to run.

5.2.2 Servo enable setting

The servo enable signal effectively represents that the servo motor is powered on. When the servo enable signal is invalid, the motor cannot operate without power. The enabling mode can be controlled by external terminal signal or upper computer communication.

■ Related parameter

Parameter	Name	Setting	Meaning	Change	Effective
P0-03	Enable mode	0	Not enable	Servo bb	At once
		1(default)	I/O enable /S-ON		
		2	Software enable (F1-05 or enabled by software)		
		3	Fieldbus enable		

Parameter	Name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-20	/S-ON	n.0001	All	Servo enable signal	Anytime	At once

(1) Forced enabling
When P0-03=2, the forced enabling of F1-05 can take effect, and the forced enabling fails after power on again.
F1-05 can write 1 to hex address 0x2105 through ModbusRTU protocol communication or set to 1 through the panel.

(2) Power on enable
Parameter setting P0-03 = 1 (default), P5-20 = n.0010
This setting mode can make the servo system in the enabling state as soon as it is powered on, without external terminal control, and the servo enabling state will remain when it is powered on again.

(3) External SI terminal control enable
When P0-03 is set to 1, the external terminal enable control is effective.
Parameter setting P0-03 = 1 (default), P5-20 = n.000□/n.001□.
□ is the SI terminal number, for example, P5-20 is n.0001 (default), that is, SI1 terminal control enable.

Prerequisite	Parameter setting status	Signal/S-ON terminal input status	Signal/S-ON terminal logic	Servo status
P0-03=1	P5-20=n.000□	SI□ terminal has no sigal input	Invalid	The panel displays bb, and the servo isn't enabled
	P5-20=n.001□	SI□ terminal has sigal input		
	P5-20=n.000□	SI□ terminal has sigal input	Valid	The panel shows run, servo enabled
	P5-20=n.001□	SI□ terminal has no sigal input		

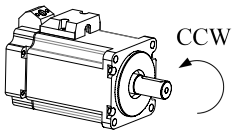
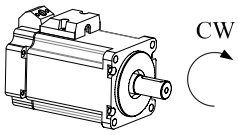
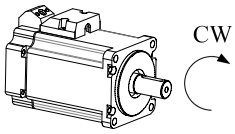
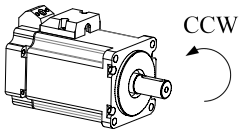
5.2.3 Rotation direction switching

■ Related parameter

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P0-05	Definition of rotation direction 0- positive mode 1- negative mode	0	-	0~1	Servo bb	Power on again

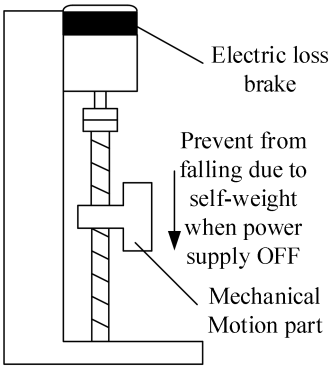
The user can change the rotation direction of servo motor through parameter P0-05. It is specified that

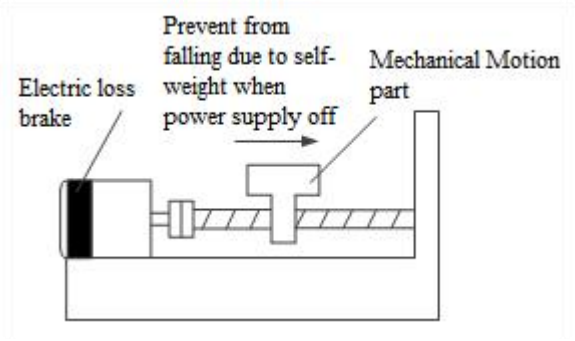
the "forward rotation" of the motor is "counter clockwise rotation" and "reverse rotation" is "clockwise rotation". (All view from the motor axis)

Mode	Forward running	Reverse running	P0-05 setting
Standard setting CCW is forward run			P0-05=0
Reverse mode CW is forward run			P0-05=1

5.2.4 Power-off brake (holding brake)

When the servo motor controls the vertical load, the purpose of using the "brake servo motor" is: when the power supply of the system is placed in the "OFF", the movable part will not move under the action of gravity.





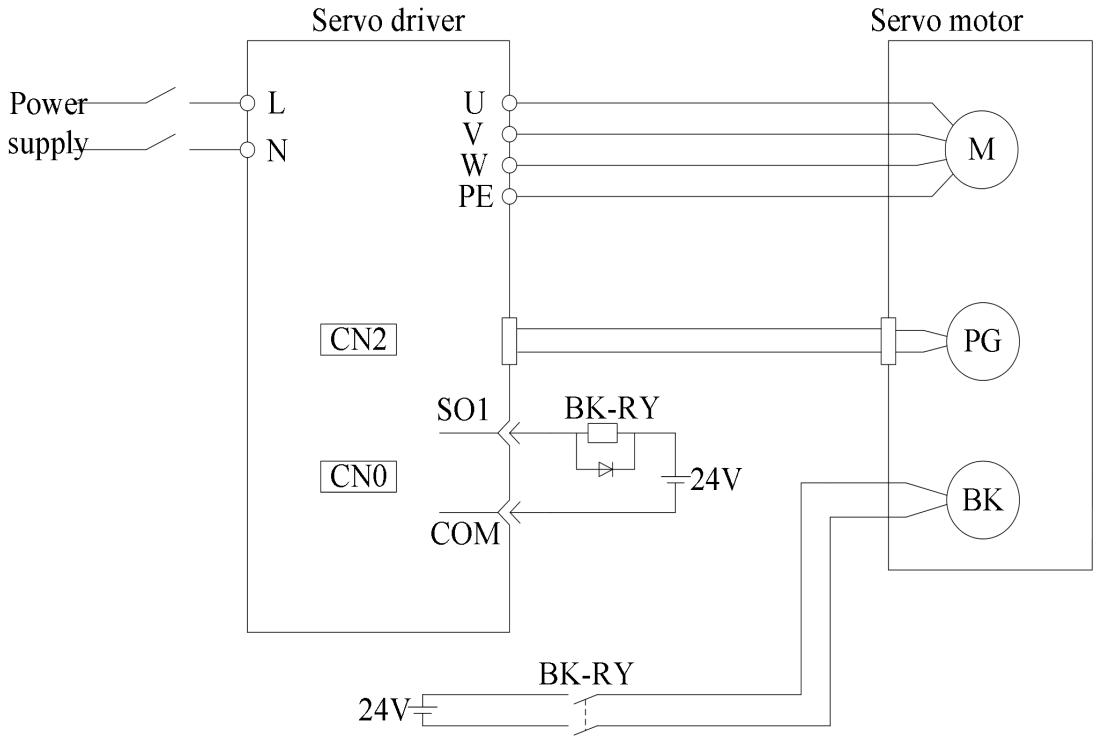
Note: The brake built in the servo motor is a fixed special brake without excitation. It can not be used for dynamic braking. Please use it only when the servo motor is in a stop state.

■ Related parameter

Parameter	Meaning	Default setting	Unit	Setting range	Modify	Effective
P5-44	Brake interlock/BK	n.0000	-	n.0000~n.ffff	Servo bb	At once
P5-07	Servo OFF delay time	500	1ms	0~65535 -500~9999 (After version 3760)	Servo bb	At once
P5-08	Brake command output speed	30	rpm	20~10000	Servo bb	At once
P5-09	Brake command wait time	500	ms	0~65535	Servo bb	At once

(1) Hardware wiring

The ON/OFF circuit of the brake is composed of the sequential output signal of the servo unit "/BK" and "brake power supply". A typical connection example is shown below.



Note:

(1) The excitation voltage of the power-off brake is 24V.

(2) If the holding brake current is more than 50mA, please transfer it through the relay to prevent terminal burnt out due to excessive current.

(2) Software parameter settings

For the servo motor with holding brake, it is necessary to configure one SO terminal of servo driver as holding brake output /BK function, and determine the effective logic of SO terminal, that is, parameter P5-44 needs to be set.

Parameter setting	Servo status	Signal/BK terminal output logic	Servo motor status
P5-44=n.000□	Servo bb	Invalid	Holding brake power off, motor in position locked state
	Servo run	Valid	The holding brake power is connected and the motor is in rotatable state
P5-44=n.001□	Servo run	Invalid	Holding brake power off, motor in position locked state
	Servo bb	Valid	The holding brake power is connected and the motor is in rotatable state

Note:

(1) When SO terminal is used to control holding brake, when servo enable is on, holding brake power is on and motor is in rotatable state.

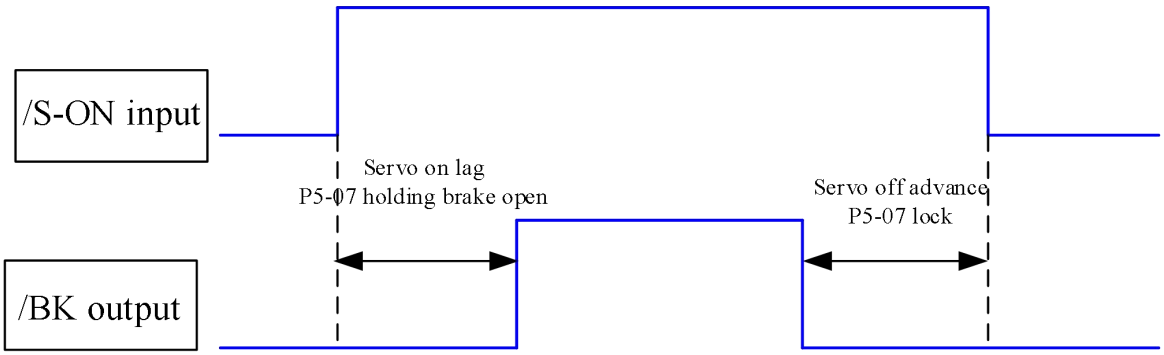
(2) If the motor fails to rotate during the debugging of the new machine, please confirm whether the holding brake is open.

(3) Time sequence of holding brake control

① Holding brake sequence in normal state

Due to the action delay time of the brake, the machine moves slightly under the action of gravity. Use P5-07 parameter to adjust the time, so that the holding brake can be opened or closed in advance.

When setting the servo motor with brake, the output signal "/ BK" of control brake and the time of servo SON signal on/off action are shown in the figure below. That is to say, before the /BK signal outputting and brake is opened, the servo motor has entered the power on enabling state. After the / BK not outputting and brake is locked, the servo motor will turn off the power on state.

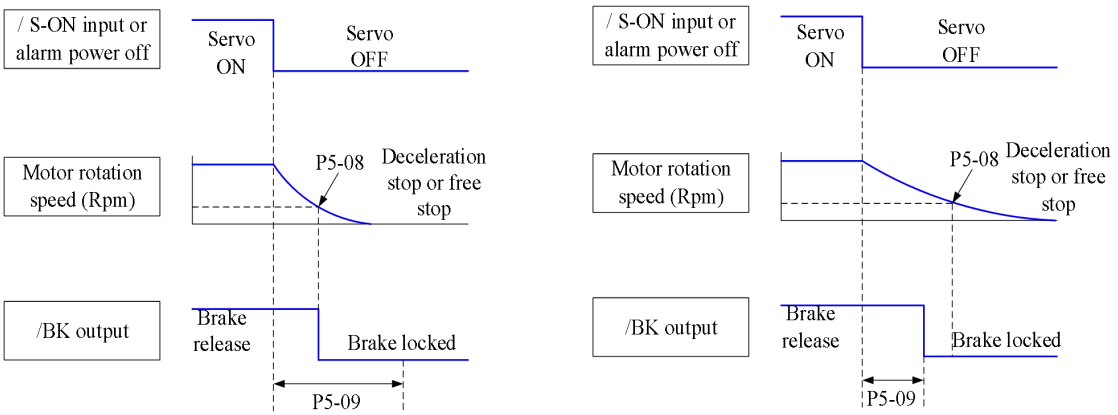


Note: The setting made here is the time when TGON of rotation detection is invalid when the motor is stopped.

② Abnormal state holding brake timing

When the alarm/power supply interruption occurs, the motor quickly becomes non energized. During the time from gravity or inertia to the brake action, the machine will move. To avoid this,
The conditions for the /BK signal to turn from on to off in the motor rotation are as follows (any of the two conditions will take effect):
1) After the servo is OFF, the motor speed is below the set value of P5-08.
2) After the servo is OFF, when the set time of P5-09 is exceeded.

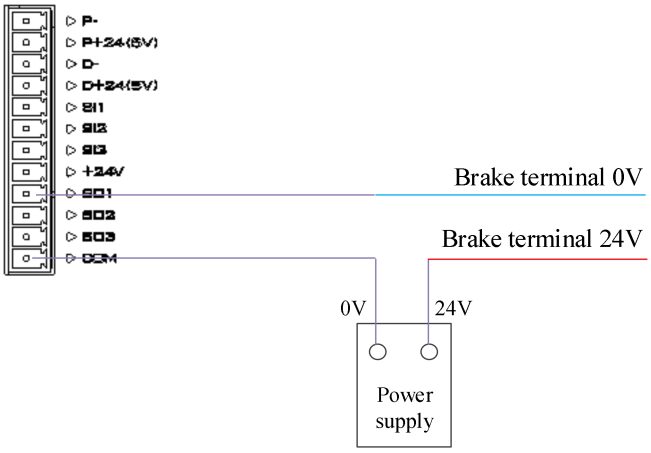
The sequence diagram is as follows:



Since the brake of the servo motor is designed for position holding, it must be enabled at the right time when the motor stops. While observing the action of the machine, adjust the user parameters.

(4) Brake wiring

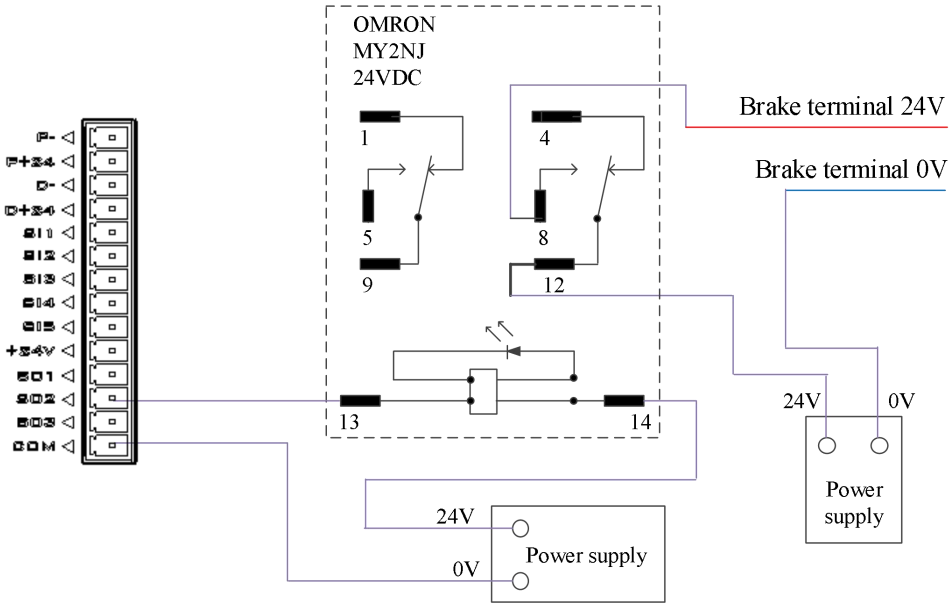
① When the power of the driver is below 750W, it can be directly connected through the SO terminal, as shown in the following figure:



Set P5-44=0001

When using SO to control the brake motor with a power of 400W or less, please use SO1 terminal control and set the brake parameter P5-44=n.0001 to prevent the brake from being worn out due to excessive current burning the terminals or failure to open.

② When the power of the driver is 750W or above, it needs to be connected through an intermediate relay, and the connection method is as follows:



Set P5-44=0001

If the holding current of 750W or above is greater than 50mA, please use relay transfer to prevent the terminals from being burned or the holding brake from being worn out due to excessive current.

Note: It is recommended that the SO terminal and intermediate relay don't share the same switching power supply.

(5) When the brake slightly drops after a power outage, the following solutions can be used to solve it:

① Reduce P5-07 appropriately (can be set to a negative number).
② Directly set P0-69.2 to 1.

5.3 Stop mode

5.3.1 Stop mode setting

Servo shutdown can be divided into free shutdown, deceleration shutdown, and dynamic braking (DB) shutdown according to the shutdown mode. The following is an explanation of the servo shutdown mode.

Shutdown mode	Free shutdown	Deceleration shutdown	DB shutdown
Stopping principle	The servo driver isn't enabled, the servo motor isn't powered, and free deceleration to 0. The deceleration time is affected by mechanical inertia, equipment friction, etc.	The servo driver outputs the reverse braking torque, and the motor decelerates rapidly to 0.	Servo motor operates in short-circuit braking state
Stopping features	Advantages:smooth deceleration, small mechanical impact, small mechanical impact Disadvantage: slow deceleration process	Advantages:short deceleration time Disadvantages: mechanical impact	Advantages:Short deceleration time Disadvantage:There may be mechanical impact

According to different scenarios of servo shutdown, it can be divided into servo OFF shutdown, alarm shutdown and over travel shutdown.

1. Servo OFF and alarm shutdown

■ Related parameter

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P0-30	Stop timeout	20000	1ms	0~65535	Servo bb	At once
P0-27	Servo OFF stop mode	0	-	0~5	Servo bb	At once
P0-29	Alarm stop mode	2	-	0~5	Servo bb	At once

Parameter	Value	Meaning
P0-27	0	Free running stop, maintain free running state after stopping
	1	Free running stops and maintains the DB state after stopping.
	2	Decelerate and brake to stop, and maintain a free running state after stopping.
	3	Decelerate and brake to stop, and maintain the DB state after stopping.
	4	DB stops and remains in a free running state after stopping.
	5	DB stops and remains in DB state after stopping.
P0-29	Shut down enable alarm	
	0	Free running stops and maintains a free running state after stopping.
	1	Free running stops and maintains the DB state after stopping.
	2	DB stops and remains in a free running state after stopping.
	3	DB stops and remains in DB state after stopping.
	4	DB stops and remains in a free running state after stopping.
	5	DB stops and remains in DB state after stopping.
	Not shut down enable alarm	
	0	Free running stops and maintains a free running state after stopping.
	1	Free running stops and maintains the DB state after stopping.
	2	Decelerate and brake to stop, and maintain a free running state after stopping.
	3	Decelerate and brake to stop, and maintain the DB state after stopping.

	4	DB stops and remains in a free running state after stopping.
	5	DB stops and remains in DB state after stopping.

Note:

(1) Servo enable shut down stop mode (P0-27)

① When P0-27=0, if the servo OFF occurs, the motor starts to rely on free stop without any alarm.
② When P0-27=1, if the servo OFF occurs, the motor starts to rely on free stop and maintains the DB state after stop.
③ When P0-27=2, if the servo OFF occurs, the motor starts to rely on free stop until the speed is less than P5-03 before turning to free stop. At the same time, the servo will time the free stop stage. If the timing time has exceeded P0-30 and the motor speed has not dropped below P5-03 during the free stop process, an alarm E-262 will report.
④ When P0-27=3, if the servo OFF occurs, the motor starts to rely on free stop until the speed is less than P5-03 before turning to free stop. At the same time, the servo will time the free stop stage. If the timing time has exceeded P0-30 and the motor speed has not dropped below P5-03 during the free stop process, an alarm E-262 will report. Maintain DB status after stop.
⑤ When P0-27=4, if the servo OFF occurs, the motor DB stops and remains in a free running state after stop.
⑥ When P0-27=5, if servo OFF occurs, the motor DB stops and maintains the DB state after stop.

(2) Servo alarm stop mode (P0-29)

a. Shut down enable alarm

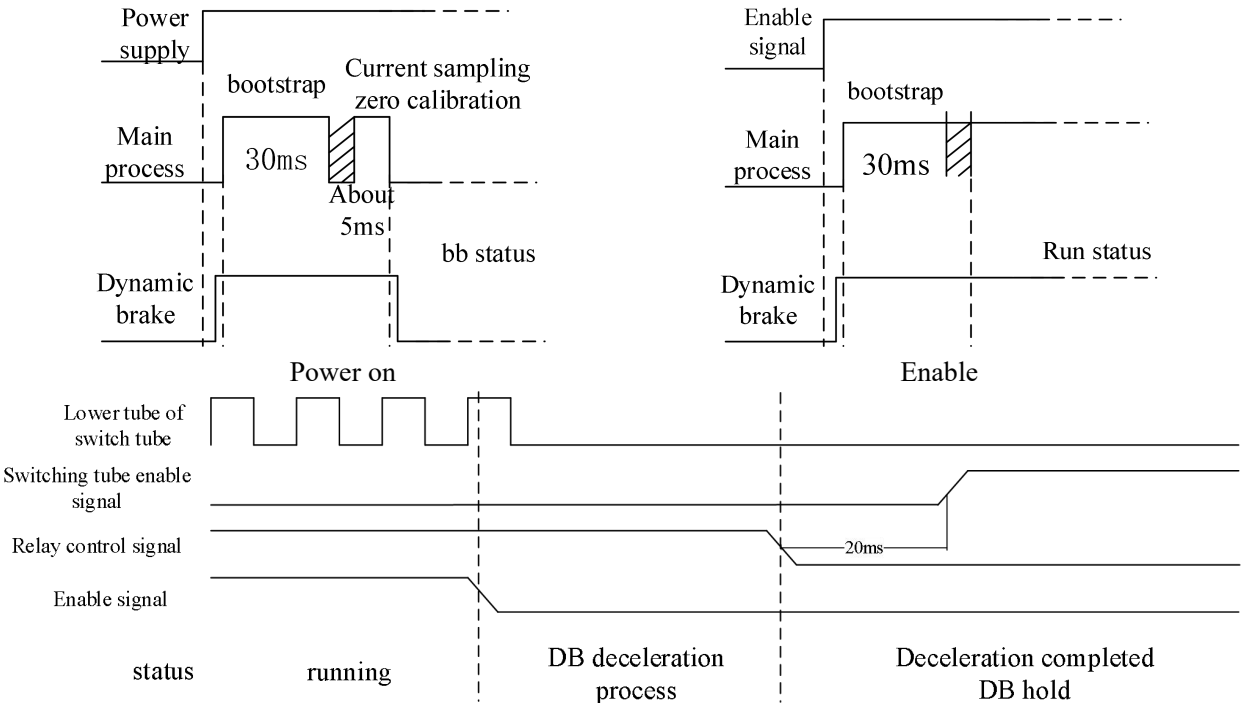
① When P0-29=0, if a servo alarm occurs, the motor starts to rely on free stop.
② When P0-29=1, if a servo alarm occurs, the motor starts to rely on free stop and remains in DB state after stop.
③ When P0-29=2, if a servo alarm occurs, the motor starts to rely on free stop.
④ When P0-29=3, if a servo alarm occurs, the motor starts to rely on free stop and remains in DB state after stop.
⑤ When P0-29=4, if a servo alarm occurs, the motor starts to rely on free stop.
⑥ When P0-29=5, if a servo alarm occurs, the motor starts to rely on free stop and remains in DB state after stop.

b. Not shut down enable alarm

① When P0-29=0, if a servo alarm occurs, the motor starts to rely on free stop.
② When P0-29=1, if a servo alarm occurs, the motor starts to rely on free stop and remains in DB state after stop.
③ When P0-29=2, if a servo alarm occurs, the motor starts to stop by deceleration until the speed is less than 50rpm, and then switches to free stop. At the same time, the servo will time the deceleration stop phase. If the timing time is already greater than P0-30 during the deceleration process, the servo will directly stop freely. At this time, since the servo is in an alarm state, regardless of the value of P0-29, it will not alarm E-262. Maintain a free running state after stopping.
④ When P0-29=3, if a servo alarm occurs, the motor will start to stop by deceleration until the speed is less than 50rpm, and then switch to free parking. At the same time, the servo will time the deceleration stop phase. If the timing time is already greater than P0-30 during the deceleration process, the servo will directly stop freely. At this time, since the servo is in an alarm state, regardless of the value of P0-29, it will not alarm E-262. Maintain DB status after stopping.
⑤ When P0-29=4, if a servo alarm occurs, the motor DB stops and remains in a free running state after stop.
⑥ When P0-29=5, if a servo alarm occurs, the motor DB stops and maintains the DB state after stop.

(3) The servo drive SO terminal has been assigned a holding brake function, and the values set in P0-27/P0-29 are invalid. They all stop in a deceleration manner.

Dynamic braking (DB) timing diagram (dynamic braking low-level indicates effective):



DB stop

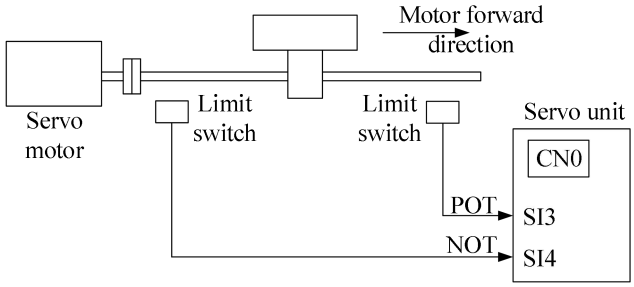
2. Stop mode in case of over travel

The overtravel prevention function of servo unit refers to the safety function that the servo motor is forced to stop by inputting the signal of limit switch when the movable part of the machine exceeds the designed safe moving range.

■ Related parameter

parameter	Meaning	Default setting	Unit	Setting range	Modify	Effective
P0-28	Servo override stop mode	2	-	0~3	Servo bb	At once
P0-30	Stop timeout	20000	1ms	0~65535	Servo bb	At once
P5-22	Forward run prohibition /P-OT	n.0003	-		Anytime	At once
P5-23	Reverse run prohibition /N-OT	Model decision	-		Anytime	At once

Be sure to connect the limit switch as shown in the figure below.



Rotary applications such as round tables and conveyors don't need the function of overrun prevention. At this time, there is no need to connect the overrun prevention with input signals.

Parameter setting	Signal /POT, terminal input status	Overtravel signal (/POT, /NOT) terminal logic
P5-22/P5-23=n.0000	No need to connect external input	Invalid
P5-22/P5-23=n.000□	SI□ terminal has no signal input	
P5-22/P5-23=n.001□	SI□ terminal has signal input	

P5-22/P5-23=n.0010	No need to connect external input	Valid
P5-22/P5-23=n.000□	SI□ terminal has signal input	
P5-22/P5-23=n.001□	SI□ terminal has no signal input	

Parameter settings in forward limit signal /POT and reverse limit signal /NOT can not be set to the same terminal input at the same time.

Direction	Meet the limit	Operation status
Forward run	Positive limit is valid	POT, set the servo overrun stop mode as P0-28
	Negative limit is valid	Alarm E-261
Reverse run	Positive limit is valid	Alarm E-261
	Negative limit is valid	NOT, set the servo overrun stop mode as P0-28

Parameter	Value	Meaning
P0-28	0	The deceleration stops 1, the overrun direction moment is 0 after stopping, and receiving instructions.
	1	Inertia stops, after stopping, overrun direction moment is 0, receiving instructions.
	2	The deceleration stops 2, after stopping, the overrun direction doesn't receive instructions.
	3	Alarm (E-260)

Note:

(1) When P0-28 = 0/2, the motor starts to decelerate and stop after receiving the overtravel stop signal, and the braking torque is P3-32 when decelerating stop, and the stop timeout also plays a role in the overtravel process.

(2) During position control, when the motor is stopped by over travel signal, there may be position deviation pulse. To clear the position deviation pulse, the clear signal /CLR must be input. If the servo unit still receives pulses, they will accumulate until the servo unit gives an alarm.

(3) During torque control, the SO terminal of servo drive has the function of holding brake, which can't be distributed through the overtravel signal terminals P5-22 and P5-23.

(4) Servo driver SO terminal is assigned with holding brake function, P0-28 is automatically set to 2.

5.4 Position control

5.4.1 General position control

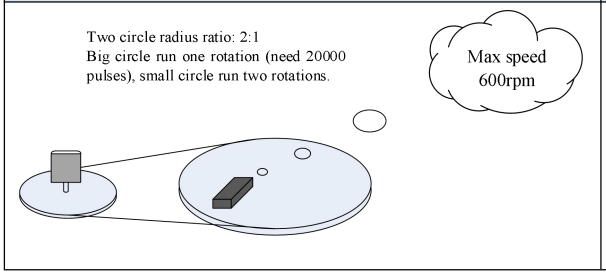
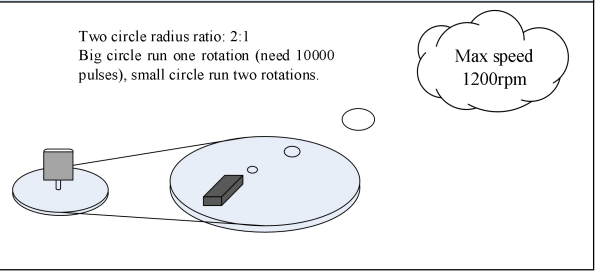
5.4.1.1 Electronic gear ratio

1. Overview

The so-called "electronic gear" function has two main applications:

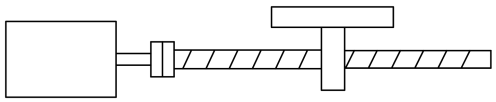
(1) Determine the number of command pulses needed to rotate the motor for one revolution to ensure that the motor speed can reach the required speed.

As an example of 19-bit encoder motor, the pulse frequency sent by the upper computer PLC is 200kHz:

Pulses per revolution set to 10000 Electronic gear ratio set to 524288:10000	Set pulses per revolution to 5000 Electronic gear ratio set to 524288:5000
	

(2) In the precise positioning, the physical unit length corresponding to 1 command pulse is set for calculation.

For example: the object moves 1um per command pulse. The command pulses of load rotating one circle = 6mm / 1um = 6000. In the case of deceleration ratio is 1:1, set pulse per rotation P0-11=6000, P0-12=0. Then if the PLC outputs 6000 pulses, the object will move 6mm.



Encoder: 524288 (19-bit) ball screw pitch: 6mm

Don't change the electronic gear ratio	Change the electronic gear ratio
Without changing the ratio of the electronic gear to the motor, the rotating cycle is 524288 pulses (P0-11=0, P0-12=0). If the workpiece is moved 6 mm in one turn, the number of pulses needed is 524288. If the workpiece is moved 10 mm, it will need 10/6*524288=873813.333 pulses. When the decimal number is omitted, the error will occur.	By changing the electronic gear ratio, the motor needs 6000 pulses to rotate one circle. If the workpiece moves 6 mm in one turn, the number of pulses needed is 6000. If the workpiece is moved 10 mm, it needs 10/6*6000 = 10000 pulses. When the pulse is sent, the decimal number will not be produced and the error will not be produced.

■ Related parameters

Parameter	Meaning	Default setting	Unit	Setting range	Modify	Effective
P0-11	Pulse numbers per rotation *1	0	pul	0~9999	Servo OFF	At once
P0-12	Pulse numbers per rotation *10000	1	pul	0~9999	Servo OFF	At once
P0-13	Electronic gear ratio (numerator)	1	-	0~65535	√	At once
P0-14	Electronic gear ratio (denominator)	1	-	0~65535	Servo OFF	At once
P0-92	Group 2 Electronic gear ratio (numerator) low bit*1	1	-	1~9999	○ (Mode 5) √ (Mode 6)	At once
P0-93	Group 2 Electronic gear ratio (numerator) high bit*10000	0	-	0~65535	Servo OFF	At once
P0-94	Group 2 Electronic gear ratio (denominator) low bit*1	1	-	1~9999	Servo OFF	At once

P0-95	Group 2 Electronic gear ratio (denominator) high bit*10000	0	-	0~65535	Servo OFF	At once

Note:

(1) P0-11 to P0-14 are parameters related to electronic gear ratios. P0-11 and P0-12 are grouped together, while P0-13 and P0-14 are grouped together. However, the priority of the number of pulses per revolution P0-11 and P0-12 is higher than that of electronic gear ratios P0-13 and P0-14. Electronic gear ratios P0-13 and P0-14 will only take effect when P0-11 and P0-12 are both set to 0.

(2) When P0-11, P0-12, P0-13 and P0-14 are all set to 0, P0-92, P0-93, P0-94 and P0-95 will take effect.

2. Calculation of Pulse Number per Rotation and Electronic Gear Ratio

Steps	Content	Description	
1	Confirm the machine specification	Confirm the deceleration ratio n:m (servo motor turns m rotations while load turns n rotations), ball screw distance, pulley diameter.	
2	Confirm the encoder pulse	Confirm the servo motor encoder accuracy	
3	Set the command unit	Determine the actual distance or angle corresponding to 1 pulse of the controller	
4	Calculate the command pulses the load shaft rotates 1 circle	Based on the determined command unit, calculate the command quantity n of the load shaft rotating for 1 revolution.	
5	Calculate the pulses per rotation M	Command pulse number of motor shaft rotating for 1 turn M=N/(m/n).	
6	Set the pulses per rotation (P0-11/P0-12) or Electronic gear ratio (P0-13/P0-14) / (P0-92~95)	P0-11=M%10000 P0-12=M/10000 $\frac{P0-13}{P0-14} = \frac{encoder\ resolution}{M} = \frac{encoder\ resolution}{N \times n} \times m$	Priority: High ↓ Low

Note:

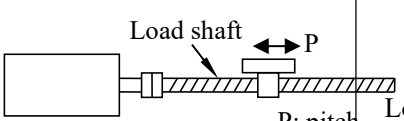
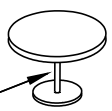
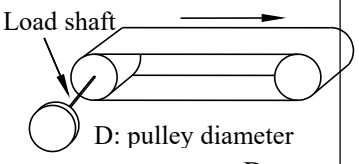
(1) In step 6, the effective priority of the number of pulses per revolution is higher than the electronic gear ratio, that is, when P0-11 ~ P0-12 are all 0, P0-13 ~ P0-14 will take effect. In special cases, if the number of pulses per revolution is calculated as a decimal, the electronic gear ratio should be considered.

(2) When P0-13 and P0-14 exceed the setting range, please divide the electronic gear ratio into numerator and denominator. If the ratio still exceeds the parameter setting range, please use the second gear ratio P0-92~P0-95. Only when P0-11~14 = 0, the second gear ratio takes effect.

(3) The resolution of DS5L2 series servo motor encoder is 524288 (19 bits) and 8388608 (23 bits).

(4) The command unit doesn't represent the machining accuracy. On the basis of the mechanical accuracy, refining the instruction unit quantity can improve the positioning accuracy of the servo system. For example, when using the lead screw, the mechanical accuracy can reach 0.01mm, so the unit equivalent of 0.01mm is more accurate than the unit equivalent of 0.1mm.

3. Example of setting the electronic gear ratio

Steps	Name	Ball screw	Round table	Belt + pulley
		 1rotate = $\frac{P}{\text{command unit}}$	 Load shaft 1 rotate = $\frac{360°}{\text{command unit}}$	 1rotate = $\frac{\pi D}{\text{command unit}}$
1	Confirm mechanical specifications	Ball screw pitch: 6mm Machine deceleration ratio: 1:1	1-circle rotate angle: 360° Deceleration ratio: 1:3	Pulley diameter: 100mm Deceleration ratio: 1:2
2	Confirm the number of encoder pulses	Encoder resolution 524288	Encoder resolution 524288	Encoder resolution 524288

3	Confirm the command unit	1 command unit: 0.001mm	1 command unit: 0.1°	1 command unit: 0.02mm
4	Calculate the command amount of 1 revolution of load shaft	6mm/0.001mm=6000	360/0.1=3600	314mm/0.02mm=15700
5	Calculate the pulse number m of one revolution of motor shaft	M =6000/(1/1)=6000	M=3600/(3/1)=1200	M=15700/(2/1)=7850
6	Set pulses per rotation P0-11/P0-12	P0-11=6000 P0-12=0	P0-11=1200 P0-12=0	P0-11=7850 P0-12=0
	Set electronic gear ratio (P0-13/P0-14) /(P0-92~95)	P0-13=524288 P0-14=6000 After reduction P0-13=32768 P0-14=375	P0-13=524288 P0-14=1200 After reduction P0-13=32768 P0-14=75	P0-13=524288 P0-14=7850 After reduction P0-13=262144 P0-14=3925 Conver to second gear ratio P0-92=2144 P0-93=26 P0-94=3925 P0-95=0

5.4.1.2 Positioning completion signal (/COIN, /COIN_HD)

In position control, the signal indicating the completion of servo motor positioning is used when the command controller needs to complete positioning confirmation.

■ Related parameters

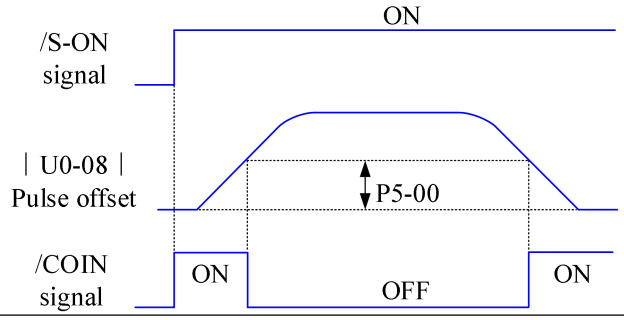
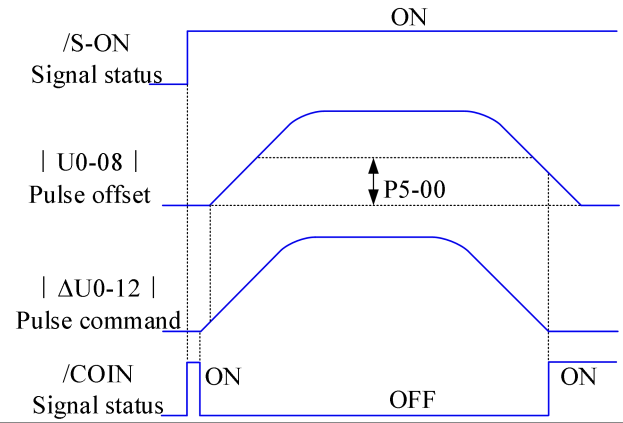
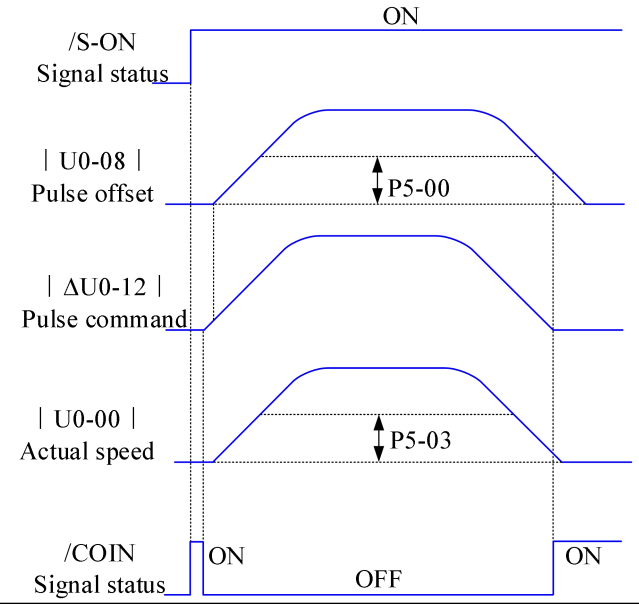
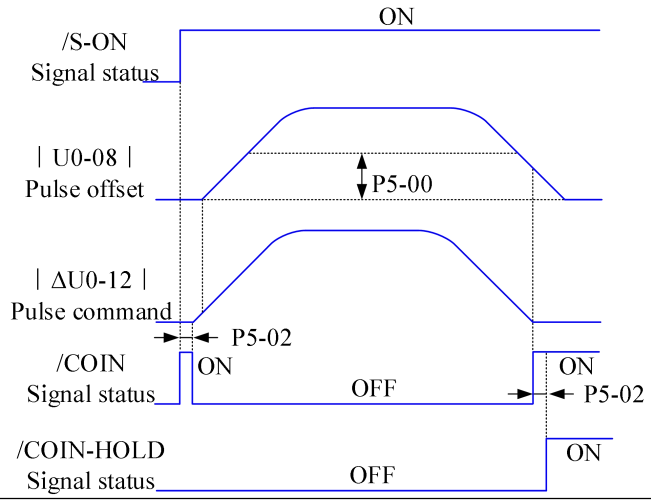
Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P5-00	Positioning completion width	11	Command unit	1~65535	Anytime	At once
P5-01	Positioning completion detection mode	0	-	0~3	Anytime	At once
P5-02	Positioning completion hold time	0	ms	0~65535	Anytime	At once

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-37	/COIN-HD	n.0000	5|6	Positioning complete holding	Anytime	At once
P5-38	/COIN	n.0000	5|6	Positioning complete output	Anytime	At once
Refer to 3.2.4 for hardware wiring details. If it is necessary to output signal from SO2, P5-37 and P5-38 are set to n.0002/0012. Note that an SO terminal can only be used as a signal function.						

1. Conditions for positioning completion signal output

(1) /COIN-HD signal output conditions
When the positioning completion detection mode P5-01 is set to 3, the positioning completion holding /COIN-HD signal can be output. When the /COIN signal holds P5-02 time, the COIN-HD signal can be output.

(2) /COIN signal output conditions
According to the positioning completion detection mode set in P5-01, output positioning completion /COIN signal. The following is the precondition for positioning output and the output diagram.

P5-01 setting	Content	Diagram
0	If the absolute deviation is below P5-00, the COIN signal will be output.	
1	After the instruction is finished, the deviation is below P5-00 and COIN signal is output.	
2	When the instruction ends and the motor speed is under the rotation detection speed (P5-03) and the absolute deviation is less than P5-00, the COIN signal is output.	
3	At the end of instruction, the absolute deviation value under P5-00, it outputs COIN signal. If COIN maintains P5-02 time, COIN-HOLD signal is output.	

2. Description of positioning completion width

(1) The positioning completion width P5-00 changes proportionally due to the change of electronic gear ratio, and the factory default is 11 command units.
The following table is an example:

Number of command pulses required for one revolution of motor	Positioning completion width P5-00
10000 (default)	11 (default)
20000	22
5000	6
3000	4
2000	3

The positioning completion width P5-00 changes proportionally with the number of command pulses required for one revolution of the motor.
The output of the positioning completion signal depends on the positioning completion width. The smaller the width is, the later the positioning completion signal output is, but the signal output doesn't affect the actual operation state of the motor.

(2) The positioning completion width can also be set separately, and its change will not affect the number of command pulses required for one revolution of the motor.

5.4.1.3 Positioning near signal (/NEAR)

The servo motor is located near the positioning completion signal, so that the equipment can prepare the next action in advance.

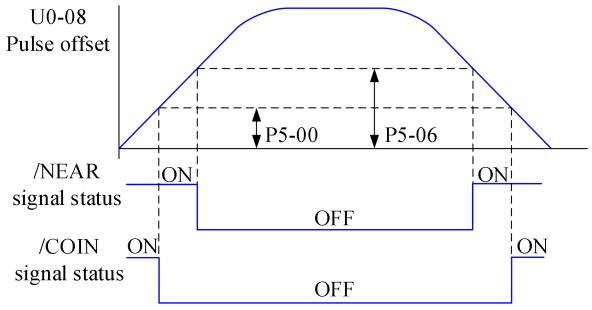
■ Related parameters

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P5-06	Near signal output width	50	Command unit	0~65535	Anytime	At once

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-46	/NEAR	n.0000	5|6	Positioning near	Anytime	At once
Refer to 3.2.2 for hardware wiring details. If it is necessary to output from the SO2, P5-46 can be set to n.0002/0012.						

1. Positioning approach signal output conditions

When the pulse deviation value U0-08 of the servo driver is lower than the P5-06 setting value, the positioning approach signal (/NEAR) is output.



2. Description of approach signal output

(1) The approach signal output width P5-06 changes proportionally due to the change of the electronic gear ratio. The default setting is 11 command units.
The following table is an example:

Number of command pulses required for one revolution of motor	Near signal output width P5-06
10000 (default)	50 (default)
20000	100

The near signal output width P5-06 changes proportionally with the number of command pulses required for one revolution of the motor.
The output of the positioning completion signal depends on the positioning completion width. The smaller the width is, the later the positioning

5000	25
3000	15
2000	10

completion signal output is, but the signal output doesn't affect the actual operation state of the motor.

(2) The approach signal output width can also be set independently, and its change will not affect the number of command pulses required for one revolution of the motor.
(3) Please set this parameter larger than the positioning completion width.

5.4.1.4 Command pulse prohibition (/INHIBIT)

Position command prohibition, including internal and external position commands. Stop the function of command pulse input during position control. When the /INHIBIT signal is on, the pulse command is no longer counted.

■ Related parameters

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-32	/INHIBIT	n.0000	5|6	Command pulse prohibition	Anytime	At once
Parameter range n.0000-001A, assigned to other input terminals by parameter P5-32. If it is necessary to input from SI2, P5-32 can be set to n.0002/0012. Refer to 3.2.2 for hardware wiring details.						

1. /INHIBIT terminal effectiveness description

Parameter setting status	Signal/INHIBIT terminal input status	Signal/INHIBIT terminal logic
P5-32=n.0000	No external terminal input	Invalid
P5-32=n.000□	SI□ terminal has no signal input	
P5-32=n.001□	SI□ terminal has signal input	
P5-32=n.0010	No external terminal input	Valid
P5-32=n.000□	SI□ terminal has signal input	
P5-32=n.001□	SI□ terminal has no signal input	

2. The influence of /INHIBIT terminal signal on the running state of motor

Control mode	Motor operation status	
	/INHIBIT terminal logic valid	/INHIBIT terminal logic invalid
5- internal position control	Pause current segment	/INHIBIT signal is from ON→OFF, continue running from pause point.
6- external pulse position control	Pause pulse command reception	/INHIBIT signal is from ON→OFF, continue running from the pulse command received after OFF.

5.4.1.5 Offset clear(/CLR)

Position offset= (position command – position feedback)(encoder unit)
The position deviation clearing function means that the driver can clear the position deviation when the servo is off or the /CLR signal is received.

■ Related parameters

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-34	/CLR	n.0000	All	Pulse deviation clear	Anytime	At once
Parameter range n.0000-001A, assigned to other input terminals by parameter P5-34. If it is necessary to input signal from SI2, P5-34 can be set to n.0002/0012. Refer to 3.2.2 for hardware wiring details.						

1. /CLR signal effectiveness

Parameter setting status	Signal /CLR terminal input status	Signal /CLR terminal logic
P5-34=n.0000	No external terminal input	Invalid
P5-34=n.000□	SI□ terminal has no signal input	
P5-34=n.001□	SI□ terminal has signal input	

P5-34=n.0010	No external terminal input	Valid
P5-34=n.000□	SI□ terminal has signal input	
P5-34=n.001□	SI□ terminal has no signal input	

2. /CLR signal explanation

Send the pulse to the servo, execute the /CLR input signal, the servo will lock the current pulse counts, then update the current position of the encoder to the position feedback in the control, at the same time, clear the intermediate quantity of the position loop, speed loop and current loop.
/CLR signal is triggered by edge.

3. Other description of pulse position deviation clearing signal

Setting F0-02 to 1 can also clear the pulse position deviation.

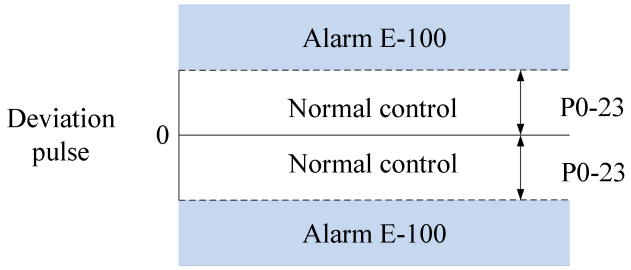
5.4.1.6 Position pulse deviation

Pulse deviation value refers to the difference between command pulse of command controller (such as PLC) and feedback pulse of servo unit in position mode. Its unit is 1 command unit, which is related to the command unit determined by electronic gear ratio.
In position control, when the deviation pulse exceeds a certain limit value, an alarm will occur, and this threshold value is the deviation pulse limit value.

■ Related parameters

parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-23	pulse deviation limit value	2000	0.01 turns	0~65535	Anytime	At once

When the deviation pulse limit is 0, the deviation pulse will not be detected.

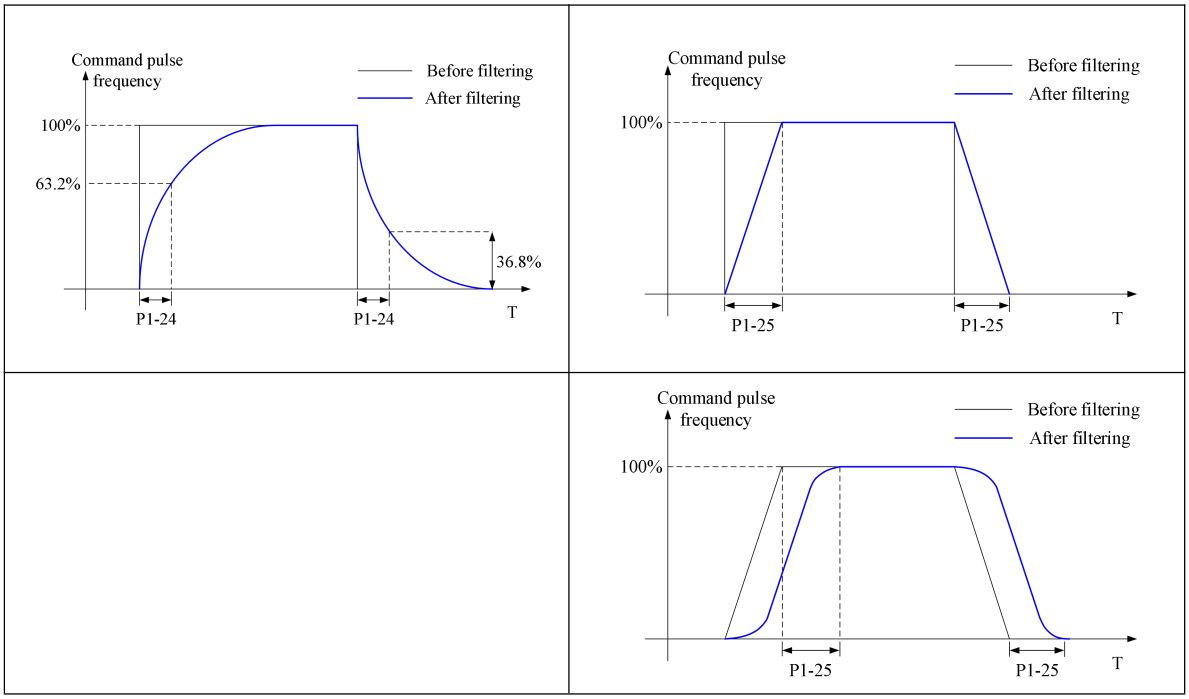


5.4.1.7 Position command filter

■ Related parameters

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P1-24	Position command acceleration and deceleration filtering time	0	0.1ms	0~65535	At once	Servo OFF
P1-25	Position command smoothing filtering time	0	0.1ms	0~65535	At once	Servo OFF

Position command acceleration and deceleration filter	Position command smoothing filter



5.4.1.8 Reference origin

1. Find the reference origin

To find out the physical origin of working table and make it as the coordinates origin of point position control. Users can select finding reference origin at forward or reverse side.

Function setting:

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P4-00 n.xx□x	Origin function	0	-	0~1	Servo OFF	At once
Note: This function is applicable to position mode 5 and 6. When this parameter is set to 0, the function of Origin-finding is invalid. When it is set to n.001x, the function of Origin-finding can be used. (for firmware 3770 and later, please set P9-21=0)						

Signal setting

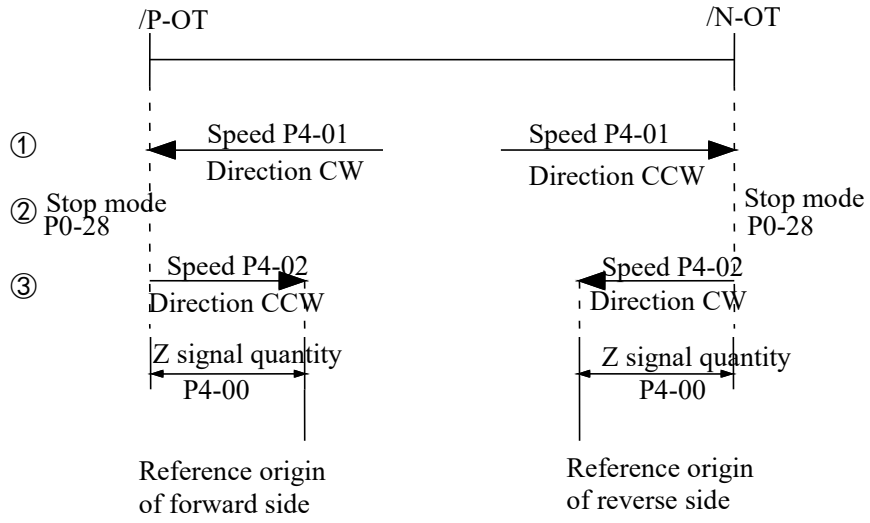
Parameter	Signal	Default	Meaning	Modify
P5-28	/SPD-A	n.0000	Mode 3: internal speed selecting signal Mode 5: find origin point at forward direction	Range: 0000-0014, distributes to input terminal through P5-28. When it set to 0001, it means input signal from SI1.
P5-29	/SPD-B	n.0000	Mode 3: internal speed selecting signal Mode 5: find origin point at reverse direction	Range: 0000-0014, distributes to input terminal through P5-29. When it set to 0001, it means input signal from SI1.

Related parameter setting:

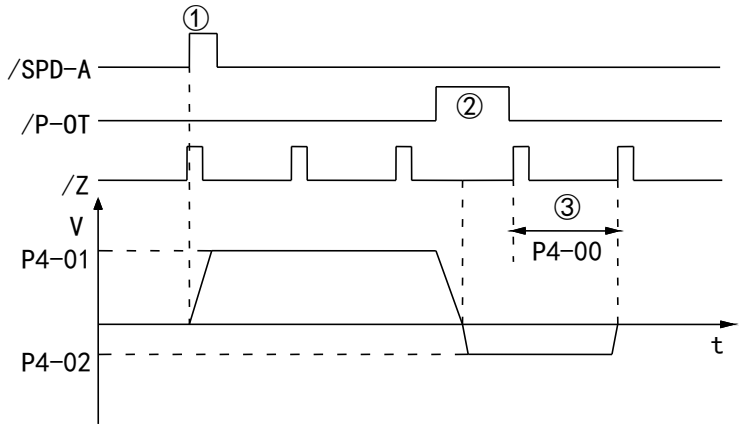
Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P4-00 n.xxx□	Z phase signal numbers	2	pc	0~f	Servo OFF	At once
P4-00 n.□xxx	Automatic calibrate encoder zero position after	0	-	0~1	Servo OFF	At once

	homing					
P4-01	The speed hitting the proximity switch	600	rpm	0~65535	Servo OFF	At once
P4-02	The speed leaving the proximity switch	100	rpm	0~65535	Servo OFF	At once

Find reference origin diagram:



Sequential diagram of finding reference origin on forward side:



Steps:
(1) Install limit switch at forward and reverse side. At the rising edge of /SPD-A, motor runs forward at the speed of P4-01 to find the reference origin on forward side.
(2) After the working table hit the limit switch, the motor stop as the mode set by parameter P0-28
(3) Motor leaves the limit switch at the speed of P4-02. After the working table left the limit switch, the motor run at the Z phase signal position of No.n optical encoder. This position is considered as the coordinates origin, n is decided by parameter P4-00.

5.4.1.9 Homing function

1. Function overview

The return to origin function refers to that when the servo enable is on in the position control mode, after the return to origin function is triggered, the servo motor will find the origin and complete the positioning function. The found origin can be used as the position reference point for subsequent position control.
During the homing operation, other position commands (including the retriggered homing signal) are shielded. After the homing is completed, the servo driver can respond to other position commands.
After the homing is completed, the servo driver outputs the homing completion signal, and the upper computer can confirm that the homing has been completed after receiving the signal.

2. Parameter setting

Parameter	Name	Range	Meaning	Set time	Effective	Default
P9-11.0	Z phase numbers	0~F	P9-11.0=0: not find Z phase P9-11.0=1: find one Z phase P9-11.0=2: find two Z phases And so on	Servo OFF	Servo ON	0
P9-11.1	Homing trigger mode	0~2	P9-11.1=0: not trigger homing P9-11.1=1: trigger homing through SI terminal (P5-28) P9-11.1=2: in the return to homing mode, it will immediately start returning to the homing position after the first power on is enabled	Servo OFF	Servo ON	0
P9-11.2	Homing mode	0~7	P9-11.2=0: homing mode 0 P9-11.2=1: homing mode 1 P9-11.2=2: homing mode 2 And so on	Servo OFF	Servo ON	0
P9-11.3	Deceleration mode when meeting the overlimit signal	0, 1	P9-11.3=0: decelerate as the setting of P9-14 P9-11.3=1: decelerate at once	Servo OFF	Servo ON	0

Note: P9-11.0 can set up to 15 Z phases. P9-11.1 = 0 means that the homing function cannot be used. This parameter can be understood as the enabling bit of the homing function. Homing modes 1, 3, 5 and 7 are the opposite situation of homing modes 0, 2, 4 and 6 respectively.

Parameter	Name	Range	Unit	Meaning	Set time	Effective	Default value
P9-12	Homing high speed	0~3000	rpm	Return to the origin at high speed, find the deceleration point and execute the mechanical offset	Servo OFF	Servo ON	200
P9-13	Homing low speed	0~1000	rpm	Homing with low speed. This low speed should be low enough not to cause mechanical shock when stopping	Servo OFF	Servo ON	20
P9-14	Homing acc/dec time	0~1000	ms	The acceleration and deceleration time here refers to the time required for 0 to 1000 rpm	Servo OFF	Servo ON	1000
P9-15	Maximum time allowed to return to the origin	0~12000	10ms	If the time spent in the whole process of homing exceeds the time set by this parameter, an alarm will be given. When P9-15 = 0, the timeout alarm will be shielded	Servo OFF	Servo ON	0
P9-16	Touch stop mode homing speed threshold	0~1000	rpm	This parameter is only available for home mode 6 and 7	Servo OFF	Servo ON	2
P9-17	Touch stop mode homing torque threshold	0~300%	%	This parameter is only available for home mode 6 and 7 The base value of the percentage is the rated torque	Servo OFF	Servo ON	100%
P9-18	Touch stop mode homing time threshold	10~1500	ms	This parameter is only available for home mode 6 and 7	Servo OFF	Servo ON	500
P9-19	Quantitative pulses low bit	-9999~9999	-	Quantitative pulses low bit	Servo OFF	Servo ON	0

Parameter	Name	Range	Unit	Meaning	Set time	Effective	Default value
P9-20	Quantitative pulses high bit	-9999~9999	-	Quantitative pulses high bit	Servo OFF	Servo ON	0
P9-21	New/old homing function selection	0, 1	-	P9-21=0: old homing function P9-21=1: new homing function	Servo OFF	Power on again	0
P9-22	New homing end filter time	50~10000	ms	When the homing is about to end, this filtering time is required. Wait until the motor stops completely before completely exiting the homing mode. After this filtering time, the return to origin completion signal will be output.	Servo OFF	Servo ON	500

Note: Actual mechanical offset =P9-19 + P9-20×10000， P9-19 and P9-20 need same symbol (all positive or negative value). The mechanical offset here is the absolute position of the servo after homing.

Parameter n.xxxx	Name	Setting range	Meaning	Set time	Effective	Default
P5-22	Forward overtravel signal POT	0~ffff	Forward limit signal in homing mode	Operation setting	Take effect at once	3
P5-23	Reverse overtravel signal NOT	0~ffff	Reverse limit signal in homing mode	Operation setting	Take effect at once	4
P5-54	Homing completion signal	0~ffff	When the homing action and status are completed, the homing completion signal will be output. Even if other modes are executed after the homing is completed, the homing completion signal will not disappear. When the homing is started again, the homing completion signal will disappear.	Operation setting	Take effect at once	0
P5-64	Homing switch signal	0~ffff	The origin switch signal is required in the process of returning to the origin.	Operation setting	Take effect at once	0
P5-28	SI terminal start homing	0~ffff	When P9-11.1=1, P5-28 distributed the SI terminal, the homing can be triggered by SI terminal.	Operation setting	Take effect at once	0

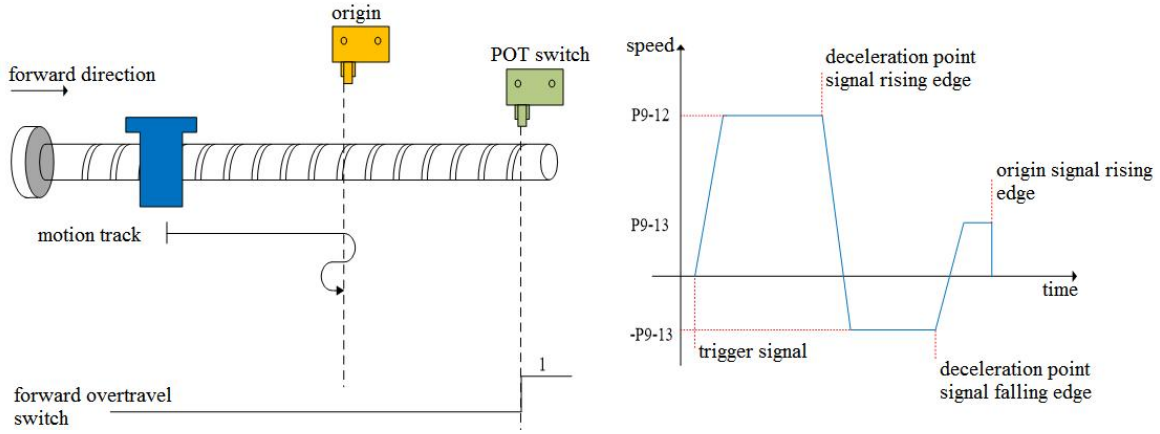
3. New homing mode selection

To use the new homing function, first set **P9-21=1**, then set the overtravel switch (POT/NOT) and the origin switch. If the mechanical offset (P9-19 and P9-20 are set), please set the offset within the travel range to ensure that the mechanical equipment will not be damaged during the homing process!
The number of Z phases (P9-11.0) and the mechanical offset (P9-19, P9-20) can be valid at the same time. If the number of Z phases (P9-11.0) and the mechanical offset (P9-19, P9-20) are not set to 0, the servo will find the number of Z phases (P9-11.0) first, and then execute the mechanical offset (P9-19, P9-20). If the number of Z phases (P9-11.0) is 0 and the mechanical offset (P9-19, P9-20) isn't 0, the servo doesn't find the Z phase, but executes the mechanical offset (P9-19, P9-20). If the number of Z phases isn't 0 but the mechanical offset is 0, the servo will find the Z phase (P9-11.0) without performing the mechanical offset.
There are 8 homing modes in total, as follows:
(1) Positive homing, the deceleration point is the origin switch, and the origin is the origin switch or motor Z signal (P9-11.2 = 0)
(2) Reverse homing, the deceleration point is the origin switch, and the origin is the origin switch or

motor Z signal (P9-11.2 = 1)
(3) Positive homing, the deceleration point and origin are motor Z signal (P9-11.2 = 2)
(4) Reverse homing, the deceleration point and origin are the motor Z signal (P9-11.2 = 3)
(5) Forward homing, the deceleration point is the forward overtravel switch, and the origin is the forward overtravel switch or motor Z signal (P9-11.2 = 4)
(6) Reverse homing, the deceleration point is the reverse overtravel switch, and the origin is the reverse overtravel switch or motor Z signal (P9-11.2 = 5)
(7) Positive homing, the deceleration point is the mechanical limit position, and the origin is the mechanical limit position or motor Z signal (P9-11.2 = 6)
(8) Reverse homing, the deceleration point is the mechanical limit position, and the origin is the mechanical limit position or motor Z signal (P9-11.2 = 7)

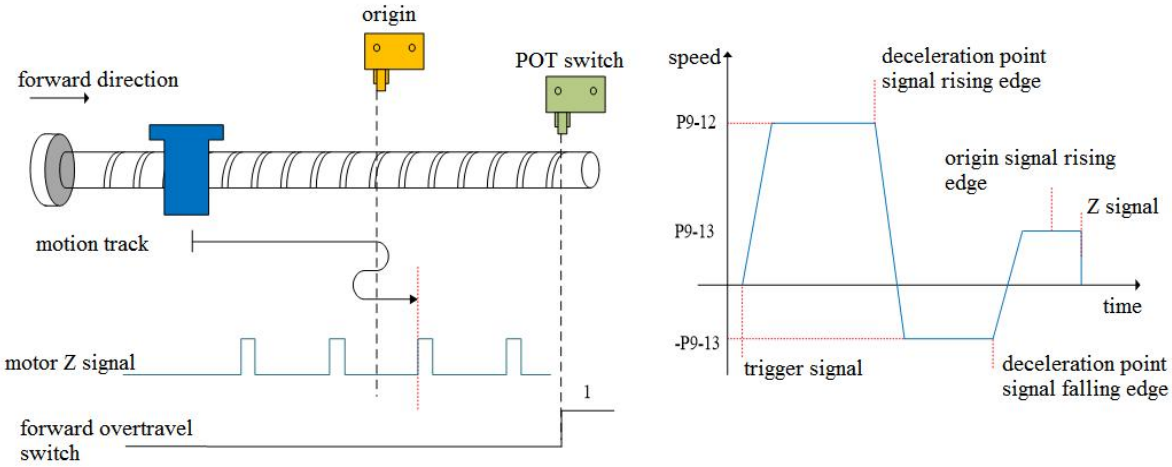
Each homing mode is analyzed in detail below:

3. Homing mode 0 —— Positive homing, the deceleration point is the origin switch, and the origin is the origin switch or motor Z signal (P9-11.2 = 0)
To use this mode, you need to connect pot, not and origin switches.
(1) When the motor starts to move, the signal of the origin switch (deceleration point) is invalid (P5-64 = 0-invalid, 1-valid), and the forward overtravel switch (POT) (P5-22) isn't triggered in the whole process.
Firstly, the servo motor searches the deceleration point (origin) signal in the high-speed forward direction with the set value of P9-12 (homing high speed) until it meets the rising edge of the deceleration point (origin) signal. After gradually decelerating to -P9-13 (homing low speed) according to the setting of P9-14 (homing acceleration and deceleration time), the servo motor searches the deceleration point (origin) signal falling edge in the reverse direction at the low speed set by -P9-13 (homing low speed). When encountering the deceleration point (origin) signal falling edge, it will reverse, and continue to search the deceleration point (origin) signal rising edge at low speed with P9-13 (homing low speed). The next homing action can be divided into four cases:
(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
During the operation of continuing to search the rising edge of deceleration point (origin) signal at low speed with P9-13 (homing low speed), stop immediately when encountering the rising edge of deceleration point (origin) signal.



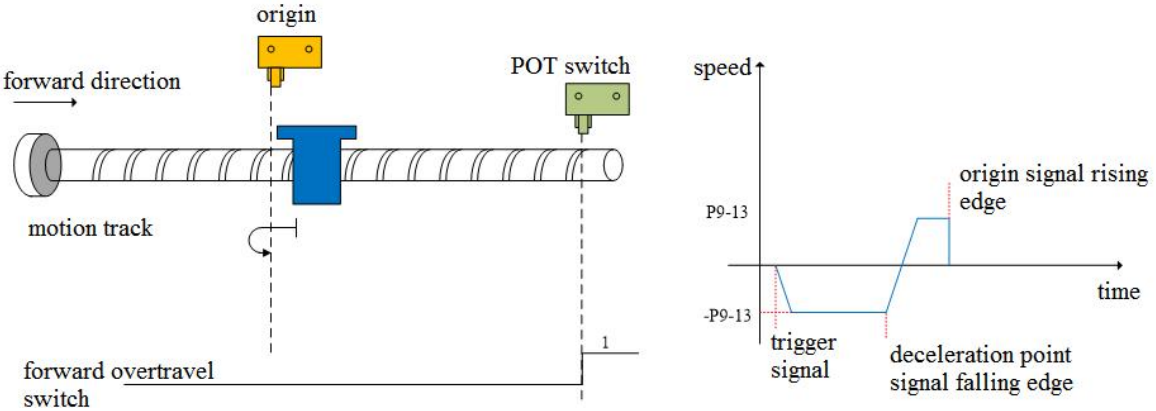
(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
In the operation process of continuing to search the rising edge of deceleration point (origin) signal at low speed with P9-13 (homing low speed), stop immediately when encountering the rising edge of deceleration point (origin) signal. After the motor is completely stopped, the motor will move a quantitative pulse (P9-19, P9-20) with speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (either positive direction or negative direction), then the motor will stop.

(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
During the operation of continuing to search the rising edge of deceleration point (origin) signal at low speed P9-13 (homing low speed), continue to run after encountering the rising edge of deceleration point (origin) signal, and then find the first Z-phase signal and stop immediately.



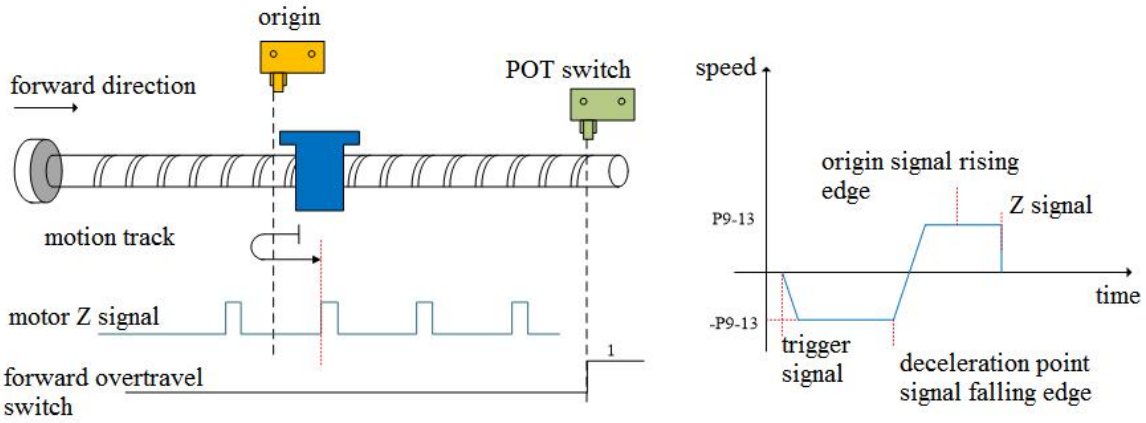
(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
During the operation of continuing to search the rising edge of the deceleration point (origin) signal at low speed P9-13 (homing low speed), continue to run after encountering the rising edge of the deceleration point (origin) signal, then find the first z-phase signal and stop immediately. After the motor is completely stopped, according to the set number of mechanical offset pulses (P9-19, P9-20) and direction (it can be positive direction or negative direction), the motor goes through a quantitative pulses (P9-19, P9-20) at the speed set by P9-12 (homing high speed), and then the motor stops.

(2) When the motor starts to move, the origin switch (deceleration point) signal is valid (P5-64 = 0-invalid, 1-valid), and the forward overtravel switch (P5-22) isn't triggered in the whole process:
The servo motor directly searches for the falling edge of the deceleration point (origin) signal at low speed -P9-13 (homing low speed). If it encounters the falling edge of the deceleration point (origin) signal, it will reverse (i.e. forward), and continue to search for the rising edge of the deceleration point (origin) signal at low speed with P9-13 (homing low speed). The next homing action can be divided into four cases:
(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
In the process of forward acceleration or forward constant speed operation, stop immediately when encountering the rising edge of deceleration point (origin) signal.



(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:

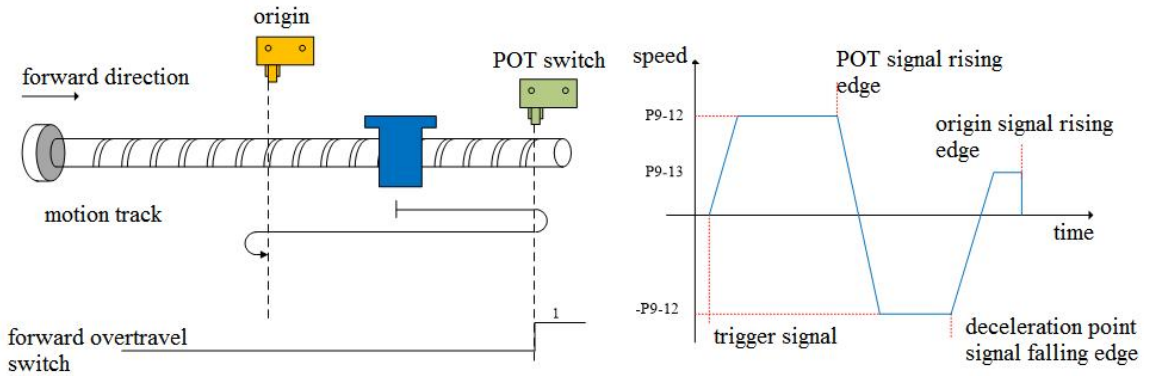
In the process of positive acceleration or positive constant speed operation, stop immediately after encountering the rising edge of the origin signal. After the motor is completely stopped, according to the set number of mechanical offset pulses and direction (either positive or negative direction), the motor will move a quantitative pulse (P9-19, P9-20) at the speed set by P9-12 (homing high speed), and then the motor will stop.
(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
In the process of forward acceleration or forward constant speed operation, continue to run after encountering the rising edge of the origin signal, and then find the first Z-phase signal and stop immediately.



(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
In the process of positive acceleration or positive constant speed operation, continue to run after encountering the rising edge of the origin signal, and then find the first Z-phase signal and stop immediately. After the motor is completely stopped, the motor will run a quantitative pulse (P9-19, P9-20) at the set speed P9-12 (homing high speed) according to the set number of mechanical offset pulses (P9-19, P9-20) and direction (either positive or negative direction), then the motor stops.

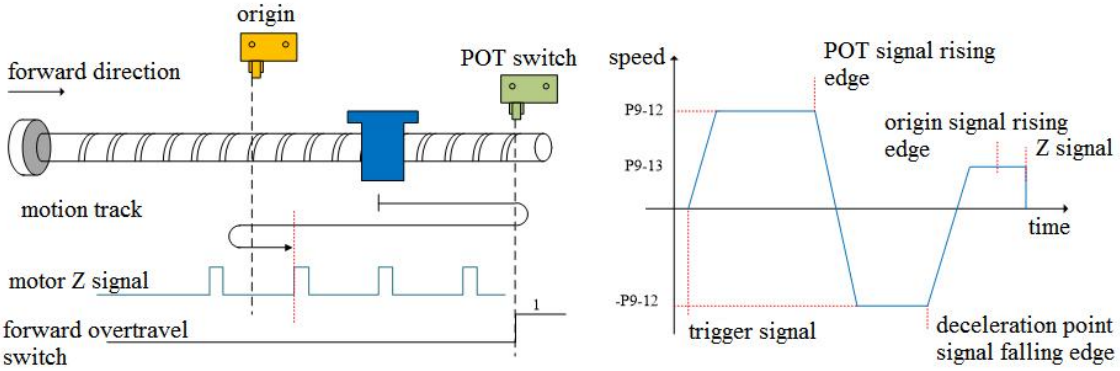
(3) When the motor starts to move, the signal of the origin switch (deceleration point) is invalid (P5-64 = 0-invalid, 1-valid), and the forward overtravel switch (P5-22) triggered in the process is valid. Firstly, the servo motor forward searches for the deceleration point signal at high speed P9-12 (homing high speed). After encountering the forward overtravel switch (POT) (P5-22), the driver immediately reverse searches for the falling edge of the deceleration point (origin) signal at the speed -P9-12 (homing high speed) according to the value set by P9-14 (homing acceleration and deceleration time). After encountering the falling edge of the deceleration point (origin) signal, decelerate in the reverse direction (i.e. restore the forward direction) according to the set value of P9-14 (homing acceleration and deceleration time). The servo motor forward searches the rising edge of the deceleration point (origin) signal at low speed of P9-13 (homing low speed). The next action back to the origin can be divided into four cases:

(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
In the process of forward acceleration or forward constant speed operation, stop immediately when encountering the rising edge of the origin signal.



(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
In the process of positive acceleration or positive constant speed operation, stop the machine immediately after encountering the rising edge of the deceleration point (origin) signal. After the motor is completely stopped, the motor will move a quantitative pulse (P9-19, P9-20) at the speed set by P9-12 (homing high speed) according to the set number and direction of mechanical offset pulses (either positive direction or negative direction), then the motor stops.

(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
In the process of forward acceleration or forward constant speed operation, continue to run after encountering the rising edge of deceleration point (origin) signal, and then find the first Z-phase signal and stop immediately.

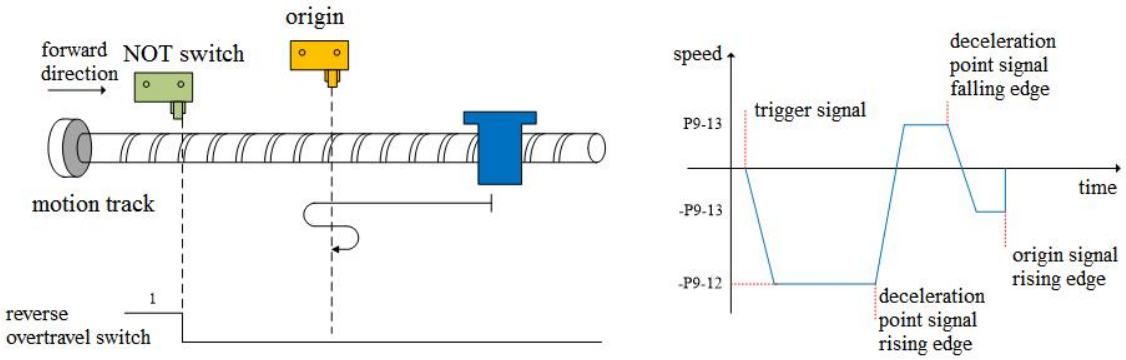


(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
In the process of positive acceleration or positive constant speed operation, continue to run after encountering the rising edge of the deceleration point (origin) signal, and then find the first Z-phase signal to stop immediately. After the motor is completely stopped, the motor will run a quantitative pulse (P9-19, P9-20) at the set speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (either positive direction or negative direction), then the motor stops.

4. Homing mode 1——Reverse return to zero, the deceleration point is the origin switch, and the origin is the origin switch or motor Z signal(P9-11.2=1)

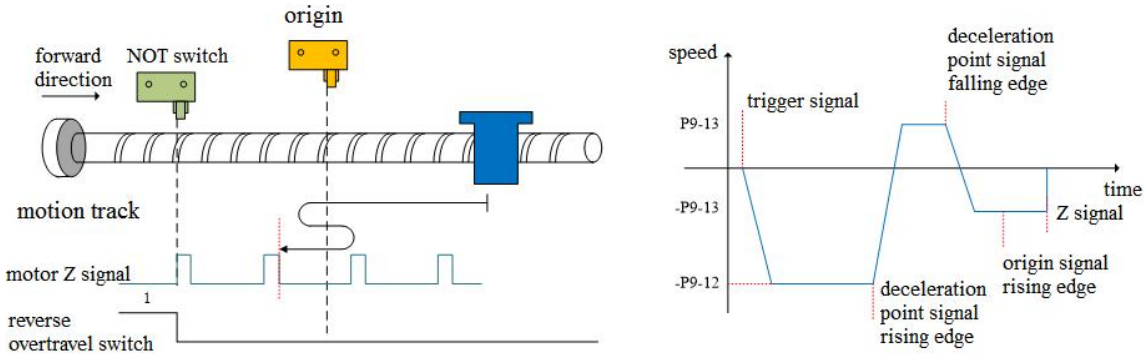
It needs to connect POT, NOT, origin switch to use this mode.
(1) When the motor starts to move, the signal of origin switch (deceleration point) is invalid, and the reverse overtravel switch (NOT)(P5-23) isn't triggered in the whole process
Firstly, the servo motor searches for the deceleration point signal at high speed -P9-12 (homing high speed) in reverse until it meets the rising edge of the deceleration point signal. After gradually accelerating to P9-13 (homing low speed) according to the setting of P9-14 (homing acceleration and deceleration time), the servo motor forward searches for the falling edge of deceleration point (origin) signal at the low speed P9-13 (homing low speed). When encountering the falling edge of deceleration point (origin) signal, it will reverse (resume reverse), and continue to search the rising edge of the deceleration point (origin) signal at a low speed -P9-13(homing low speed). The next back to origin action can be divided into four cases:

(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
During the operation of continuing to search for the rising edge of deceleration point (origin) signal at low speed -P9-13 (homing low speed), stop immediately when encountering the rising edge of deceleration point (origin) signal.



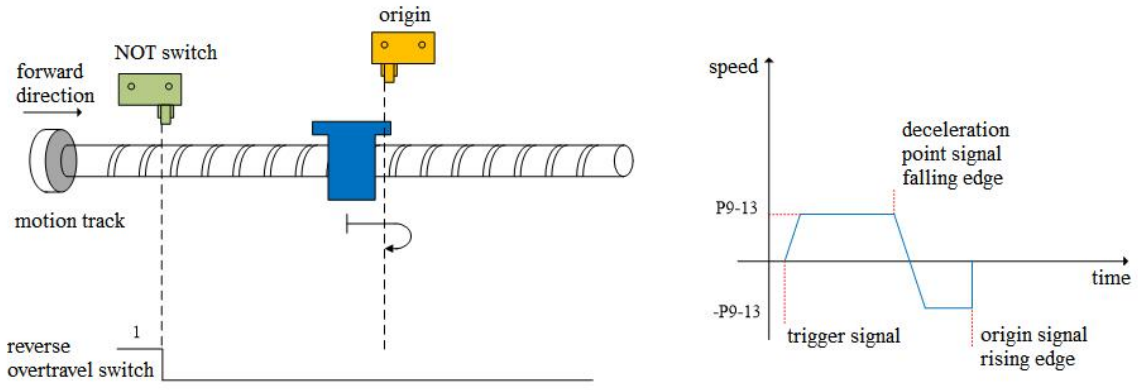
(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
During the operation of continuing to search the rising edge of deceleration point (origin) signal at low speed -P9-13 (homing low speed), stop the machine immediately after encountering the rising edge of deceleration point (origin) signal. After the motor is completely stopped, the motor will run a quantitative pulse (P9-19, P9-20) at the set speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (either positive direction or negative direction), then the motor stops.

(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
During the operation of continue to search the rising edge of deceleration point (origin) signal at low speed -P9-13 (homing low speed), continue to run after encountering the rising edge of deceleration point (origin) signal, and then find the first Z-phase signal and stop immediately.



(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
During the operation of continue to search the rising edge of the deceleration point (origin) signal at low speed -P9-13 (homing low speed), continue to operate after encountering the rising edge of the deceleration point (origin) signal, then find the first Z-phase signal and stop immediately. After the motor stops completely, according to the set number of mechanical offset pulses and direction (either positive direction or negative direction), the motor goes through a quantitative pulse (P9-19, P9-20) at the speed P9-12 (homing high speed), and then the motor stops.

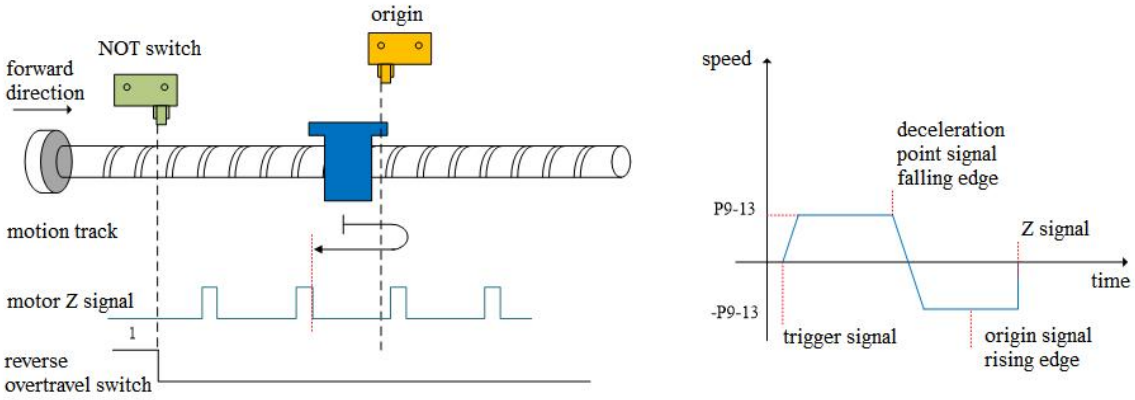
(2) When the motor starts to move, the signal of origin switch (deceleration point) is valid (P5-64 = 0-invalid, 1-valid), and the reverse overtravel switch isn't triggered in the whole process (NOT) (P5-23).
The servo motor directly forward searches for the falling edge of the deceleration point (origin) signal at low speed P9-13 (homing low speed). If it encounters the falling edge of the deceleration point (origin) signal, it will reverse (i.e. negative direction), and continue to search for the rising edge of the deceleration point (origin) signal at low speed -P9-13 (homing low speed). The next action of returning to origin can be divided into four cases:
(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
In the process of negative acceleration or negative constant speed operation, stop immediately when encountering the rising edge of the origin signal.



(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
In the process of negative acceleration or negative constant speed operation, stop the machine immediately after encountering the rising edge of the origin signal. After the motor is completely stopped, the motor will walk a quantitative pulse (P9-19, P9-20) at the speed P9-12 (homing high speed) according to the set number and direction of mechanical offset pulses (either positive direction or negative direction), and then stop the motor.

(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:

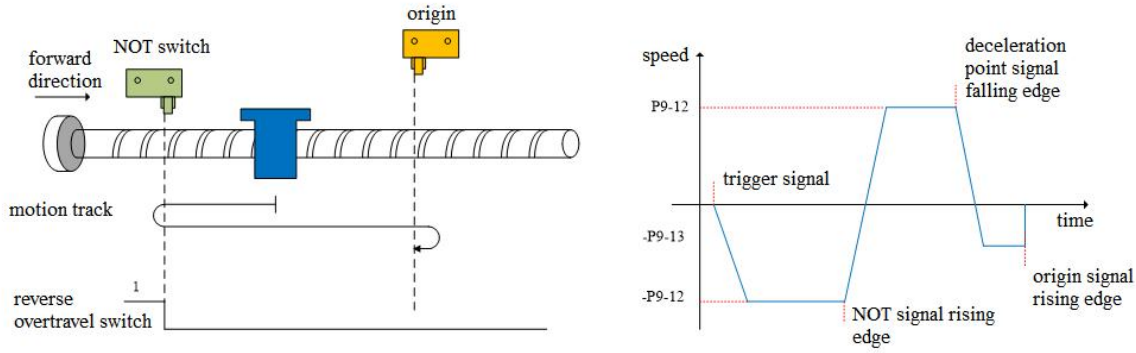
During negative acceleration or negative constant speed operation, continue operation after encountering the rising edge of deceleration point (origin) signal, and then stop immediately after finding the first Z-phase signal.



(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
In the process of negative acceleration or negative constant speed operation, continue to operate after encountering the rising edge of the deceleration point (origin) signal, and then find the first Z-phase signal to stop immediately. After the motor stops completely, the motor will run a quantitative pulse (P9-19, P9-20) at the set speed P9-12 (homing high speed) according to the set mechanical offset pulse numbers and direction (either positive or negative direction), then the motor stops.

(3) When the motor starts to move, the signal of the origin switch (deceleration point) is invalid (P5-64 = 0-invalid, 1-valid), and the reverse overtravel switch triggered in the process is valid (NOT) (P5-23).
Firstly, the servo motor reverse searches for the deceleration point (origin) signal at high speed -P9-12 (homing high speed). After encountering the reverse overtravel switch (NOT), the driver decelerates in reverse (i.e. forward) according to the value set in P9-14 (homing acceleration and deceleration time), and immediately searches for the falling edge of the deceleration point (origin) signal at high speed P9-12 (homing high speed) in the forward direction. After encountering the falling edge of the deceleration point (origin) signal, decelerate in the reverse direction (i.e. negative direction) according to the set value of P9-14 (homing acceleration and deceleration time), and the servo motor searches the rising edge of the deceleration point (origin) signal in the reverse low speed -P9-13 (homing low speed). The next homing action can be divided into four cases:

(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
In the process of reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge of the origin signal.

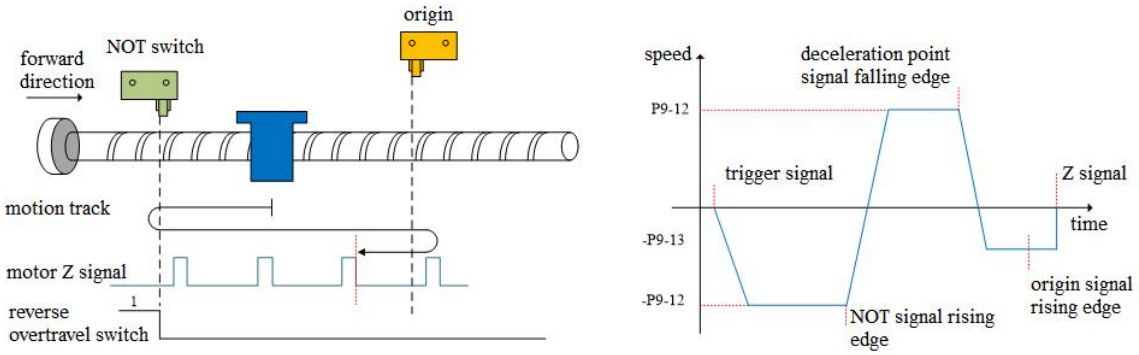


(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:

In the process of reverse acceleration or reverse constant speed operation, stop the machine immediately after encountering the rising edge of the deceleration point (origin) signal. After the motor is completely stopped, the motor will move a quantitative pulse (P9-19, P9-20) at the speed set by P9-12 (homing high speed) according to the set number and direction of mechanical offset pulses (either positive direction or negative direction), then the motor stops.

(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
In the process of reverse acceleration or reverse constant speed operation, continue the operation after encountering the rising edge of the origin signal, and then stop immediately after finding the first

Z-phase signal.



(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
In the process of reverse acceleration or reverse constant speed operation, continue to operate after encountering the rising edge of the deceleration point (origin) signal, and then find the first Z-phase signal to stop immediately. After the motor is completely stopped, the motor will run a quantitative pulse (P9-19, P9-20) at the set speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (either positive direction or negative direction), then the motor stops.

5. Homing mode 2——forward homing, deceleration point and origin are motor Z signal (P9-11.2=2)

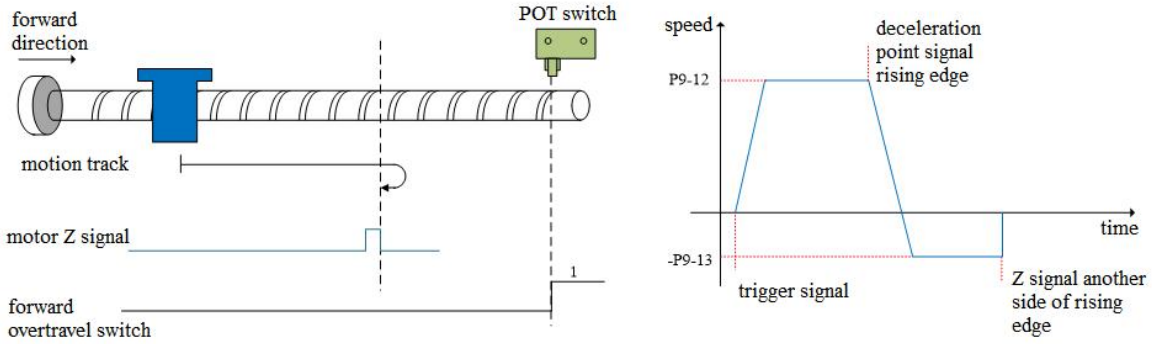
In this mode, the number of Z phases of the motor isn't found. To use this mode, you need to connect POT and NOT.

(1) When the motor starts to move, the Z signal is invalid or valid (P5-64 = 0-invalid, 1-valid), and the forward overtravel switch (POT) isn't triggered in the whole process.

Firstly, the servo motor forward searches the Z signal at the high-speed P9-12 (homing high speed). After encountering the rising edge of the Z signal, it decelerates in the reverse direction according to the set value of P9-14 (homing acceleration and deceleration time), accelerates to -P9-13 (homing low speed) and reverse searches the Z signal at low speed. Next, the homing action is divided into two cases:

(a) Mechanical offset (P9-19, P9-20) is 0:

In the process of reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge of the other side of the motor Z signal.



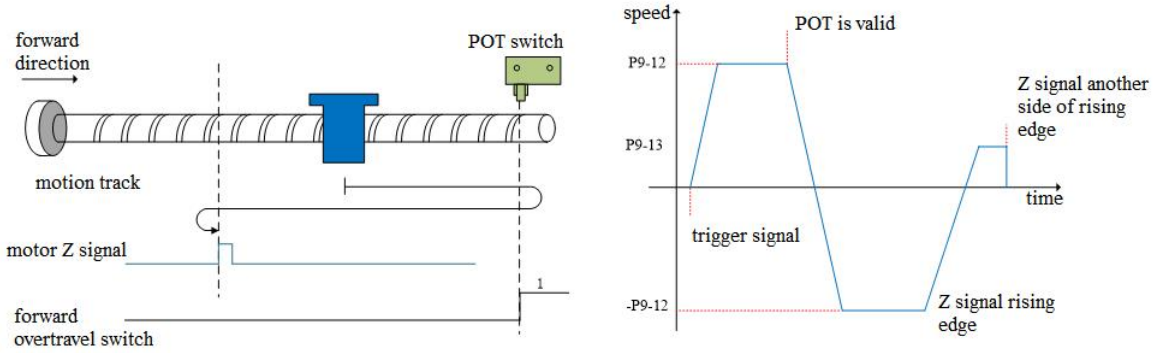
(b) Mechanical offset (P9-19, P9-20) isn't 0:

In the process of reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge on the other side of the motor Z signal. After the motor is completely stopped, the motor will walk a quantitative pulse (P9-19, P9-20) at the speed set by P9-12 (homing high speed) according to the set number and direction of mechanical offset pulses (either positive direction or negative direction), then the motor stops.

(2) When the motor starts to move, the Z signal is invalid or valid (P5-64 = 0-invalid, 1-valid), and the forward overtravel switch is triggered in the process (POT) (P5-22).

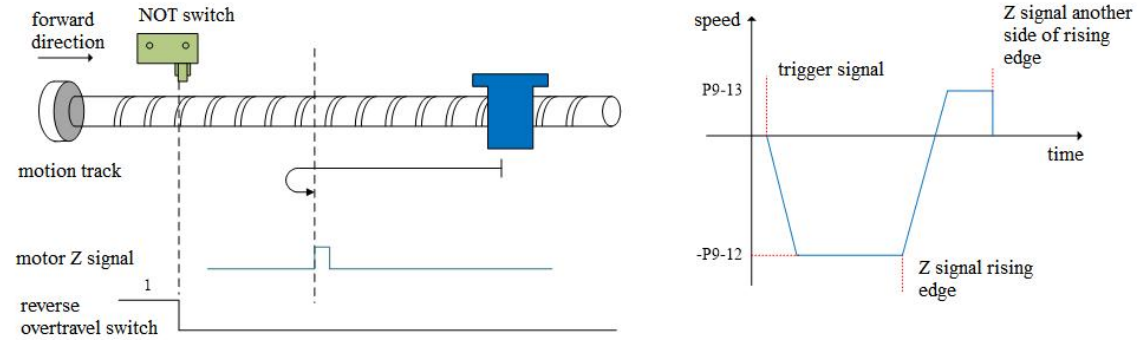
Firstly, the servo motor searches for the Z signal in forward direction with the high speed P9-12 (homing high-speed speed). After encountering the forward overtravel switch, the driver decelerates in the reverse direction according to P9-14 (homing acceleration and deceleration time), and searches for

the Z signal in the reverse direction with the high-speed -P9-12 (homing high-speed) until encountering the rising edge of the Z signal. The machine gradually decelerates in the reverse direction (i.e. returns to the forward direction) according to P9-14 (homing acceleration and deceleration time). The servo motor searches the rising edge of the other side of the Z signal in the forward direction and low speed P9-13 (homing low speed). The next homing action is divided into two cases:
(a) Mechanical offset (P9-19, P9-20) is 0:
In the process of forward acceleration or forward constant speed operation, stop immediately when encountering the rising edge of the other side of the Z signal.



(b) Mechanical offset (P9-19, P9-20) isn't 0:
In the process of positive acceleration or positive constant speed operation, stop immediately when encountering the rising edge on the other side of the motor Z signal. After the motor is completely stopped, the motor will walk a quantitative pulse at the speed set by P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (either positive direction or negative direction), and then stop the motor.

6. Homing mode 3——reverse homing, the deceleration point and origin are motor Z signal (P9-11.2=3)
In this mode, the number of Z phases of the motor isn't found. To use this mode, you need to connect POT and NOT.
(1) When the motor starts to move, the Z signal is invalid or valid (P5-64 = 0-invalid, 1-valid), and the reverse overtravel switch isn't triggered in the whole process (NOT).
Firstly, the servo motor searches for the Z signal in reverse direction with the high speed -P9-12 (homing high speed). After encountering the rising edge of the Z signal, it decelerates and reverses according to the set value of P9-14 (homing acceleration and deceleration time), accelerates to P9-13 (homing low speed) and searches for the Z signal at low speed in forward direction. Next, the homing action is divided into two cases:
(a) Mechanical offset (P9-19, P9-20) is 0:
In the process of forward acceleration or forward constant speed operation, stop immediately when encountering the rising edge of the other side of the motor Z signal.



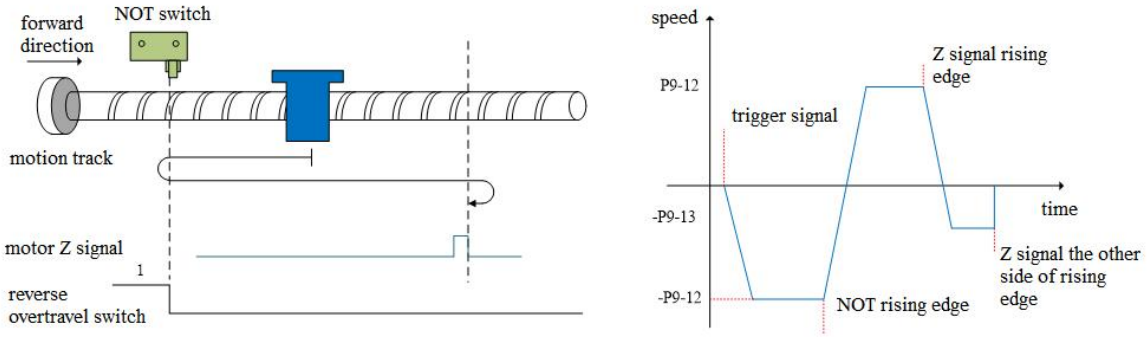
(b) Mechanical offset (P9-19, P9-20) isn't 0:
In the process of positive acceleration or positive constant speed operation, stop the machine immediately when encountering the rising edge on the other side of the motor Z signal. After the motor is completely stopped, the motor will walk a quantitative pulse (P9-19, P9-20) at the speed set by P9-12 (homing high speed) according to the set number and direction of mechanical offset pulses (either positive direction or negative direction), then the motor stops.

(2) When the motor starts to move, the Z signal is invalid or valid (P5-64 = 0-invalid, 1-valid), and the reverse overtravel switch is triggered in the process (NOT)

The servo motor searches for the Z signal at high speed -P9-12 (homing high speed) in reverse direction. After encountering the reverse overtravel switch, the driver decelerates and reverses according to P9-14, and then searches for the Z signal at high speed P9-12 (homing high speed) in forward direction until encountering the rising edge of the Z signal, and gradually decelerates and reverses (i.e. restores the reverse direction) according to the set value of P9-14 (homing acceleration and deceleration time). The servo motor searches the rising edge on the other side of the Z signal at low speed -P9-13 (homing low speed) in reverse direction. Next, the homing action is divided into two cases:

(a) Mechanical offset (P9-19, P9-20) is 0:

In the process of reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge of the other side of the Z signal.



(b) Mechanical offset (P9-19, P9-20) isn't 0:

In the process of reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge on the other side of the motor Z signal. After the motor is completely stopped, the motor will walk a quantitative pulse (P9-19, P9-20) at the speed set by P9-12 (homing high speed) according to the set number and direction of mechanical offset pulses (either positive direction or negative direction), then the motor stops.

7. Homing mode 4——forward homing, deceleration point and origin are forward overtravel switch POT (P5-22) (P9-11.2=4)

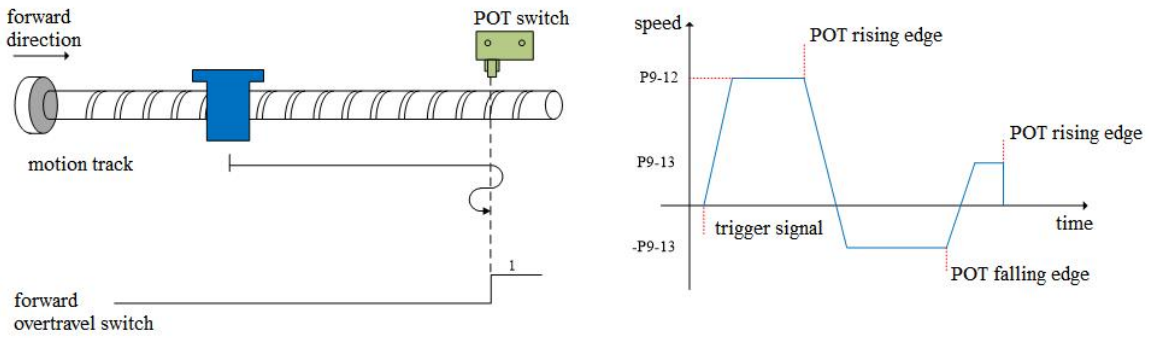
To use this mode, it needs to connect NOT, POT.

(1) When the motor starts moving, the forward overtravel switch (POT) is invalid

Firstly, the servo motor searches the forward overtravel switch at high speed P9-12 (homing high speed). After encountering the rising edge of the forward overtravel switch signal, it gradually decelerates in reverse according to the setting of P9-14 (homing acceleration and deceleration time). The servo motor searches the falling edge of the forward overtravel switch signal in reverse direction at low speed -P9-13 (homing low speed). After encountering the falling edge of the forward overtravel switch signal, the next action of returning to the origin can be divided into four cases:

(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:

Decelerate in the reverse direction (i.e. restore the forward direction), and search for the rising edge of the forward overtravel switch signal in the forward direction and low speed P9-13 (homing low speed). In the process of forward acceleration or forward constant speed operation, stop immediately when encountering the rising edge of the forward overtravel switch signal.

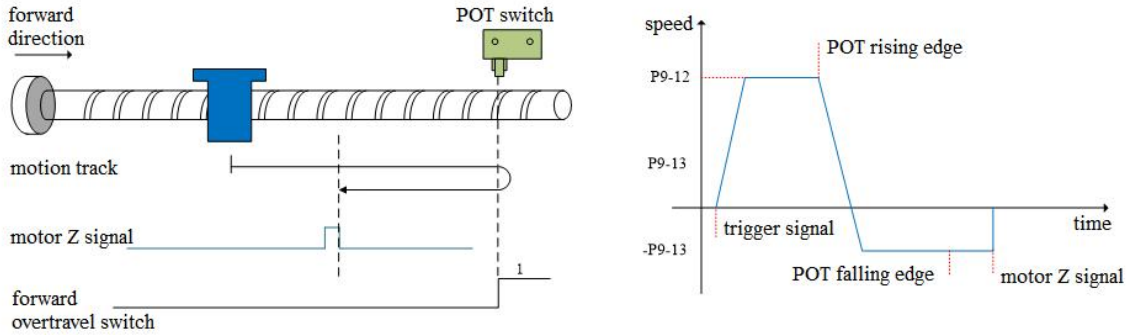


(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:

Decelerate in the reverse direction (i.e. restore the forward direction), and search the rising edge of the forward overtravel switch signal in the forward with low speed P9-13 (homing low speed). In the process of forward acceleration or forward uniform speed operation, stop immediately when encountering the rising edge of the forward overtravel switch signal. After the motor is completely stopped, motor walks a quantitative pulse at the speed set by P9-12 (homing high speed) according to the set number and direction of mechanical offset pulses (it can only be in the negative direction, that is, it must move between the origin switch and NOT), and then the motor will stop.

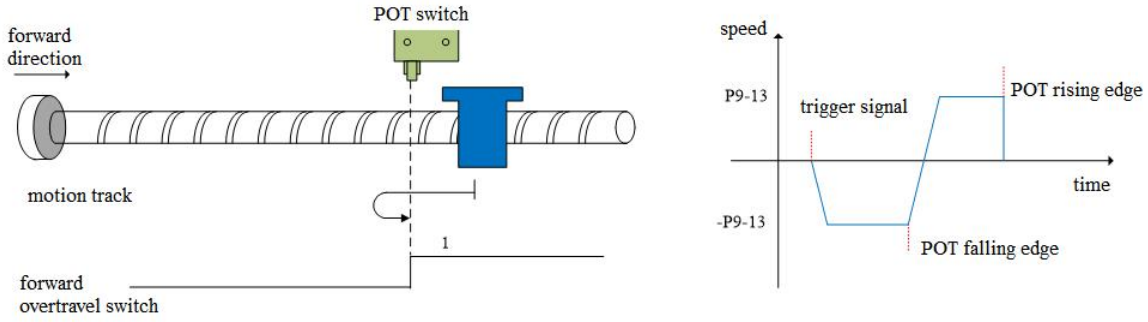
(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:

Continue to operate in reverse at the low speed set by -P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal.



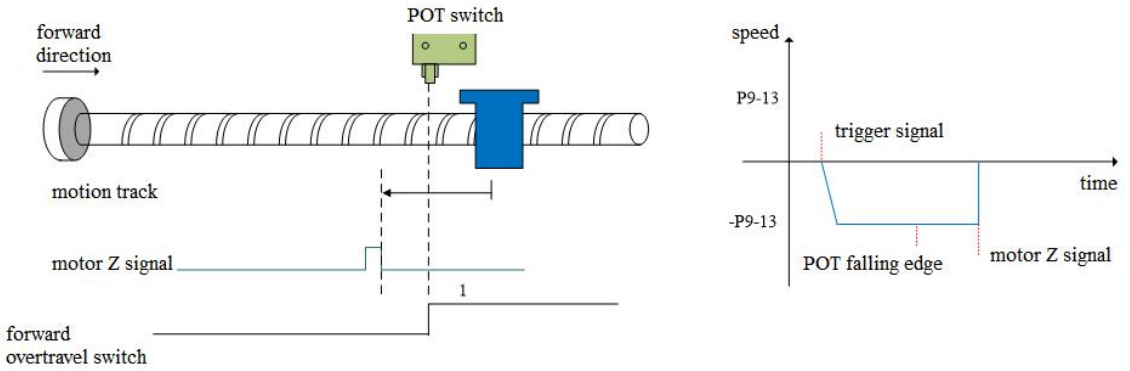
(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
Continue to operate in the reverse direction at the low speed set by -P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal. After the motor stops completely, the motor will move a quantitative pulse at the speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (it can be negative or positive, but it must move between the origin switch and NOT), and then the motor stops.

(2) Forward overtravel switch is valid when motor starts moving (POT) (P5-22)
The servo motor directly searches for the falling edge of the forward overtravel switch signal (POT) at a reverse low speed -P9-13 (homing low speed). After encountering the falling edge of POT, the next homing action is divided into four cases:
(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
Decelerate in the reverse direction (i.e. restore the forward direction), search for the rising edge of POT in the forward low-speed P9-13 (homing low speed), and stop immediately when encountering the rising edge of POT during forward acceleration or forward constant speed operation.



(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
Decelerate in reverse direction (i.e. restore the positive direction), search the rising edge of POT at low speed and positive direction with P9-13 (homing low speed). In the process of positive acceleration or positive constant speed operation, stop immediately when encountering the rising edge of POT. After the motor stops completely, the motor will move a quantitative pulse at the speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (it only can be negative direction, but it must move between the origin switch and NOT), and then the motor stops.

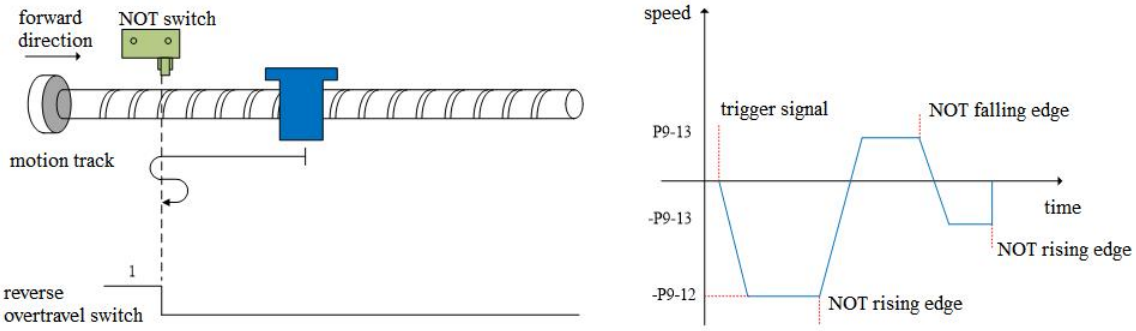
(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
Continue to operate in reverse at the low speed -P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal.



(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
Continue to operate in the reverse direction at the low speed -P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal. After the motor stops completely, the motor will move a quantitative pulse at the speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (it can be negative or positive, but it must move between the origin switch and NOT), and then the motor stops.

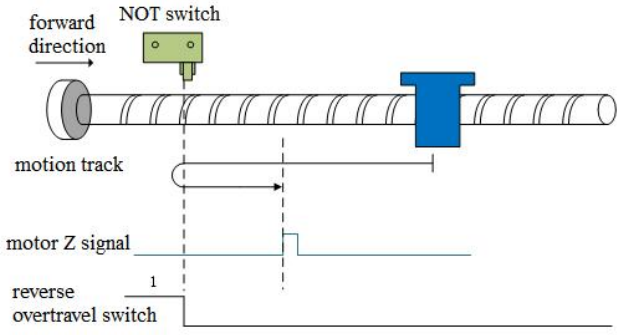
8. Homing mode 5——reverse homing, deceleration point and origin are reverse overtravel switch NOT (P5-23) (P9-11.2=5)
To use this mode, please connect POT, NOT.
(1) When the motor starts moving, the reverse override switch (NOT) is invalid
Firstly, the servo motor searches for the reverse overtravel switch (NOT) at reverse high speed -P9-12 (homing high speed). After encountering the rising edge of NOT, it gradually decelerates in reverse according to the setting of P9-14 (homing acceleration and deceleration time). The servo motor searches for the falling edge of NOT at forward low speed P9-13 (homing low speed). After encountering the falling edge of NOT, the next homing action can be divided into four cases:

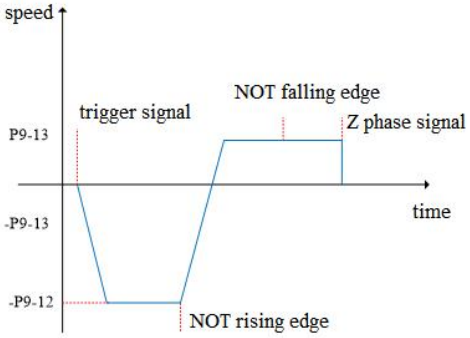
(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
Decelerate in the reverse direction (i.e. restore the reverse direction), and search for the rising edge of NOT at the reverse low speed -P9-13 (homing low speed). In the process of reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge of NOT.



(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
Decelerate in the reverse direction (i.e. restore the reverse direction), and search for the rising edge of the reverse overtravel switch signal (NOT) at the reverse low speed -P9-13 (homing low speed). In the process of reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge of NOT. After the motor stops completely, the motor will move a quantitative pulse at the speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (it only can be positive, but it must move between the origin switch and POT), and then the motor stops.

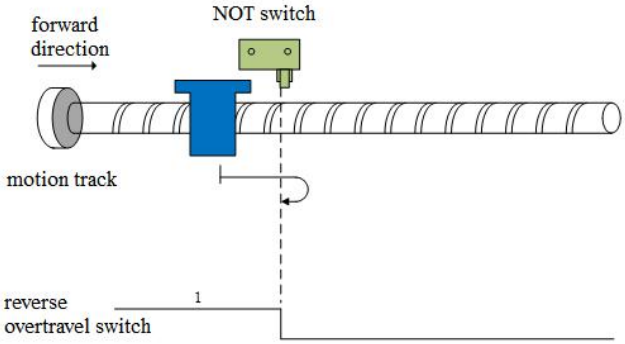
(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
Continue to operate in the forward low-speed P9-13, and then stop immediately after encountering the rising edge of the first Z-phase signal.

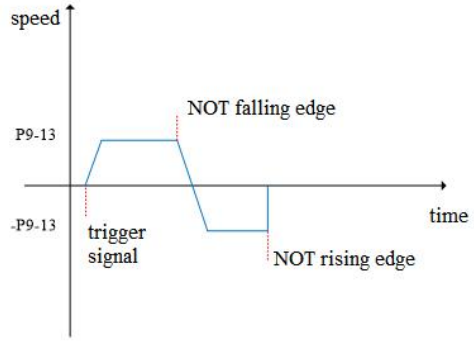




(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
Continue to operate in the forward low-speed P9-13, and then stop immediately after encountering the rising edge of the first Z-phase signal. After the motor stops completely, the motor will move a quantitative pulse at the speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (it can be positive or negative), but it must move between the origin switch and POT), and then the motor stops.

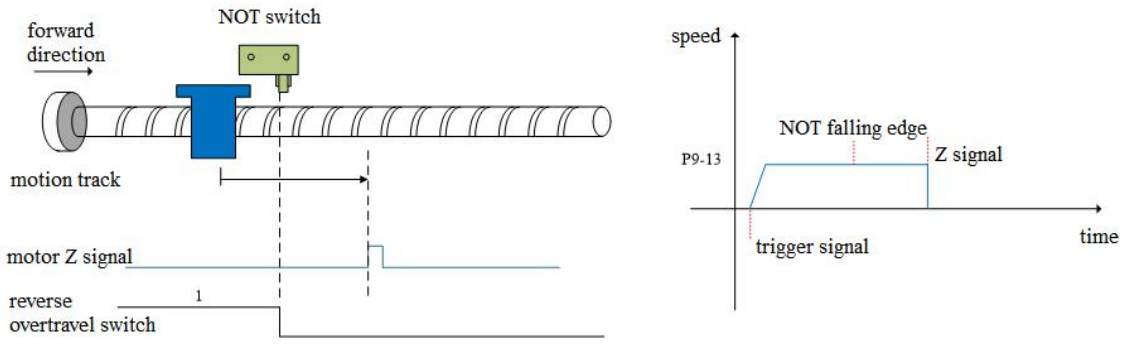
(2) When the motor starts to move, the reverse overtravel switch (NOT) (P5-23) is valid
The servo motor directly searches for the falling edge of the reverse overtravel switch signal (NOT) at the forward low speed P9-13 (homing low speed). After encountering the falling edge of NOT, the next homing action is divided into four cases:
(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
Decelerate in reverse direction (i.e. resume reverse direction), search for the rising edge of NOT in reverse direction at low speed -P9-13(homing low speed). During reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge of NOT.





(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
Decelerate in reverse direction (i.e. recover in reverse direction), search for the rising edge of NOT in reverse direction at low speed -P9-13 (homing low speed). During reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge of NOT. After the motor stops completely, the motor will move a quantitative pulse at the speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (it only can be positive), but it must move between the origin switch and POT), and then the motor stops.

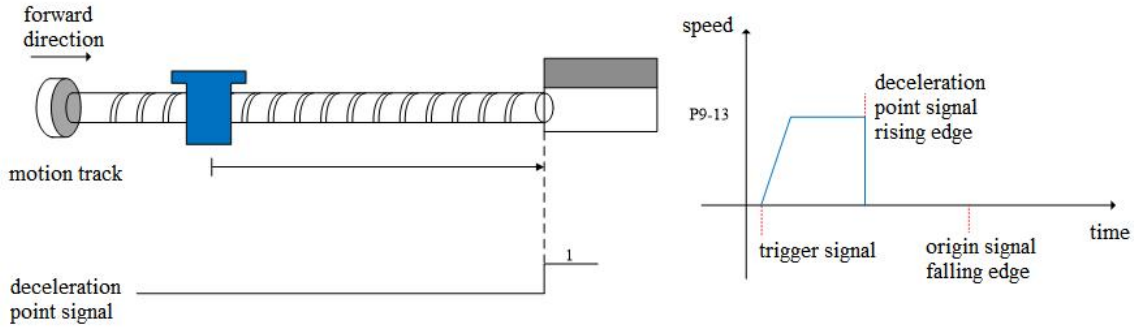
(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
Continue to operate at the forward low speed P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal.



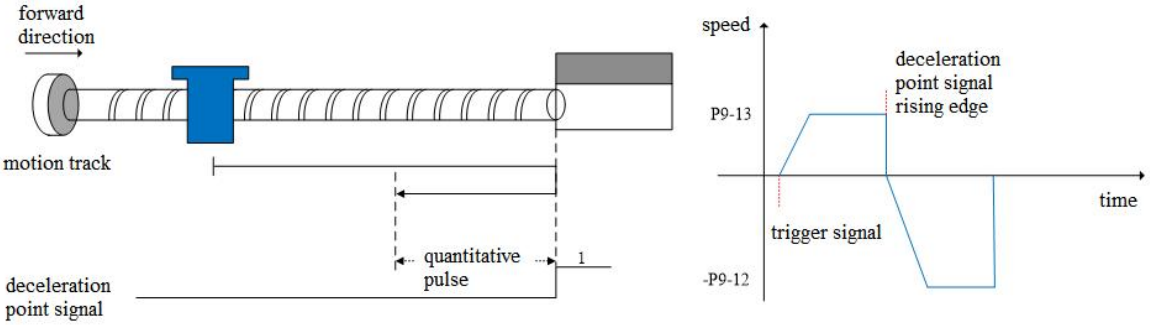
(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
Continue to operate at the forward low speed P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal. After the motor stops completely, the motor will move a quantitative pulse at the speed P9-12 (homing high speed) according to the set number of mechanical offset pulses and direction (it can be positive or negative, but it must move between the origin switch and POT), and then the motor stops.

9. Homing mode 6——forward homing, deceleration point and origin are forward mechanical limit position (P9-11.2=6)

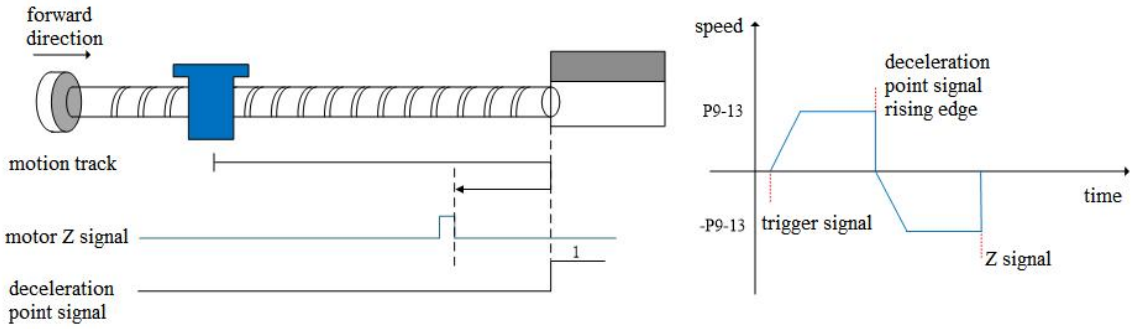
To use this mode, no need to connect POT, NOT and origin switch.
Firstly, the servo motor runs forward at low speed P9-13 (homing low speed). After hitting the mechanical limit position, if the absolute value of torque reaches the upper torque limit of P9-17 (touch stop homing mode torque threshold), and the absolute value of speed is lower than the set value of P9-16 (touch stop homing mode speed threshold), this state remains P9-18 (touch stop homing mode time threshold) After the set time, it is judged that the mechanical limit position is reached, and the next homing action can be divided into four cases:
(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
Shut down immediately.



(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
The servo motor stops immediately. After it stops completely, according to the set number of mechanical offset pulses, the motor reverse moves a quantitative pulse (P9-19, P9-20) at the speed set by -P9-12 (homing high speed), and then the motor stops.

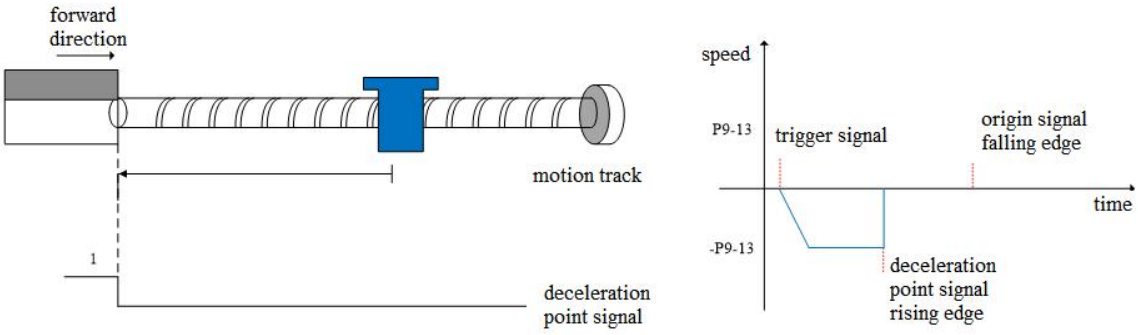


(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
Operate in reverse at the low speed set by -P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal.

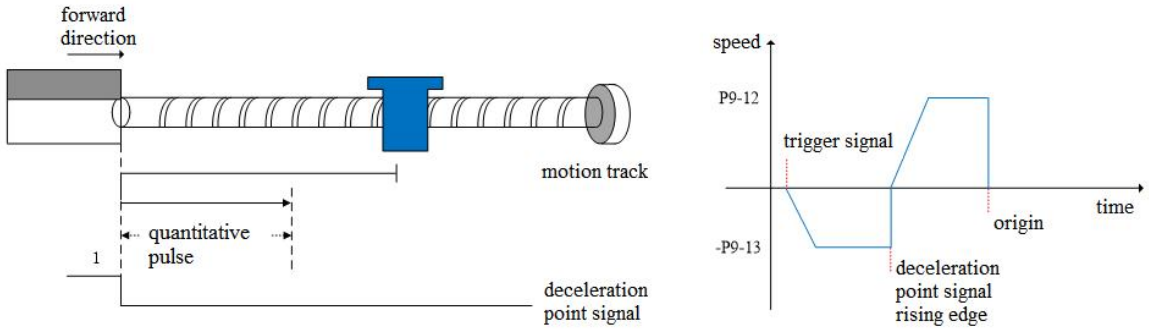


(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
Run in reverse at the low speed set by -P9-13 (homing low speed), then stop immediately after encountering the rising edge of the first Z-phase signal, and then walk a quantitative pulse (it can run in positive direction or negative direction, but it must be within the mechanical limit position) at the speed set by -P9-12 (homing high speed) according to the set number of mechanical offset pulses after complete stop, and then the motor stops.

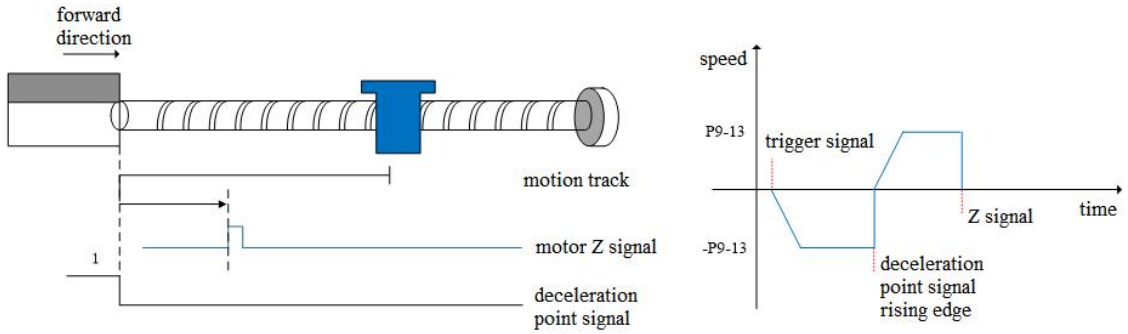
10. Homing mode 7——reverse homing, deceleration point and origin are reverse mechanical limit position (P9-11.2=7)
To use this mode, no need to connect POT, NOT and origin switch.
Firstly, the servo motor runs in reverse direction with the low speed -P9-13 (homing low speed). After hitting the mechanical limit position, if the absolute value of torque reaches the upper torque limit of P9-17 (touch stop homing mode torque threshold), and the absolute value of speed is lower than the set value of P9-16 (touch stop homing mode speed threshold), this state remains P9-18 (touch stop homing mode time threshold). After the set time, it is judged that the mechanical limit position is reached, and the next action of returning to the origin can be divided into four cases:
(a) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
Shut down immediately.



(b) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) isn't 0:
The servo motor stops immediately. After it stops completely, the motor moves forward a quantitative pulse (P9-19, P9-20) at the speed set by P9-12 (high speed back to the origin) according to the set number of mechanical offset pulses, and then the motor stops.



(c) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
Operate in the forward direction at the low speed P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal.



(d) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) isn't 0:
Operate in the forward direction with low-speed P9-13 (homing low-speed), and then stop immediately after encountering the rising edge of the first Z-phase signal. After complete stop, the motor will walk a fixed pulse (P9-19, P9-20) at the speed set by P9-12 (homing high-speed) according to the set number of mechanical offset pulses (it can operate in positive direction or negative direction, but it must be within the mechanical limit position), and then the motor stops.

Note: only for homing mode 6 and 7.
For homing modes 6 and 7, once these two homing modes are triggered, the maximum torque during homing is 1.1 times of the set value of P9-17 (touch stop homing torque threshold). If the internal forward and reverse torque limits P3-28 and P3-29 are smaller than 1.1 times of the set value of P9-17 (touch stop homing torque threshold), the torque limit is the set value of P3-28 and P3-29. Similarly, if the external forward and reverse torque limits P3-30 and P3-31 are enabled, the actual torque limit is the minimum of the internal torque limit, the external torque limit and 1.1 times of the P9-17 set value.

Only when these two homing modes are triggered, 1.1 times of the set value of torque limit P9-17 (touch stop homing torque threshold) will take effect. If only the homing is enabled and (homing mode) P9-11.2 is 6 or 7, but the homing isn't triggered, 1.1 times of the set value of torque limit P9-17 (touch stop homing torque threshold) will not take effect.

5.4.2 Position control (external pulse command)

Parameter	Overview	Reference chapter
P0-01 control mode selection	Set to 6: external pulse mode	5.4.2.1
P0-10 pulse instruction form	Set the pulse form 0-CW/CCW 1-AB 2-P+D	5.4.2.2
P0-11 Motor pulse numbers per rotation*1 P0-12 Motor pulse numbers per rotation*10000 P0-13 Electronic gear ratio (numerator)	Setting of command pulse number required for one revolution of motor P0-11 and P0-12=0, P0-13/P0-14 are effective	5.4.2.2

P0-14 Electronic gear ratio (denominator) P0-92~P0-93 32-bit electronic gear ratio (numerator) P0-94~P0-95 32-bit electronic gear ratio (denominator)	P0-11~P0-14 are 0, P0-92~P0-95 are valid 32-bit electronic gear ratio (numerator): P0-92*1 + P0-93 *10000 32-bit electronic gear ratio denominator: P0-94*1 + P0-95 *10000	
P0-09 Pulse command setting	You can set the command direction and filter time of low-speed pulse respectively	5.4.2.2

5.4.2.1 External pulse position mode

Parameter	Setting value	Meaning	Modify	Effective
P0-01	6	Control the position by external pulse	Servo OFF	At once

5.4.2.2 Forward direction of pulse instruction and pulse form

1. Set the forward direction of pulse instruction

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-09.0 n.xxx□	Forward direction of pulse instruction	0	-	0/1	Servo bb	Re-power on
P0-09 will change the counting direction of the internal counter in the servo system. The counting direction determines the rotation direction of the motor. Therefore, this parameter can be adjusted if the actual rotation direction of the motor is different from the expected direction in the position mode.						

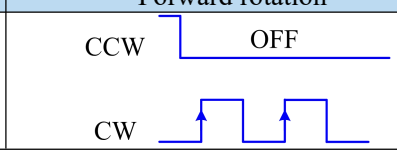
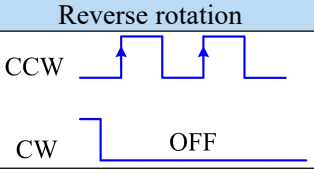
Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-09.2 n.x□xx	Low speed pulse command filter time	F	4.167ns	0~F	Servo bb	Re-power on
P0-09.2 is pulse filter time. It can enhance the anti-interference ability of low-speed pulses (less than 200K). When the input is less than 700K, the maximum filtering time F is recommended. When the input pulse frequency exceeds 1M, the filtering time should not be more than 7.						

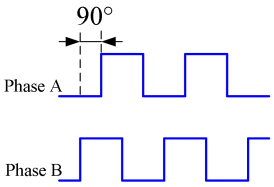
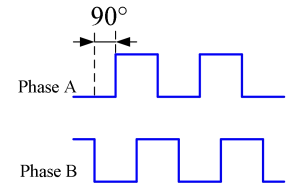
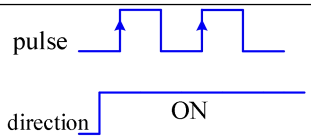
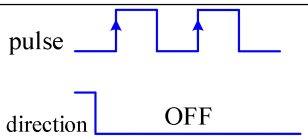
Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-09.3 n.□xxx	Predistribution of input pulse command filter	0	-	0~7	Servo bb	Re-power on
P0-09.3 setting value is n (range is 0~7), the received pulse number is 2^-n of normal one. The received frequency is 2^-n of original one. For example, pulse number per rotation is 10000, sending frequency is 10KHz, pulse number is 10000, when P0-09=1000, then U0-12=5000, U0-00 is 2^-n of original one.						

2. Set the pulse instruction form

Parameter	Meaning	Setting	Meaning	Change	Effective
P0-10 n.xxx□	Pulse command form	0	CW, CCW mode	Servo bb	At once
		1	AB phase		
		2	Pulse + direction (defaulted)		

3. Logical form of instruction pulse

P0-10.0	Forward rotation	Reverse rotation
0:CW/CCW		

1:AB		
2:P+D		

4. Pulse specification

Pulse specification		Highest input frequency	Voltage	Forward current
Low speed pulse	Differential signal	500Kpps	3.3~5V	<25mA
	Open collector	200Kpps	24V	<25mA

5.4.3 Position control (Internal command)

Parameter	Overview	Reference chapter
P0-01 control mode selection	Set to 5: internal position mode	5.4.3.1
P4-03 internal position mode P4-04 valid segment number P4-10~P4-254 internal position 1 to 35 parameters	Control mode setting of internal position mode: including step change mode, positioning mode and adjustment time Configuration of pulse displacement, speed, acceleration and deceleration time of each segment	5.4.3.3
P5-35 change step signal / GHGSTP P5-32 pause present segment signal /INHIBIT P5-31 jump present segment signal /Z-CLAMP	Common terminal function assignment	5.4.3.4 5.4.1.4 5.4.3.5
P4-00 number of Z-phase signal after leaving limit switch P4-01 speed of hitting the proximity switch P4-02 speed of leaving proximity switch P5-28 /SPD-A: find reference origin on forward side in position mode P5-29 /SPD-B: find reference origin on reverse side in position mode	Internal position back to origin setting parameters	5.4.1.8
F2-09 35 segments position setting	Set segment no. by communication	5.4.3.6

5.4.3.1 Internal position mode

Parameter	Setting value	Meaning	Change	Effective
P0-01	5	Position control by preset values of internal registers in servo units	Servo bb	At once

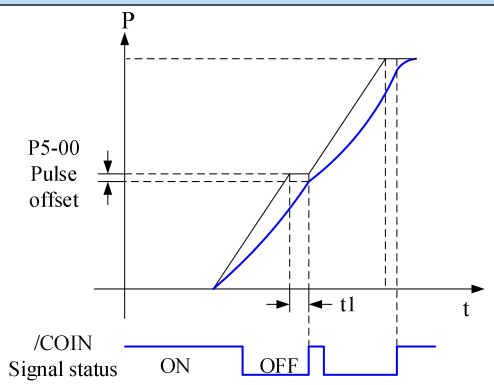
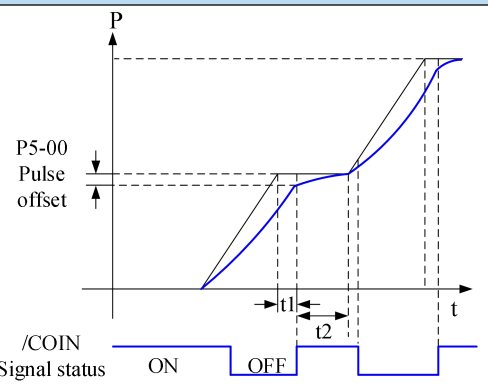
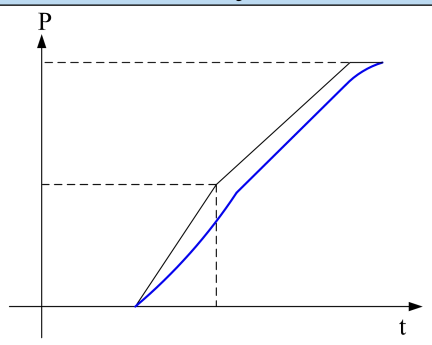
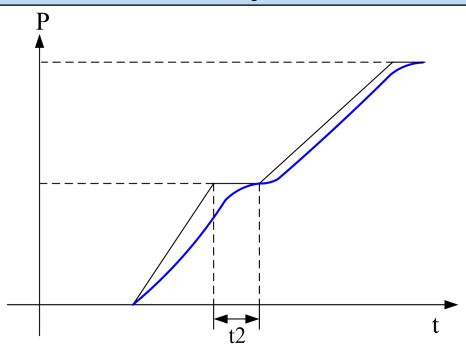
5.4.3.2 Internal position mode setting

Parameter	Function	Unit	Default setting	Suitable mode	modify	Effective
P4-03	Internal position mode setting	—	n.0000	5	Servo bb	At once

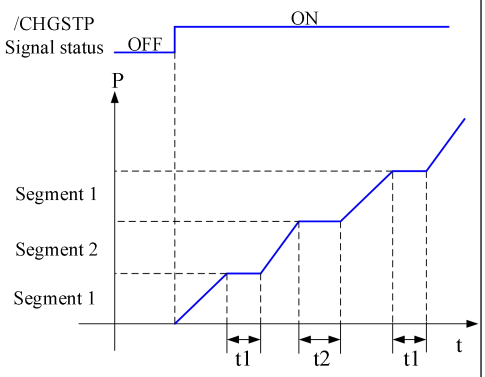
	Parameter setting	Meaning	Default setting	Setting range
	n.□xxx	No meaning		
	n.x□xx	Waiting mode	0	0~1
	n.xx□x	Change step mode	0	0~6
	n.xxx□	Positioning mode	0	0~1

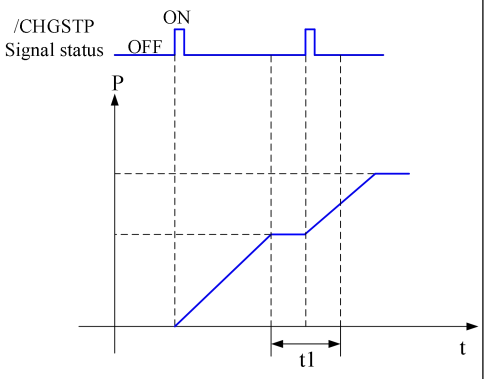
1. Waiting mode

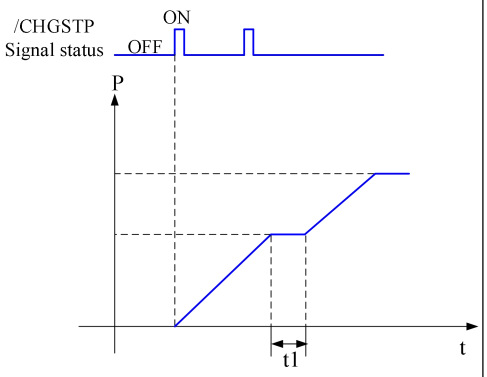
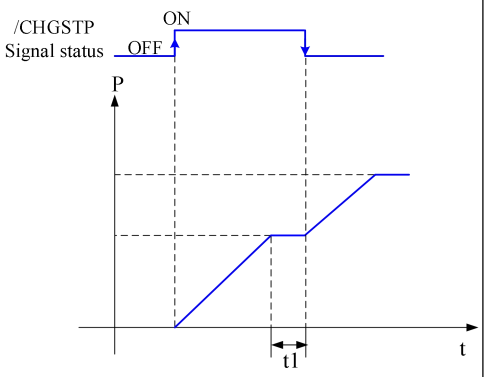
n.x□xx	Meaning
0	Wait for positioning completion
1	Not wait for positioning completion
Note: Waiting mode refers to whether the driver waits for the motor to be positioned after outputing a position instruction in internal position mode. It takes effect in all Step-Changing modes.	

Waiting mode=0, adjust time =0ms	Waiting mode =0, adjust time >0ms
	
After the drive output 1-segment position command, it will wait for the completion of motor positioning, and then start the next position command at once. T1 is positioning time, which means the time from pulse output complete to the output of positioning completion signal.	After the drive output 1-segment position command, it will wait for the completion of motor positioning, and pass the adjust time, then start the next position command. T1 is positioning time, t2 is adjust time. Refer to parameter P4-16.
Wait mode = 1, adjust time = 0ms	**Wait mode = 1, adjust time > 0ms**
	
After the drive output 1-segment position command, it will not wait for the completion of motor positioning, and start the next position command at once.	After the drive output 1-segment position command, it will not wait for the completion of motor positioning, but pass the adjust time, and then start the next position command. T2 is adjust time. Refer to parameter P4-16.

2. Change step mode

n.xx□x	Description	
0: Change the step when signal is ON, recycling		t1=P4-16, t2=P4-23. 1. If the /CHGSTP signal is always on, the servo unit will cycle the set position segment all the time. 2. If the /CHGSTP signal is set to off when executing a certain segment, the servo will continue to complete the execution of that segment without the execution of the next segment. 3. In this mode, the step change signal /CHGSTP is triggered at high level. 4. When the servo enable is off during a certain section of operation, the motor stops according to the servo off shutdown mode. After the shutdown, the positioning is invalid. 5. After each operation completion, positioning completion and positioning approach signal are all effective. 6. In this mode, the adjustment time of each period is valid.

n.xx□x	Description	
1: Change the step at the rising edge of the signal, single-step execution		Take setting two segments as an example, t1 = p4-16 in the figure. 1. Note that as shown in the figure, in this mode, the set adjustment time actually doesn't work. As long as the previous position command has been sent out, the next command will be entered immediately when a new step change signal arrives. 2. In this mode, the step change signal /CHGSTP is triggered by rising edge. 3. After each operation completion, positioning completion and positioning approach signal are all effective. 4. When the servo enable is off during a certain section of operation, the motor stops according to the servo off shutdown mode. After the shutdown, the positioning is invalid. 5. The adjustment time isn't valid in this mode.

<table>
<tr>
<td>2: Start at the rising edge of the signal, sequential run all, not recycling</td>
<td> 
</td>
<td>Take setting two segments as an example, t1 = p4-16 in the figure.
1. The /CHGSTP signal before the completion of a cycle will not be counted, as shown in the second /CHGSTP signal in the figure.
2. In this mode, the step change signal /CHGSTP is triggered by rising edge.
3. After each operation completion, positioning completion and positioning approach signal are all effective.
4. When the servo enable is off during a certain section of operation, the motor stops according to the servo off shutdown mode. After the shutdown, the positioning is invalid.
5. The adjustment time is valid in this mode.</td>
</tr>
<tr>
<td>3: set segment no.through communication</td>
<td colspan="2">Servo is ON, set parameter P2-09=0, then set the running segment. The motor will run the setting segment. Refer to 5.4.3.6.</td>
</tr>
<tr>
<td>4: /CHGSTP double edge triggering</td>
<td> 
</td>
<td>t1 = p4-16 in the figure.
1. /CHGSTP rising edge triggers the first segment and falling edge triggers the second segment. Where, if the first segment position is required to operate completely, the /CHGSTP signal remains on until the end of the first segment.
2. Only in this mode, the number of p4-04 valid segments is invalid.
3. After each operation completion, positioning completion and positioning approach signal are all effective.
4. When the servo enable is off during a certain section of operation, the motor stops according to the servo off shutdown mode. After the shutdown, the positioning is invalid.
5. The adjustment time isn't valid in this mode.
6.Before using this mode, p5-35 terminals need to be allocated first, but not when using this mode.</td>
</tr>
<tr>
<td>5: /PREFA(P5-57) /PREFB(P5-58) /PREFC(P5-59) Choose the</td>
<td colspan="2"><table>
<tr><th>/PREFC</th><th>/PREFB</th><th>/PREFA</th><th>Segment no.</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>-</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1 (segment 1 position)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>2 (segment 2 position)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>3 (segment 3 position)</td></tr>
</table></td>
</tr>
</table>

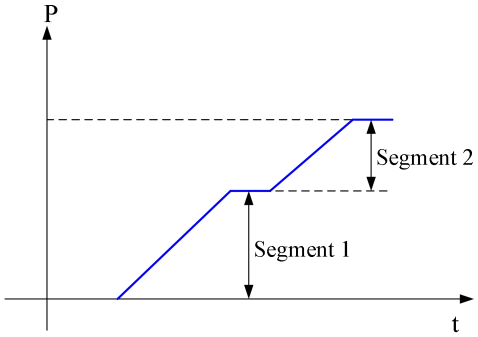
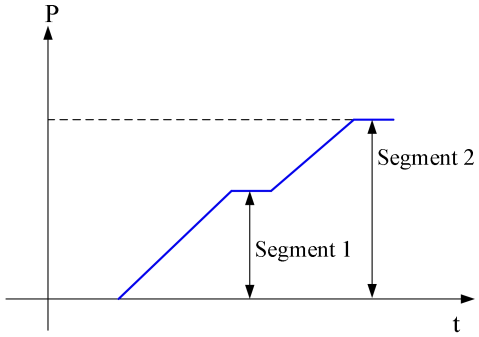
<table>
<tr><td>segment through terminal, the range is segment 1~3</td><td>1. After each operation completion, positioning completion and positioning approach signal are all effective.
2. When the servo enable is off during a certain section of operation, the motor stops according to the servo off shutdown mode. After the shutdown, the positioning is invalid.
3. The adjustment time is valid in this mode.
4. /CHGSTP signal is invalid only in this mode.
5. The segment number selection terminal can trigger a step change at the edge or maintain an ON state. This mode supports continuous and repeated triggering of a certain segment. If the segment number selection terminal remains in the ON state and the motor stops when encountering an overtravel signal, the segment number selection terminal needs to be changed to the OFF state. Otherwise, the motor will still execute the position segment when the overtravel signal is cancelled.</td></tr>
<tr><td>6:
/PREFA(P5-57)
/PREFB(P5-58)
/PREFC(P5-59)
/PREFD(P5-60)
Choose the segment through terminal, the range is segment 1~16.</td><td>
<table>
<tr><th>/PREFD</th><th>/PREFC</th><th>/PREFB</th><th>/PREFA</th><th>Segment no.</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1 (segment 1 position)</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>2 (segment 2 position)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>3 (segment 3 position)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>4 (segment 4 position)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>5 (segment 5 position)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>6 (segment 6 position)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>7 (segment 7 position)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>8 (segment 8 position)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>9 (segment 9 position)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>10 (segment 10 position)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>11 (segment 11 position)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>12 (segment 12 position)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>13 (segment 13 position)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>14 (segment 14 position)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>15 (segment 15 position)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>16 (segment 16 position)</td></tr>
</table>
Note: the rising edge of P5-35 step change signal triggers each position (the rising edge is invalid during operation).
1. When the servo enable is off during a certain section of operation, the motor stops according to the servo off shutdown mode. After the shutdown, the positioning is invalid.
2. The adjustment time isn't valid in this mode.
3.After each operation completion, positioning completion and positioning approach signal are all effective.
4. After the segment number is selected, the rising edge of P5-35/CHGSTP step change signal is required to trigger to run the position segment, and the step change triggering during segment operation is invalid.
5. Segment number selection terminal logic is voltage level valid. Input high voltage level is valid, input low voltage level is invalid.</td></tr>
</table>

The following input signal can switch the segment 1 to 3 or 1 to 8:

Parameter	Signal name	Default setting	Suitable mode	Setting range	Modify	Effective
P5-57	/PREFA internal position segment 1	n.0000	5	Range 0000-0014, distribute to input terminal through P5-57	Anytime	At once
P5-58	/PREFB internal position segment 2	n.0000	5	Range 0000-0014, distribute to input terminal through P5-58		
P5-59	/PREFC internal position segment 3	n.0000	5	Range 0000-0014, distribute to input terminal through P5-59		
P5-60	/PREFD internal position segment 4	n.0000	5	Range 0000-0014, distribute to input terminal through P5-60		

3. Positioning mode

n.xxx□	Meaning
0	Relative positioning
1	Absolute positioning

0: relative positioning	1: absolute positioning (take the reference origin as the absolute positioning origin)
	

5.4.3.3 Position segment 1 to 35 parameter settings

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P4-10+(n-1)*7	Pulse number (low bit)	0	1 pulse	-9999~9999	Anytime	At once
P4-11+(n-1)*7	Pulse number (high bit)	0	10000 pulses	-32767~32767	Anytime	At once
P4-12+(n-1)*7	Speed	0	0.1rpm	0~65535	Anytime	At once
P4-13+(n-1)*7	Trapezoid acceleration time	0	ms	0~65535	Anytime	At once
P4-14+(n-1)*7	Trapezoid deceleration time	0	ms	0~65535	Anytime	At once
P4-15+(n-1)*7	Reserved	-				
P4-16+(n-1)*7	Adjust time	0	ms	0~65535	Anytime	At once

Notes:
1. Set pulse number = pulse number (high bit) ×10000 + pulse number (low bit).
2. In formula P4-10+(n-1)*7, n is the segment no. of internal position. the range is 1~35. Segment 1~12 can be set through the operate panel, segment 13~35 needs to write in parameters through communication (RS232 or RS485).
3. In the relative positioning mode, if the pulse high position is set to 9999, the pulse low position is set to 9999, or the pulse high position is set to - 9999, and the pulse low position is set to - 9999, and p4-03.3 = 1 (Don't wait for the positioning to be completed), the infinite pulse mode will be entered. On the contrary, the number of pulses is limited.
4. If one of the segment speed is zero, servo will skip this segment and run the next segment.
5. In relative positioning mode, if one segment speed isn't zero but the pulse number is zero, the motor will not run, but the wait mode is effective. The servo will run the next segment when the adjust time is out.
6. In absolute positioning mode, if one segment speed isn't zero but the pulse number is zero, the motor will return to the reference origin with the speed of this segment.
7. In absolute positioning mode, if two consecutive segments speed are not zero, but the pulse number is the same, the servo motor will not run but the wait mode is effective.
8. In the absolute positioning mode, the number of rotations of the motor is limited and cannot be unlimited.
9. At present, there are only two kinds of velocity in the internal position mode: step speed and slope speed. When the trapezoidal acceleration time and trapezoidal deceleration time are set to 0, it is in the form of step speed. When the trapezoidal acceleration time and trapezoidal deceleration time are greater than 0, it is in the form of slope speed.

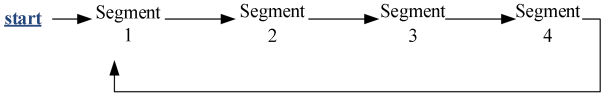
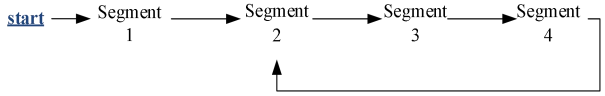
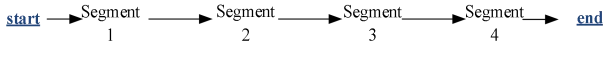
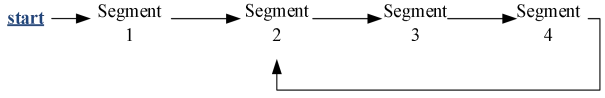
10. Trapezoidal acceleration time and trapezoidal deceleration time refer to the time required to change from 0 to rated speed.
11. If the speed of a certain parameter set is 0, the position command of this section will be ignored in the step change mode of 0 / 1 / 2. However, in the mode of 4 / 5 / 6, the motor doesn't rotate when the step change is triggered at this section.
12. In the internal position section parameters, the position commands of pulse settings are still affected by the electronic gear ratio. The actual number of turns of the motor should be determined by combining the set pulse command and the electronic gear ratio.
13. In the absolute positioning mode, the starting position of each step change is based on the starting position of the first triggering step change. In the relative positioning mode, the starting position of each step change is based on the position at the end of the last step change.
14. In the relative positioning mode, the infinite pulse position segment can be set in the 35 segment positions. The motor will run continuously in this segment, unless the trigger skips the current segment.

Parameter	Meaning	Default setting	Range	Change	Effective
P4-04	Effective segment	0	0~35	Servo bb	At once

There are 35 sections in total in the internal position. If 10 sections need to be operated and 5 sections need to be operated switched for use due to process requirements, the effective segment can be set. For example, parameters are set for sections 1-10, and P4-04 is set to 5, that is, the position of section 1-5 is valid. if it is set to 10, the position of section 1-10 is valid.

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P4-08	Internal position mode start segment number	1	-	0~35	Servo bb	At once

P4-08 sets the starting operation section number after the first round, and it is valid when the change mode P4-03.1 is set to 0 and 1. The settings are explained below, and valid values are set for No.1-No.8 sections.

Change step mode	Setting	Parameter	Actions
P4-03.1=0	P4-08=0 or P4-08>P4-04	P4-08=8 P4-04=4	
	1≤P4-08≤P4-04	P4-08=2 P4-04=4	
P4-03.1=1	P4-08=0 or P4-08>P4-04	P4-08=8 P4-04=4	
	1≤P4-08≤P4-04	P4-08=2 P4-04=4	

When using skip current segment function, the SI terminal assigned by P5-31 needs rising edge trigger.

5.4.3.4 Change step signal (/CHGSTP)

Parameter	Name	Setting	Meaning	Range
P5-35	Change step signal /CHGSTP	n.0000	Defaulted isn't distribute to input terminal. Refer to 5.4.3.2.	Range:0000-0014. Distribute to input terminal through P5-35. When it set to 0001, it means input from SI1.

5.4.3.5 Skip present segment signal (/ZCLAMP)

Parameter	Signal name	Setting	Meaning	Range
P5-31	Skip the present segment /Z-CLAMP	n.0000	Defaulted isn't distribute to input terminal.	Range: 0000-0014. Distribute to input terminal through P5-31. When it set to 0001, it means input from SI1.

In different Step-Changing modes, the function of skipping the current segment will have different effects, as follows:

Change step mode P4-03 n.xx□x	Skip the present segment	Actions
0	/Z-CLAMP	Cancel current segment, execute the next segment at once
1		Cancel current segment, execute the next segment when the change step signal is ON
2		Cancel current segment, execute the next segment at once
3		Cancel current segment, set the F2-09 again
4		The current segment is cancelled and the next segment is executed on the falling edge of the /CHGSTP step change signal
5		If the current segment is cancelled, the corresponding segment will be executed after selecting other segments
6		The current segment is cancelled, the selected position segment is executed at the rising edge of /CHGSTP step signal

5.4.3.6 Set segment through communication

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
F2-09	Set the segment number through communication	0	-	0~35	Anytime	At once
If this parameter is set to a certain segment number, this segment position will be executed without step change signal. Communication can be used to modify parameters. For example: To execute the second segment position, set F2-09 = 0, and then F2-09 = 02.						

5.4.3.7 Motion start signal (/MRUN)

Parameter	Signal name	Default setting	Meaning	Modify
P5-50	Motion start /MRUN	n.0000	Terminal output isn't assigned by default. It is only valid in the internal position mode, similar to the positioning completion signal in the external pulse mode. there is output when the motor is running, and there is no output when the motor stops.	Parameter range 0000-0014, assigned to the output interface through parameter P5-50. When it is set to 0001, the signal is output from SO1 terminal.

5.5 Speed control

5.5.1 Speed mode general control

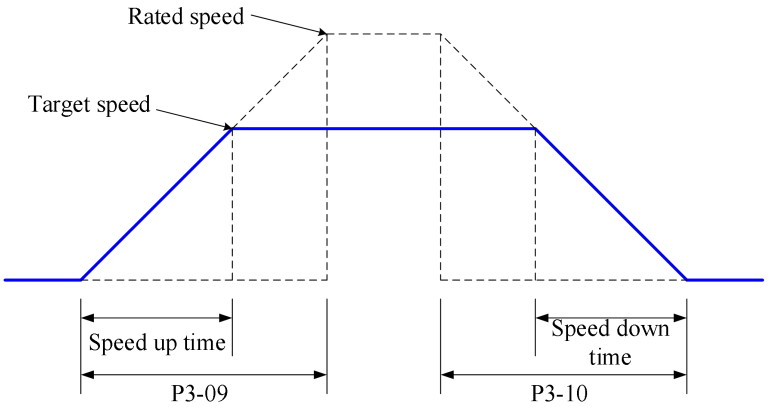
5.5.1.1 Soft start

Parameter	Meaning	Defaulted setting	Unit	Range	Modify	Effective
P3-09	Soft Start Acceleration Time	200	ms	0~65535	Servo bb	At once
P3-10	Soft Start deceleration Time	200	ms	0~65535	Servo bb	At once

Soft start acceleration and deceleration time is suitable for mode 3/4/7. Smooth speed control can be carried out when step speed instruction is input or internal setting speed is selected.

P3-09: Time from stop to rated speed

P3-10: Time from rated speed to stop



5.5.1.2 Zero clamp (/ZCLAMP)

1. Overview

This function is used when host controller uses speed command input and the servo system isn't configured the position loop. In other words, the function will be used when the motor must stop and enter lock state even the V-REF input voltage isn't zero.

When set ON the zero clamp function, it will configure the position loop inside the servo, the motor will do zero clamp within ±1 pulse at this position. The motor will return to zero clamp position even it is run by external force.

The present speed must be smaller than zero clamp speed when using zero clamp function, it can clamp the motor shaft from moving. The motor will switch from speed mode to position mode when starting the zero clamp function. At this time, rotate the motor shaft, it will return to the original position. It will not return to original position in speed mode, because it has no position feedback.

2. Input signal setting

Parameter	Signal	Setting	Meaning	Range
P5-31	Zero clamp /ZCLAMP	n.0000 (default)	Defaulted isn't distribute to input terminal	Parameter range 0001-0014, can be assigned to other input terminals through parameter P5-31
		n.0002	Input signal from SI2 terminal	

3. Parameter setting

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P3-13	Zero clamp speed	10	rpm	0~300	Servo bb	At once

P3-12	Zero clamp mode	0	-	0~3	Servo bb	At once

P3-12 setting	Contents
0	ZCLAMP input signal is ON, forced speed command is 0, when the speed below P3-13, switch to position mode and the servo lock in this position.
1	ZCLAMP input signal is ON, forced set the speed command to 0.
2	ZCLAMP input signal is ON, the speed below P3-13, switch to position mode and the servo lock in the position. Note: after entering zero clamp mode, present setting speed is higher than P3-13, motor doesn't run, the ZCLAMP signal must be OFF, then motor will run again.
3	ZCLAMP signal is ON, the setting speed is less than P3-13, switch to position control mode, and servo is locked at this position. At this time, if setting speed is over P3-13, the motor will run again.

5.5.1.3 Speed reach signal (/V-RDY)

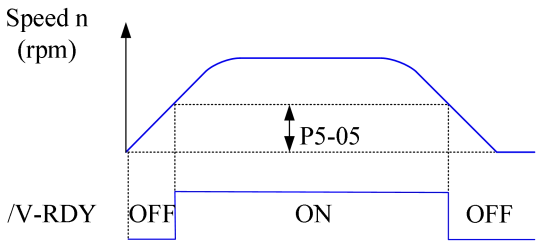
■ Related parameter

Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	Effective
P5-51	Speed arrived/ V-RDY	n.0000	3, 4, 7	Speed reach signal	Anytime	At once

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P5-05	Reach speed	1000	rpm	0~10000	Anytime	At once

Speed arrival signal output condition

When the actual motor speed is greater than P5-05, output speed reach signal (/V-RDY).

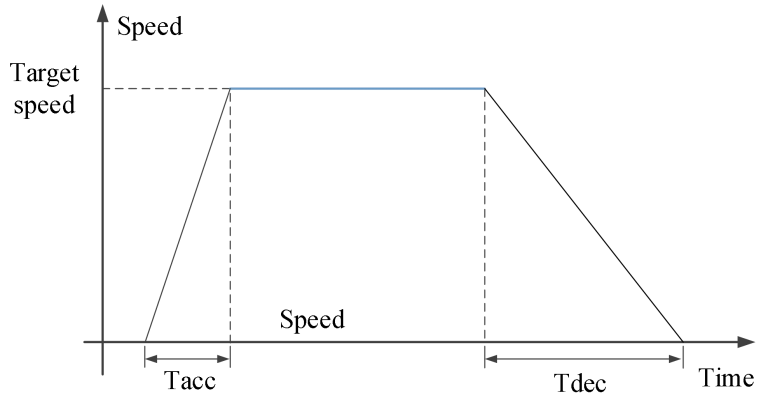


5.5.1.4 Speed command filter

■ Related parameters

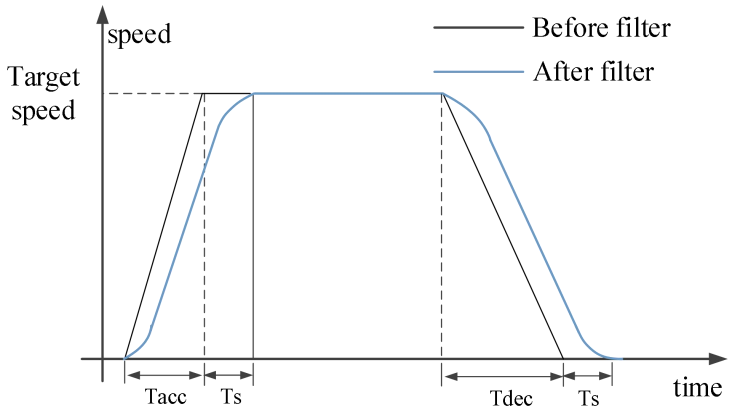
Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P1-23	Speed command filtering time constant	0	0.1ms	0~65535	Servo bb	At once
P3-09	Acceleration time	200	1ms	0~65535	Servo bb	At once
P3-10	Deceleration time	200	1ms	0~65535	Servo bb	At once
P3-11	Sliding average filtering time constant	0	0.1ms	0~65535	Servo bb	At once

Firstly, set P3-09 and P3-10. Plan the speed command acceleration and deceleration time.



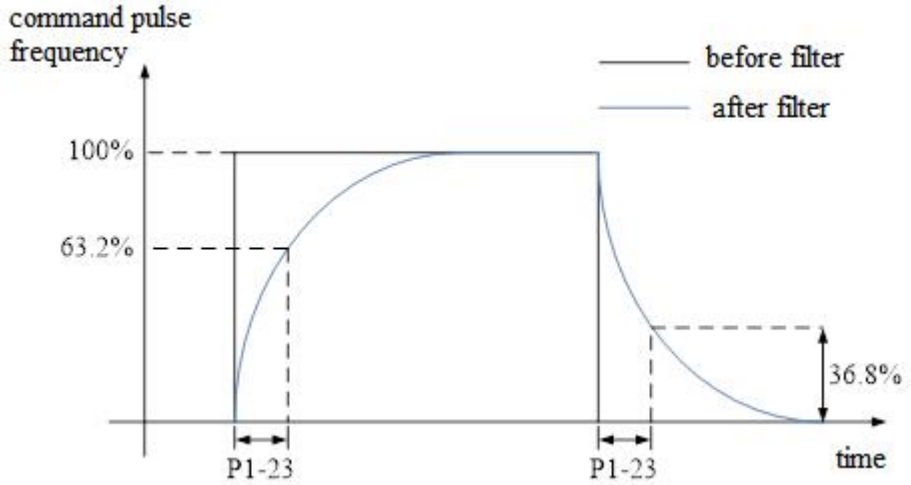
Among them, the acceleration time Tacc=(target speed/rated speed) * P3-09 [ms], and the deceleration time Tdec=(target speed/rated speed) * P3-10 [ms].

Set an appropriate sliding average filtering time constant P3-11 (S-type acceleration and deceleration time constant). Ts=P3-11*0.1 [ms].



Note: The setting of the sliding average filtering time constant must meet the requirements, Ts<0.5 * Tacc, Ts<0.5*Tdec. Otherwise, excessive sliding average filtering time will result in an increase in deceleration time, which doesn't comply with the settings of P3-09 and P3-10.

When P3-09 and P3-10 are set to 0, setting the sliding average filtering time will change the speed command into a trapezoidal acceleration/deceleration speed command. Set P1-23 (speed command filtering time constant) and P1-24 (first-order low-pass filtering time constant), and the effect is as follows:



Note: If acceleration and deceleration are set, the first-order low-pass filtering will increase the lag of the speed command.

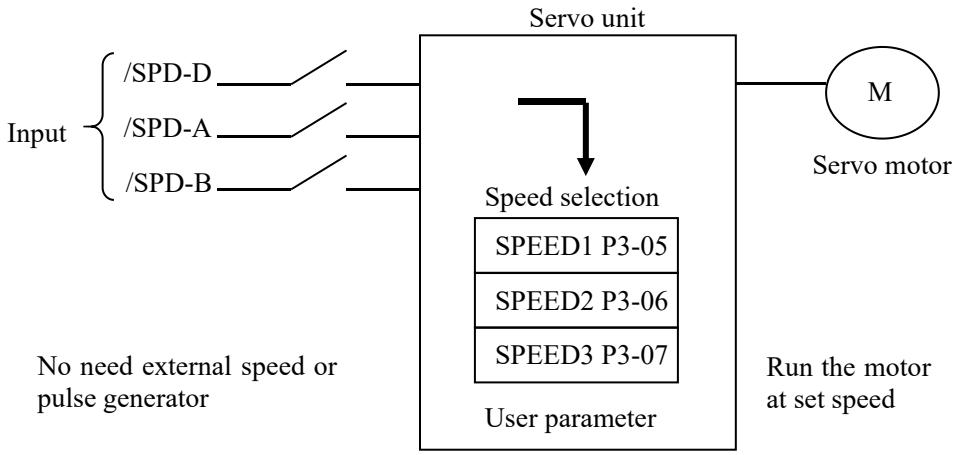
5.5.2 Speed control (internal speed)

Parameter	Overview	Chapter
P0-01 Control mode selection	Set to 3: internal speed control mode	5.5.2.1
P3-05 Internal speed 1 P3-06 Internal speed 2 P3-07 Internal speed 3	Speed value setting of internal 3-segment speed in rpm	5.5.2.1
P5-28 internal speed selection /SPD-A P5-29 internal speed selection /SPD-B	The combination of terminals determines the speed of corresponding section	5.5.2.1
P5-27 internal speed direction selection /SPD-D	Direction changing, default is n.0000 If the direction changing is given through SI2 terminal, P5-27 can be set to n.0002	5.5.2.1
P3-09 soft start acceleration time P3-10 soft start deceleration time	Set acceleration and deceleration time in ms	5.5.1.1

5.5.2.1 Internal speed mode

Parameter	Set value	Meaning	Modify	Effective
P0-01	3	Speed control: internal speed selection	Servo bb	At once

Function: Internal speed selection will set 3 motor speeds and select the speed by external signal. It is no need to configure external speed generator or pulse generator.



■ Related parameter

Parameter	Meaning	Defaulted setting	Unit	Range	Modify	Effective
P3-05	Internal speed 1	0	rpm	-9999~+9999	Anytime	At once
P3-06	Internal speed 2	0	rpm	-9999~+9999	Anytime	At once
P3-07	Internal speed 3	0	rpm	-9999~+9999	Anytime	At once

Parameter	Signal	Default setting	Range	Modify	Effective
P5-27	Internal direction /SPD-D	n.0000	Range: 0000-0014. Distribute to input terminal through P5-27.	Anytime	At once
P5-28	Internal speed /SPD-A	n.0000	Range: 0000-0014. Distribute to input terminal through P5-28.		
P5-29	Internal speed /SPD-B	n.0000	Range: 0000-0014. Distribute to input terminal through P5-29.		

1. Correlation between running speed and terminal signal

Input signal			Running speed
SPD-D(P5-27)	SPD-A(P5-28)	SPD-B(P5-29)	

0: forward run	0	0	Internal speed is zero
	0	1	P3-05:SPEED1
	1	1	P3-06:SPEED2
	1	0	P3-07:SPEED3
1: reverse run	0	0	Internal speed is zero
	0	1	P3-05:SPEED1
	1	1	P3-06:SPEED2
	1	0	P3-07:SPEED3

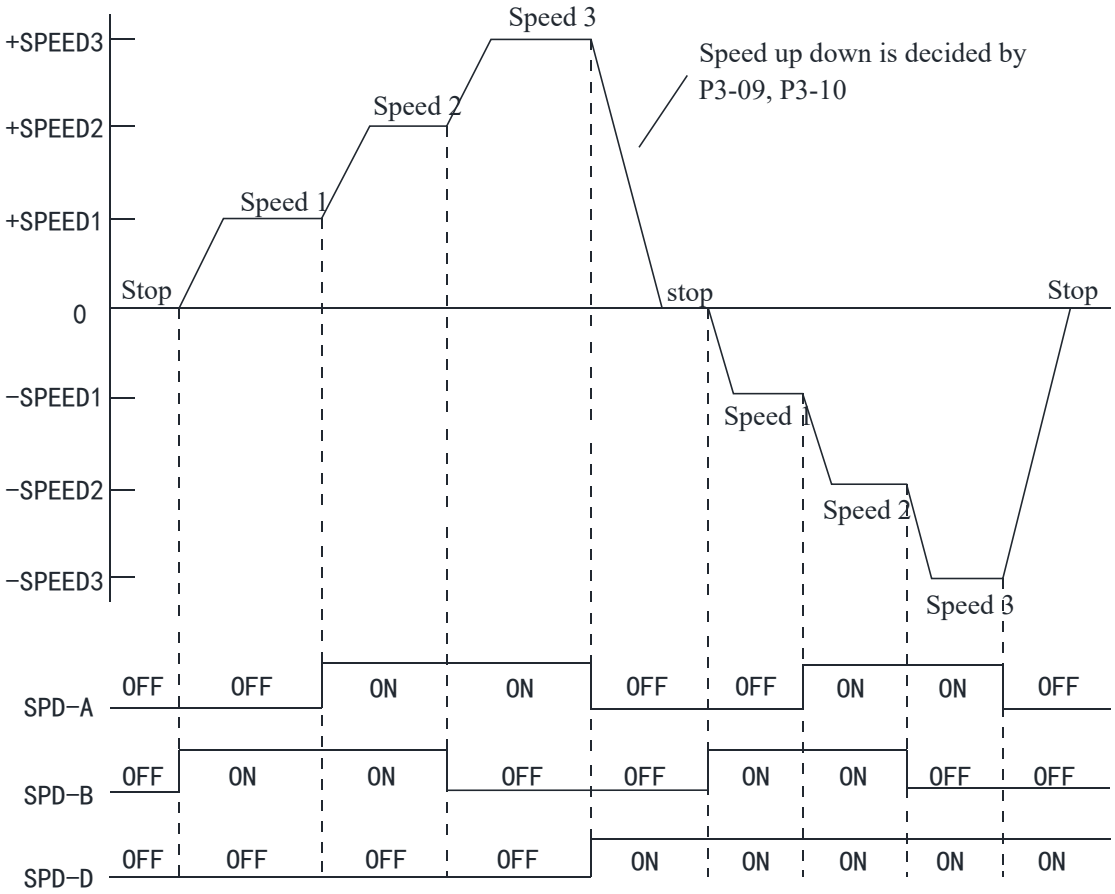
Note:
(1) /SPD-D signal is direction control, input SI terminal can be changed according to P5-27. The validity of the terminal signal determines the direction of the motor.
(2) The combination of /SPD-A and /SPD-B input terminal effectiveness determines the multi segment speed.
(3) 0/1 of the above table represent the validity of the signal. The 0-bit terminal input is invalid. 1 is the terminal input valid.

2. Terminal effectiveness description

The following table takes /SPD-D as an example, /SPD-A, /SPD-B signals are the same.

Parameter setting	Signal/SPD-D terminal input status	Signal/SPD-D terminal logic
P5-27=n.0000	No need external terminal input	Invalid
P5-27=n.000□	SI□ terminal no signal input	
P5-27=n.001□	SI□ terminal has signal input	
P5-27=n.0010	No need external terminal input	Valid
P5-27=n.000□	SI□ terminal has signal input	
P5-27=n.001□	SI□ terminal no signal input	

3. Running example



5.5.3 Speed control (pulse frequency command)

Parameter	Overview	Reference chapter
P0-01 Control mode selection	Set to 7: external pulse speed mode	5.5.3.1
P0-10 Pulse command form	Set pulse form 0-CW/CCW 1-AB 2-P+D	5.4.2.2
P0-15 Command pulse frequency at rated speed	Determine the linear relationship between the command pulse frequency and the speed	5.5.3.3
P0-16 Speed command pulse filter time	When the command pulse frequency is relatively low, setting this parameter properly can reduce the speed fluctuation	5.5.3.4
P5-71 Function selection of direction terminal in pulse speed mode	Change the pulse direction	5.5.3.5

5.5.3.1 External pulse speed mode

Parameter	Setting value	Meaning	Modify	Effective
P0-01	7	Speed control: pulse frequency speed command	Servo bb	At once
Function: Speed command is decided by external pulse frequency, but not related to pulse quantity. The wiring is the same as position command. Select CW, CCW mode or direction + pulse mode, AB phase pulse mode.				

5.5.3.2 Pulse frequency command

Pulse frequency command is the same as external pulse command position control, refer to 5.4.2.

5.5.3.3 Command pulse frequency at rated speed

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P0-15	Command pulse frequency at rated speed	1000	100Hz	0~10000	Servo bb	At once
Note: The unit is 100Hz. Example: P0-15=300, command pulse frequency at rated speed=30kHz. P0-15=1000, command pulse frequency at rated speed= 100kHz.						

5.5.3.4 Speed command pulse filter time

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P0-16	Speed command pulse filter time	100	0.01ms	0~10000	Servo bb	At once
When the command pulse frequency is low, setting a suitable value for this parameter can decrease the speed fluctuation.						

5.5.3.5 Speed command pulse direction

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P5-71	Function selection of direction terminal in pulse speed mode	0	-	0~1	Servo bb	At once

5.6 Torque control

Parameter	Overview	Reference chapter
P0-01 Control mode selection	Set to 1: internal torque mode	5.6.1
P3-33 Internal torque command	The given value is the percentage of rated torque	5.6.1.1
P3-16 Internal forward speed limit of torque control P3-17 Internal reverse speed limit of torque control P3-14 Forward max speed limit (MAX speed) P3-15 Reverse max speed limit (MAX speed)	Speed limit in torque mode	5.5.2.1
P5-27 Speed direction switch /SPD-D	Change the direction, default is n.0000 If it is given through SI2 terminal, P5-27 can be set to n.0002	

5.6.1 Torque control (internal setting)

Parameter	Set value	Function	Modify	Effective
P0-01	1	Torque control: internal setting	Servo bb	At once
Function: Control the torque by internal torque command.				

5.6.1.1 Internal torque command

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-33	Preset torque 1	0	1% rated torque	-1000~+1000	Anytime	At once
P3-34	Preset torque 2	0	1% rated torque	-1000~+1000	Anytime	At once
P3-35	Preset torque 3	0	1% rated torque	-1000~+1000	Anytime	At once
P3-51	Internal torque mode setting mode	0	-	0~1	OFF	At once

The unit of this parameter is 1% of the rated torque. Positive and negative values correspond to the forward and reverse rotation of the motor.
For example: P3-33=50, motor forward run with 50% of the rated torque.
P3-33= -20, motor reverse run with 20% of the rated torque.
In addition to using the torque to control the direction of servo operation, it can also use / SPD-D to control the direction.

5.6.1.2 Internal speed limit of torque control

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-16	internal forward speed limit in torque control mode	Motor rated	rpm	5~65535	Anytime	At once
P3-17	internal reverse speed limit in torque control mode	Motor rated	rpm	5~65535	Anytime	At once
Note: Even if the setting speed of this parameter is greater than the speed limit of P3-14, the actual						

effective speed limit is the lower speed limit. (The maximum speed is the smaller value in P3-14/P3-15 and P3-16/P3-17)

5.6.1.3 Speed reach signal output (/VLT)

In torque mode, when the absolute value of the actual speed of the servo motor exceeds the speed limit value, it is considered that the actual speed of the servo motor is limited. At this time, the servo driver can output /VLT signal. Otherwise, if any condition isn't met, the speed limit signal is invalid.

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-43	/VLT	n.0000	1, 2	Speed limit detection	Anytime	At once
By default, no terminal is allocated, the parameter range is 0000-0014, and is allocated to the output interface through parameter P5-43. When set to 0002, the signal is output from the SO2 terminal. /VLT signal is only valid in torque mode.						

5.7 Absolute value system

5.7.1 Absolute system setting

In order to save the position data of absolute encoder, the battery unit needs to be installed.
Install the battery on the battery unit of the encoder cable with the battery unit(Internal configuration).
If you don't use encoder cable with battery unit, please set P-79 to 1, that is, multi-loop absolute value encoder is used as incremental encoder.

Pararmeter	Name	setting	Meaning	Range
P0-79	Absolute encoder battery undervoltage alarm switch	0	Normally use absolute encoder and use battery to memorize position.	0~2
		1(default)	Use multi-loop absolute encoder as incremental encoder and no longer remember position	
		2	Use as absolute encoder, ignore the multi-loop overflow alarm	

Note: After replacing the multi-turn motor, an E-222 alarm will occur, which will automatically clear the number of times the multi-turn overflow occurred. Otherwise, serious position deviation may occur, causing danger.

5.7.2 Replace the battery

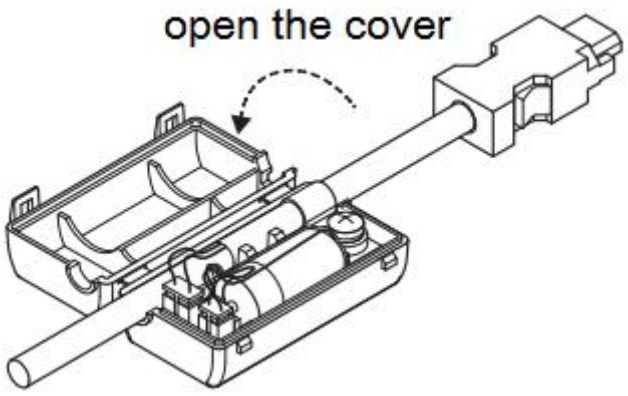
When replacing the battery, please replace the battery while keeping the driver and motor connected well and the control power is connected. If the battery is replaced when the control power between the driver and the motor is closed, the data stored in the encoder will be lost.

Note: Absolute Encoder Battery Model (This Battery Can't Charge)
Battery unit for normal cable:CP-B-BATT
Battery unit for tank chain cable: CPT-B-BATT

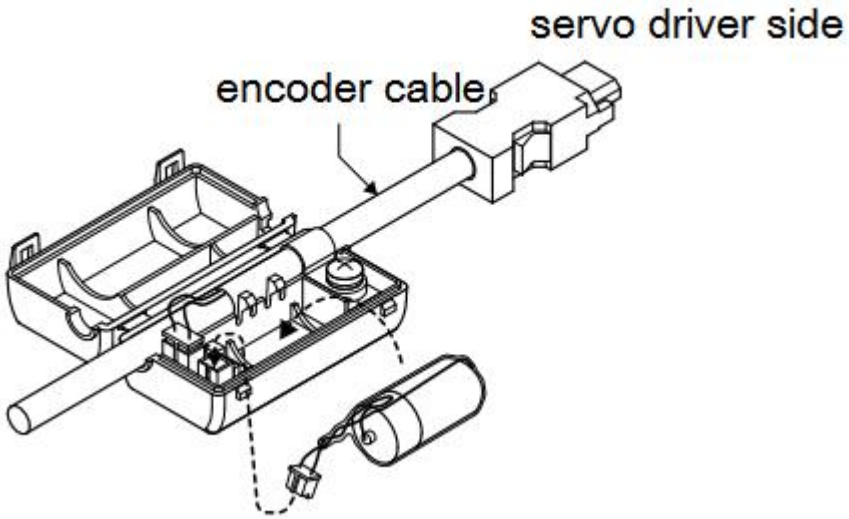
Battery replacement steps

When using encoder cable with battery unit

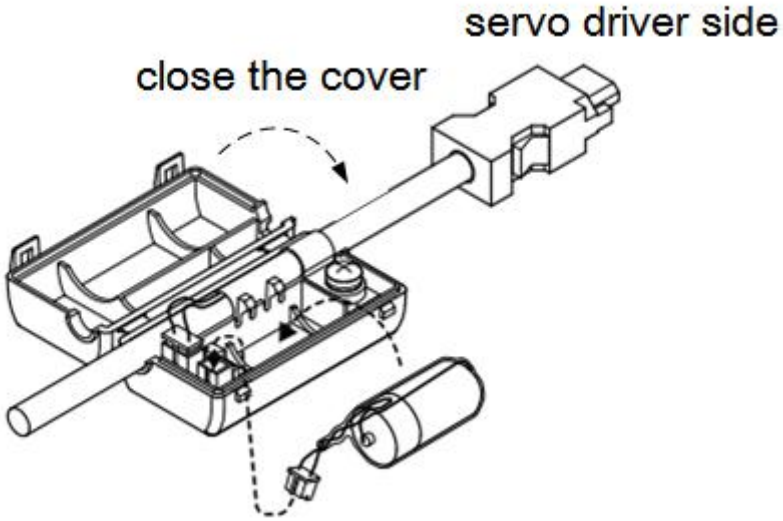
(1) Only the control power of the servo unit is connected.
(2) Open the cover of the battery cell.



(3) Take out the old battery, install the new one.



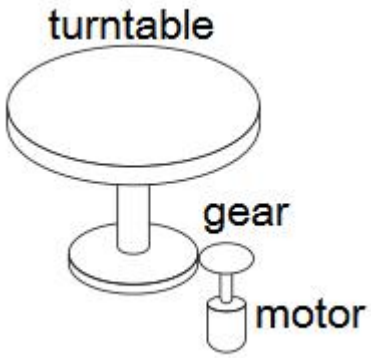
(4) Close the cover of the battery unit



(5) After replacing the battery, in order to remove the "Encoder Battery Alarm (E-222)" display, please do clear alarm twice (F0-00=1) (Version 3770 and later only need to be cleared once).
(6) Connect the power supply of the servo unit again.
(7) Make sure the error display disappears and the servo unit can operate normally.

5.7.3 The upper limit of turns

The upper limit of rotating cycles can be used for position control of gyroscopes such as turntables. For example, suppose there is a machine whose turntable moves only in one direction, as shown in the figure below.



Because it can only rotate in one direction, after a certain period of time, the number of revolving cycles will always exceed the upper limit of absolute value encoder.

Servo motor series	Resolution (single-circle data)	Rotating Circle Serial Data Output range	Operation of overtime
CS/M	17	-32768~32767	When it is higher than the upper limit value in the forward direction (+32767*2 ^{17}): Rotation serial data = 32767*2^{17} When it is below the lower limit of reversal direction (-32768*2^{17}): Rotation Serial Data=-32767*2^{17}
TL	23		When it is higher than the upper limit value in the forward direction (+32767*2^{23}): Rotation serial data = 32767*2^{23} When it is below the lower limit of reversal direction (-32768*2 ^{23}): Rotation Serial Data=-32767*2^{23}

5.7.4 Read absolute position by communication

Basic parameter		
User parameter	Name	Function
U0-10	Encoder feedback value	Absolute single turn position, read the single word of the hex address 0x100A and 0x100B through Modbus-RTU, U0-10+U0-11*10000 is current encoder single turn position
U0-11		
U0-91	Multi-turn absolute encoder present turns	read the single word of the hex address 0x105B through Modbus-RTU, it is current encoder turns
U0-57	Absolute encoder present position feedback low 32-bit	read the double words of the hex address 0x1039 through Modbus-RTU, it is current encoder position, with ± pulses
U0-58		
U0-59	Absolute encoder present position feedback high 32-bit	Read the double words of the hex address 0x103B through Modbus-RTU, it is current encoder position high bits, needs to plus the low bits data
U0-60		

The servo driver transmits the position data information of the encoder through RS485 interface and Modbus RTU protocol.

- 19 bits absolute value encoder, with 524288 pulses per revolution.

First read the U0-60 (0x103C) value,
① 0 is the positive direction of the encoder zero position. The current encoder value is U0-57*1+U0-58*2^{16}+U0-59*2^{32}+U0-60*2^{48}.
② -1 is the reverse direction of the encoder zero position. The current encoder value is: [U0-57+U0-58*2^{16}+U0-59*2^{32}+(65536+U0-60) * 2^{48}] -2^{64}.

Description of communication parameters:

Default communication parameter of RS485 port: baud rate 19200bps, 8 data bits, 1 stop bit, even parity, Modbus station number 1.

Note: Refer to Appendix 1 (P7-XX) for the description of communication parameters.

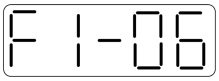
5.7.5 Clear multi-turn

The encoder clearing turns needs to be completed in the servo bb state. The encoder turns can be cleared through the servo panel and ModbusRTU communication. When F1-06 writes 1, the current turns of multi-turn absolute value U0-91 will be set to zero, and the multi-turn values in current position feedback U0-57~U0-60, U0-94~U0-97 will be cleared, and the single turn values in these parameters will not be cleared.

1. Servo panel clearing

Enter parameter F1-06 in servo bb status:

Press【INC】add to 1, keep press【ENT】to confirm and exit:



The absolute encoder position turns can be cleared through F1-06.

2. ModbusRTU clearing

Write 1 in hex address 0x2106 through Modbus-RTU can clear the turns.
It will take effective when servo is in bb status. Please write 0 to 0x2106 after clearing.

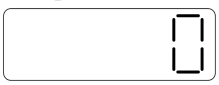
5.7.6 Zero calibration of absolute encoder

User parameter	Name
F1-06	1: absolute encoder position clearing 3:absolute encoder zero point calibration
U0-94	Relative encoder feedback value which can be cleared
U0-95	
U0-96	
U0-97	

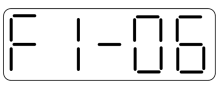
The zero calibration of the absolute value encoder needs to be completed in the servo bb state, which can be calibrated through servo panel calibration and Modbus RTU communication calibration. F1-06 writes 3, and the current position feedback of the absolute value encoder U0-94~97 will calibrate the encoder position to 0.

1. Servo panel calibration

Enter the parameter F1-06 in servo bb status:



Press【INC】add to 3, keep press【ENT】to exit:



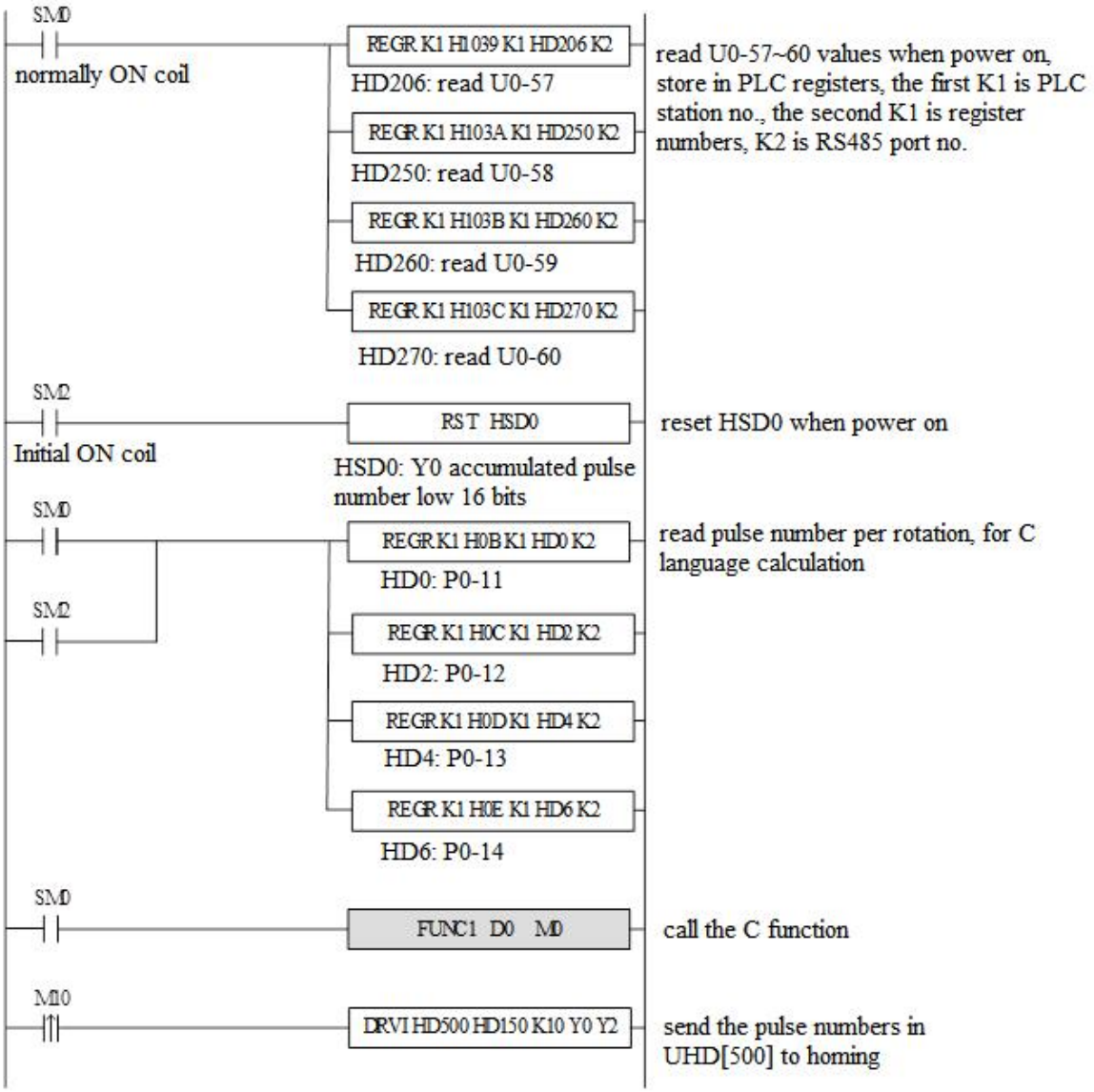
Calibrate the encoder current position to zero point thorugh F1-06. U0-94~97 will show the encoder position after calibration.

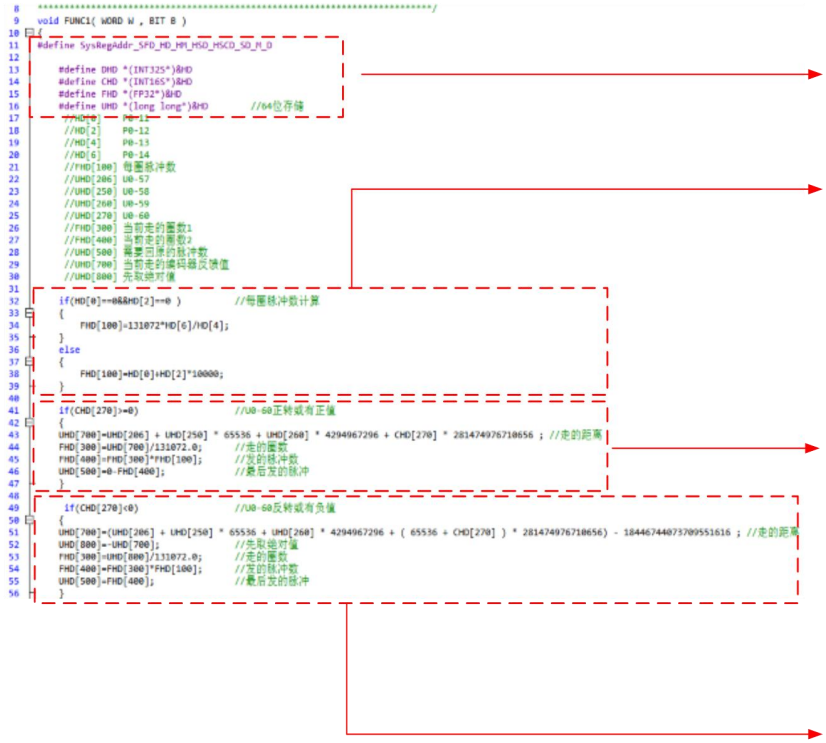
2. ModbusRTU calibration

Write 3 to the parameter F1-06 (modbus address 0X2106), U0-94~97 will show the motor absolute position after calibration.

5.7.7 Absolute value homing application

Read the multi-turn absolute position through Xinje PLC, it can be read in four words. The following example is homing through multi-turn absolute encoder feedback. M1 is ON, memory the origin position. SM12 is ON, memory the real-time position. Read the encoder feedback of the passed position through function calling. Return to origin through DRVI instruction.





Define bytes of register data

First, based on the pulse number per revolution read from communication and the electronic gear ratio, determine the pulse number per revolution required for the motor to rotate one revolution, and store it in FHD [100]

① Calculate the feedback value of the encoder's real-time movement and store it in UHD[700].

② Running in the positive direction, U0-60>0. Due to the difference in encoder feedback resolution and number of pulses per cycle, the number of cycles is first calculated, and then multiplied by the number of pulses per cycle to obtain pulse numbers required for the real time distance traveled.

③ Traveling in a positive direction, so when sending a pulse, it is necessary to send a negative pulse back to the origin, take a negative value, and save it in UHD[500].

① If running in the opposite direction, U0-60<0, take th value of the encoder feedback for the real-time distance

② Due to the difference in encoder feedback resolution of pulses per cycle, the previous calculation ②.

5.8 Auxiliary functions

5.8.1 Anti-blocking protection

Anti-blocking alarm: When the motor speed is lower than P0-75 (unit 1 rpm) and the duration reaches the set value of P0-74 (unit ms), the current output torque U0-02 is greater than the internal positive torque limit of P3-38 and the internal reverse torque limit of P3-39, it will show the alarm E-165 blocking overtime.

■ Related parameters

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P0-74	Blocking alarm time	According to models	1ms	0~65535	Anytime	At once
P0-75	Blocking alarm speed	50	rpm	5~9999	Anytime	At once
P3-38	Anti-blocking alarm internal forward torque limit	According to models	%	0~Motor overload multiple	Anytime	At once
P3-39	Anti-blocking alarm internal reverse torque limit	According to models	%	0~Motor overload multiple	Anytime	At once

Note:

(1) When P0-74 or P0-75 is set to 0, this alarm will not be detected.

(2) If this alarm occurs during normal operation of servo, please confirm:

(a) Monitor U0-02 motor torque and check if P3-38 and P3-39 torque limits are set properly.

(b) Check the external mechanical structure and installation.

(3) P0-74 the default value of locked rotor alarm time is as follows:

Driver model	P0-74 (/ms) default parameter
DS5□-20P1-PTA	2000
DS5□-20P2-PTA	3000
DS5□-20P4-PTA	3000
DS5□-20P7-PTA	5000

5.8.2 Torque limit

1. Internal torque limit

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-28	Internal forward torque limit	According to the model	%	0~Motor overload multiple	Anytime	At once
P3-29	Internal reverse torque limit	According to the model	%	0~Motor overload multiple	Anytime	At once
1. If this parameter value is less than external torque limit value, the final limit value is this parameter. 2.The setting unit is% relative to the rated torque of the motor. If the motor is overloaded by three times, the factory set rated torque is 300%, and the actual maximum output torque is also limited by the motor overload multiple.						

2. External torque limit (via input signal)

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-30	Forward external torque limit	According to the model	%	0~Motor overload multiple	Anytime	At once
P3-31	Reverse external torque limit	According to the model	%	0~Motor overload multiple	Anytime	At once
The setting unit is% relative to the rated torque of the motor. If the motor is overloaded by three times, the factory setting is 300% of the rated torque.						

Parameter	Signal name	Default setting	Meaning	Range	Modify	Effective
P5-25	/P-CL	n.0000	The necessary condition to use forward external torque limit	Range 0000-0014, can be distributed to other input terminals through P5-25.	Anytime	At once
P5-26	/N-CL	n.0000	The necessary condition to use reverse external torque limit	Range 0000-0014, can be distributed to other input terminals through P5-26.	Anytime	At once

3. Relationship

The following are the relationship of internal torque limit, external torque limit, P-CL, /N-CL.

P-CL/N-CL status	Final forward torque	Final reverse torque
0	Decided by P3-28	Decided by P3-29
1	The smaller one of internal forward torque limit and external forward torque limit	The smaller one of internal reverse torque limit and external reverse torque limit

4. Output torque up to limit value signal

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-42	Torque limit /CLT	n.0000	All	Output signal when motor output torque up to P3-28, P3-29.	Anytime	At once
No terminals are assigned by default. The parameter range is 0000-0014, which is assigned to the output interface through parameter P5-42. When set to 0002, the signal is output from the SO2 terminal.						

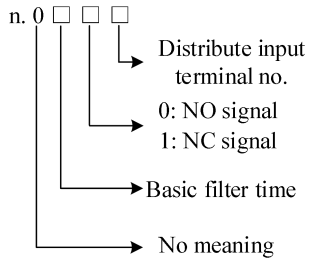
5.8.3 Speed limit

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-14	Forward max speed command limit	4000	rpm	0~10000	Servo bb	At once
P3-15	Reverse max speed command limit	4000	rpm	0~10000	Servo bb	At once
Note: P3-14 and P3-15 are effective in all the modes. (For firmware 3770, this parameter cannot take effect in position mode).						

5.8.4 I/O signal distribution

5.8.4.1 Input terminal distribution

1. Input signal distribution

Parameter	Parameter Meaning	Set value	Meaning
P5-20~P5-36		n.0000	Not distribute to terminal input
		n.000x	Input always open signal from SIx
		n.0010	Set the signal to be always valid
		n.001x	Input always close signal from SIx

Note: The basic filtering time refers to input terminal filtering time.

2. Default setting of input terminal

Terminal	SI1	SI2	SI3	SI4	SI5
Function	S-ON/enable	ALM-RST/alarm reset	P-OT/forward run prohibition	N-OT/reverse run prohibition	Not distribute

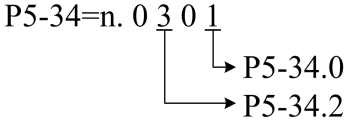
3. Filtering time of input terminal

■ Related parameter

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P5-18	IO filtering time multiple	1	Multiple	0~10000	Anytime	At once

SI input filtering time is determined by IO parameter value and P5-18. Examples are as follows:
Pulse deviation clear set to SI1 terminal, and 30ms Filtering Time

The parameters are set as follows:



P5-34.0=1 input terminal is SI1

P5-34.2=3 basic filtering time is 3ms

P5-18=10 filtering time multiple is 10

So the total filtering time is P5-34.2 * P5-18=3ms*10=30ms

5.8.4.2 Output terminal distribution

1. Output signal distribution

Parameter	Parameter Meaning	Set value	Meaning
P5-37~P5-53	n. 0 □ □ □ Distribute output terminal no. 0: NO signal 1: NC signal No meaning No meaning	n.0000	Not distribute to terminal input
		n.000x	Output always open signal from SOx
		n.0010	Set the signal to be always valid
		n.001x	output always close signal from SOx

2. Default setting of output terminal

Output terminal	SO1	SO2	SO3
Signal	COIN/positioning completed	ALM/alarm	Not distribute

5.8.5 Output terminal function

5.8.5.1 Servo ready output (/S-RDY)

■ Related parameter

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P5-70	/S-RDY: output condition selection	0	-	0~1	Anytime	At once

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-41	/S-RDY	n.0000	All	Servo ready output	Anytime	At once
Refer to 3.2.4 for hardware wiring details. P5-41 parameter setting range is n.0000-0014, which is assigned to other output terminals through parameters. If it is necessary to output signal from SO2, P5-41 can be set to n.0002/0012.						

Servo ready signal output conditions

When P5-70 is set to 0: after the driver initialization is completed and the servo has no alarm status /S-RDY is valid.
When P5-70 is set to 1: after enabling, the servo has no alarm status /S-RDY is valid.

5.8.5.2 Rotating detection output (/TGON)

1. Signal setting

Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	Effective
P5-40	/TGON	n.0000	All	Rotating detection output	Anytime	At once
It is the output signal indicating that the servo motor is rotating at a speed higher than the set value. 1. No terminal output signal is assigned by default. The parameter range is 0000-0014, which is allocated to other output terminals through parameter P5-40. 2. When the speed of the servo motor is higher than the set value of P5-03, the signal that the servo is rotating is considered.						

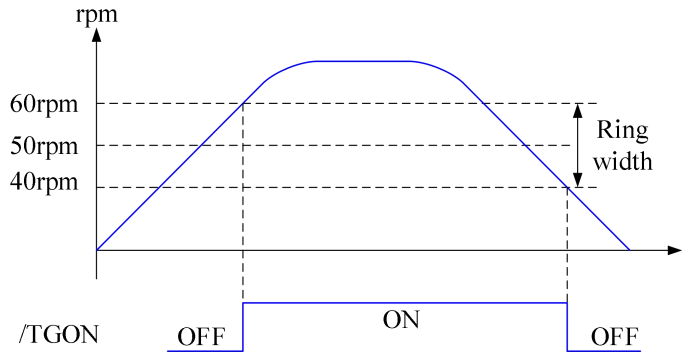
2. Related parameters

Parameter	Meaning	Default value	Unit	Range	Modify	Effective
P5-03	Rotating detection speed /TGON	50	rpm	0~10000	Anytime	At once
If the speed of the servo motor exceeds the set value of P5-03, it is judged that the servo motor is rotating and the output of the rotation detection (/TGON) signal.						

Note: Rotation detection has a hysteresis of 10 rpm.

3. Hysteresis

Hysteresis is set up to prevent the system from repeatedly acting and oscillating when the parameters fluctuate up and down in a certain value. Once the hysteresis value is set, there will be a fixed ring width. Then only when the parameter must be greater than a certain value can the action be taken. When the parameter is smaller than another value, the action will be released. The ring width determines the interval time of the action. The action of small ring width is sensitive and frequent, and the action of large ring width is slow. It should be noted that the rotation detection speed (P5-03), the same speed detection speed (P5-04), the arrival detection speed (P5-05), all contain 10 rpm hysteresis. For example, the rotation detection speed P5-03 is set to 50, and the rotation detection/TGON output port is SO3.



5.8.5.3 Same speed detection (/V-CMP)

Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	Effective
P5-39	Same speed detection / V-CMP	n.0000	3, 4, 7	Same speed detection	Anytime	At once
Defaulted isn't distribute to the terminals. Range: 0000-0014. Distribute to output terminal through P5-39. When it set to 0002, it means output from SO2.						

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P5-04	Same speed detection signal width	50	rpm	0~10000	Anytime	At once

There is default 10rpm hysteresis loop, please refer to 5.8.5.2 for hysteresis loop.

5.8.5.4 Warn output (/WARN)

Set the alarm output threshold, when the current speed is higher than the warning speed, output /WARN.

Parameter	Meaning	Default value	Unit	Range	Modify	Effective

P3-19	Forward warning speed	Motor related	rpm	0~65535	Servo bb	At once
P3-20	Reverse warning speed	Motor related	rpm	0~65535	Servo bb	At once

Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	Effective
P5-45	/WARN	n.0000	All	Warning output	Anytime	At once
1. No terminal output signal is assigned by default. The parameter range is 0000-0014, which is allocated to other output terminals through parameter P5-45. 2. When a warning occurs, the servo unit only outputs the warning and will not be forced to set OFF.						

5.8.5.5 Alarm output (/ALM)

1. Servo alarm output /ALM

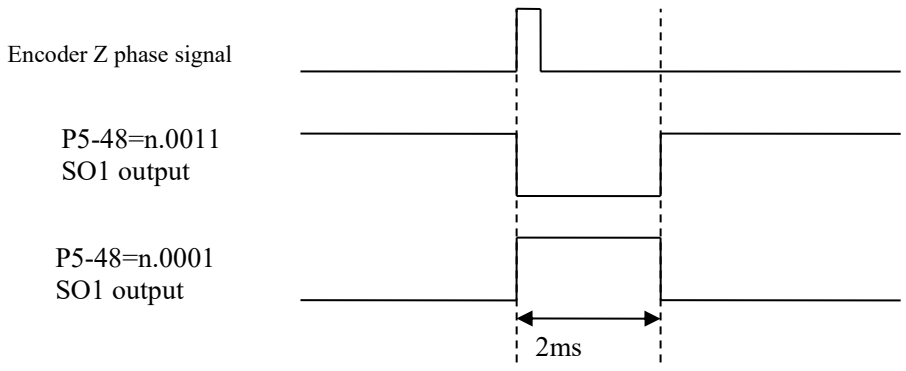
Parameter	Signal name	Setting	Meaning	Range
P5-47	Alarm output /ALM	n.0002 (default)	When the servo alarm, SO2 and COM are connected, and the alarm signal is output.	The parameter range is 0000-0014, which is assigned to the output interface by parameter P5-47. When set to 0001, the signal is output from the SO1 terminal.
		n.0012	When the servo alarm, the SO2 and COM are switched off.	

Note:
(1) When an alarm occurs, the servo unit is forced to set OFF, and the motor will move with external forces (including gravity). If you need to keep the motor in position, please select the motor with power loss brake (also known as brake) and use / BK signal. Refer to 5.2.4.
(2) The output of the functional parameters can not be repeated.

5.8.5.6 Encoder Z phase output (/Z)

parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P5-48	Z phase output /Z	n.0000	-	0000~0014	Anytime	At once
P5-19	Z phase pulse width	2	ms	1~65535	Anytime	At once

1. /Z signal can be distributed to the output terminal through P5-48.
2. Z phase signal is single pulse output mode, the default pusle width is 2ms, it can set through P5-19, it isn't related to the motor speed.
Note: multi-turn motor has no Z phase output (3770 version and later support multi turn motor Z-phase output).



5.8.5.7 User-defined output signal

User can define 2 outputs. The defined method is SOx output when A>B or A<B. A is 9 activating conditions. B is user-defined comparison value.

User-defined output 1:

P5-10	The trigger condition of user-defined output 1					
	Default trigger condition	Trigger condition setting	Unit	Suitable mode	Change	effective
	0	See below table: optional trigger condition	Related to trigger condition	All the modes	Anytime	At once
P5-11	The comparison value for the trigger condition of user-defined output 1					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	-32768~ 32767	All the modes	Anytime	At once
P5-12	When P5-10≥P5-11 or P5-10<P5-11, SOx output					
	Setting value	Function	Default value	Suitable mode	Change	Effective
	0	P5-10≥P5-11, SOx output	0	All the modes	Anytime	At once
	1	P5-10＜P5-11, SOx output				
	2	P5-10 absolute value ≥P5-11, SOx output				
	3	P5-10 absolute value ≤P5-11, SOx output				
P5-13	User-defined output 1 hysteresis loop					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	0~65535	All the modes	Anytime	At once
P5-52	Output terminal setting of user-defined output 1					
	Signal name	Default setting	Meaning	Change		
	User-defined output 1	n.0000	Default setting isn't distribute to the output terminal	Range 0000-0014, distribute to the output terminal through P5-52.		

User-defined output 2:

P5-14	The trigger condition of user-defined output 2					
	Default trigger condition	Trigger condition setting	Unit	Suitable mode	Change	Effective
	0	See table: optional trigger condition	Related to trigger condition	All the modes	Anytime	At once
P5-15	The comparison value for the trigger condition of user-defined output 2					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	-9999~9999	All the modes	Anytime	At once
P5-16	When P5-14≥P5-15 or P5-14<P5-15, SOx output					
	Setting	Function	Default	Suitable	Change	Effective

	value		setting	mode		
	0	P5-14≥P5-15, SOx output	0	All the modes	Anytime	At once
	1	P5-14＜P5-15, SOx output				
	2	P5-14 absolute value ≥P5-15, SOx output				
	3	P5-14 absolute value ≤P5-15, SOx output				

P5-17	User-defined output 2 hysteresis loop					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	-32768~ 32767	All the modes	Anytime	At once

P5-53	Output terminal setting of user-defined output 2			
	Signal name	Default setting	Meaning	Change
	User-defined output 2	n.0000	Default setting isn't distribute to the output terminal	Range 0000-0014, distribute to the output terminal through P5-53

Optional trigger conditions:

Condition no.	Meaning	Unit
0	-	-
203	Current command	Rated current %
205	Current feedback	Rated current %
301	Speed command	rpm
302	Speed feedback	rpm
308	Speed deviation	rpm
4402	Position command	1 command
4404	Position feedback	1 command
1405	Position deviation	1 command
502	Bus voltage	V
503	Drive internal temperature	℃
506	Average output power	W
508	Average thermal power	W

5.8.5.8 Other SO terminal function

Terminal name	Description	Chapter
/COIN-HD	Positioning completion hold	5.4.1.2
/COIN	Positioning end	5.4.1.2
/CLT	Torque limit detection	5.8.2
/VLT	Speed limit detection	5.6.1.3
/MRUN	Internal position mode motion start	5.4.3.7
/V-RDY	Speed arriving signal	5.5.1.3
/PREFA	Internal position selection signal	5.4.3.2
/PREFB	Internal position selection signal	5.4.3.2

/PREFC	Internal position selection signal	5.4.3.2
/PREFD	Internal position selection signal	5.4.3.2

5.8.6 Input terminal function

5.8.6.1 Proportion action command (/P-CON)

Parameter	Signal	Type	Default	State	Meaning	Modify	Effective
P5-21	Proportional action /P-CON	Input	n.0000	Valid	Run in P control mode	Anytime	At once
				Invalid	Run in PI control mode		
1. /P-CON is the speed control mode signal selected from PI (proportion integral) and P (proportion). 2. If set to P control mode, the motor rotate and micro-vibration caused by speed command input drift can be decreased. But the servo stiffness will decrease. 3. /P-CON signal can be distributed to input terminal via parameter P5-21.							

5.8.6.2 Alarm reset (/ALM-RST)

■ Alarm reset /ALM-RST

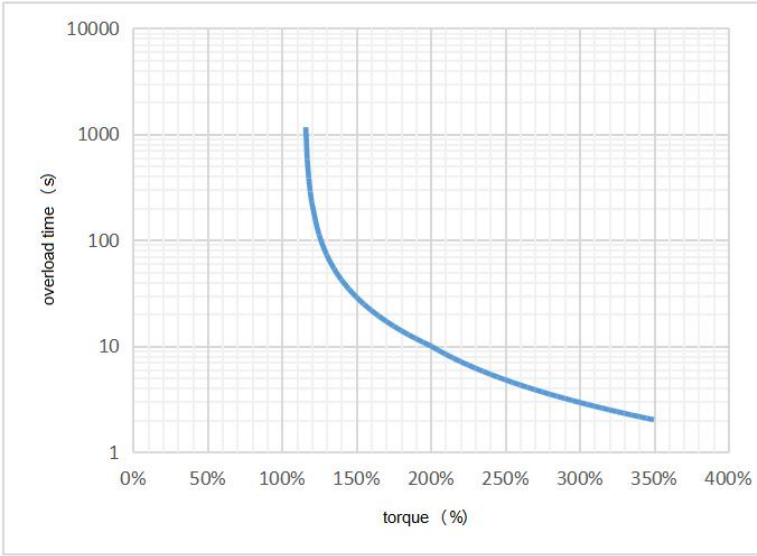
Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	effective
P5-24	/ALM-RST	n.0002	All	Input normally open signal from SI2 terminal	Anytime	At once
1. The parameter range is 0000-0014, which is allocated to other input terminals through parameter P5-24. 2. When an alarm occurs, find out the cause of the alarm and remove it, then clear the alarm by setting the signal to be effective. 3. /ALM-RST signal can be assigned to other terminals through this parameter, because the alarm signal is related to the safe operation of the servo, so the /ALM-RST signal can not be set to be always valid (n.0010).						

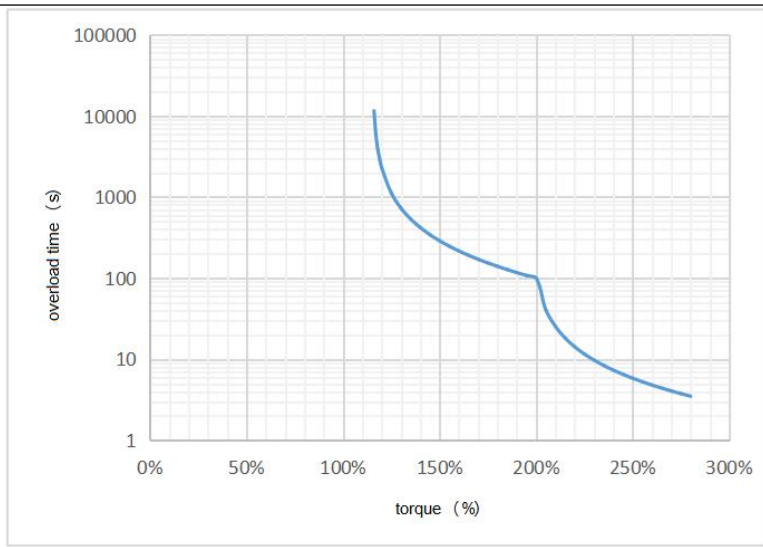
5.8.6.3 Other SI terminal function

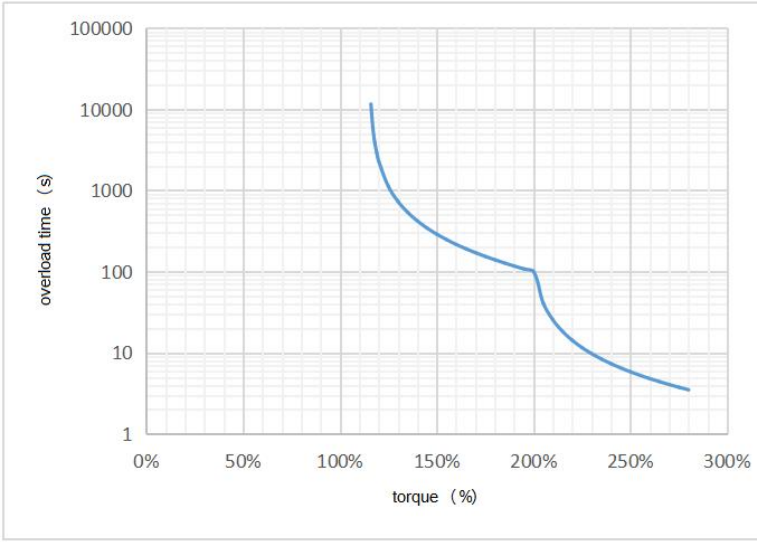
Terminal name	Description	Chapter
/S-ON	Servo enable	5.2.2
/P-OT	No forward driving	5.2.4
/N-OT	No reverse driving	5.2.4
/P-CL	Forward side external torque limit	5.8.2
/N-CL	Reverse side external torque limit	5.8.2
/SPD-D	Internal speed direction	5.4.2
/SPD-A	Internal setting speed	5.4.2
	Position mode reference origin triggering	5.4.1.8
/SPD-B	Internal setting speed	5.4.2
	Position mode reference origin triggering	5.4.1.8
/C-SEL	Control mode selection	5.1.2
/ZCLAMP	Zero clamp	5.4.1.2
/INHIBIT	Command pulse inhibit	5.3.1.4

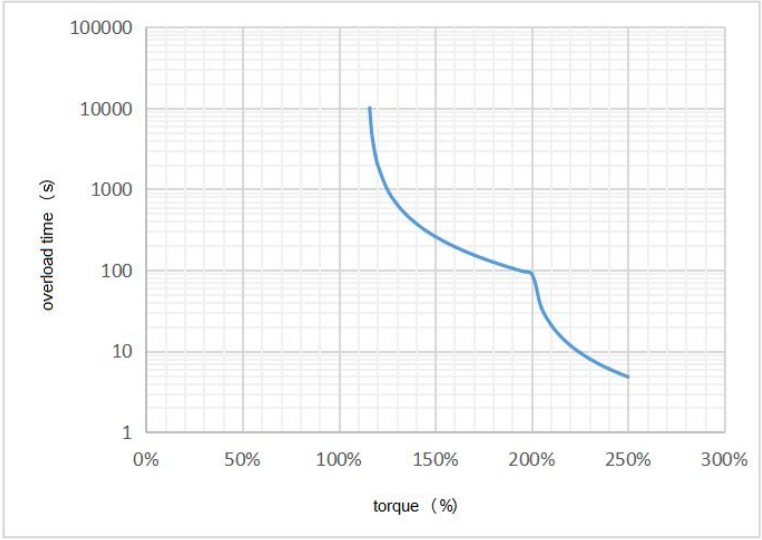
5.8.7 Time limit curve of overload protection

The time limit curve of overload protection is only used for the judgment of alarm output and the protection of overload operation. It is recommended to use it within the continuous operation stage of torque speed curve. For the torque speed curve, please refer to appendix 9.

Applicable model (motor code)	
5022 5822 5003 5803 50C3 58C3 5004 5804 50C4 58C4 4004 50C5 58C5 5011 5811 50D1 58D1 4011 4012 50D7 5012 50D2	

Applicable model (motor code)	
5072 5872 9072 9872	

Applicable model (motor code)	
5072 5872 9072 9872	

Applicable model (motor code)	
5033 9033 4031 4032 4042 5042 4044 5044 5078 5079 5077 5877 9077 9877	

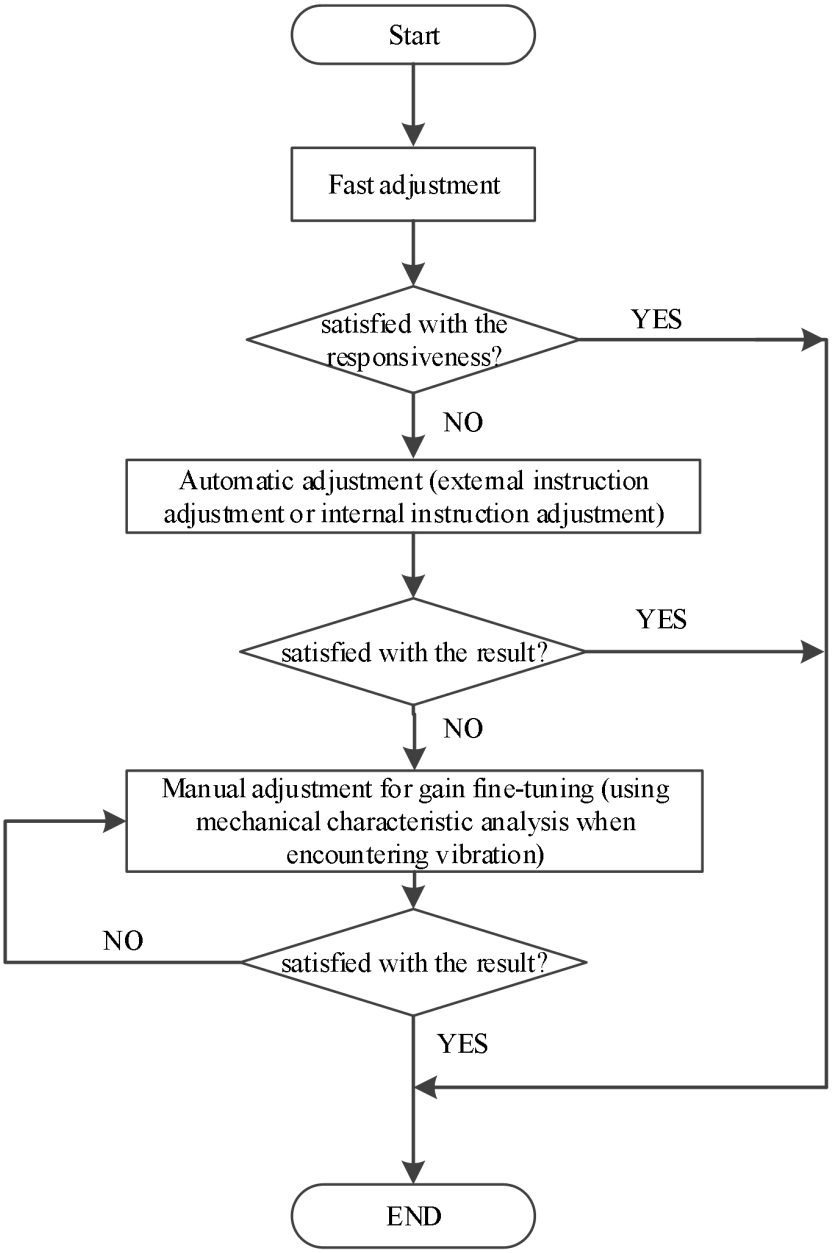
6 Servo gain adjustment

6.1 Overview of servo gain adjustment

6.1.1 Overview and process

The servo driver needs to drive the motor as fast and accurately as possible to track the instructions from the upper computer or internal settings. In order to meet this requirement, the servo gain must be adjusted reasonably.

Servo gain factory value is adaptive mode, but different machines have different requirements for servo responsiveness. The following figure is the basic process of gain adjustment, please adjust according to the current machine status and operation conditions.



6.1.2 The difference of these adjustment modes

Adjustment modes are divided into adaptive and auto-tuning, and their control algorithms and parameters are independent. Among them, the auto-tuning mode is divided into three functions: fast adjustment, automatic adjustment and manual adjustment. The three functions are the same in essence but different in implementation. Refer to the corresponding chapters of each function.

Mode	Type	Parameters	Rigidity	Responsiveness	Related parameters
Adaptive	Automatic adaptation	P2-01.0=1	middle	150ms	P2-05 adaptive speed loop gain P2-10 adaptive speed loop integral P2-11 adaptive position loop gain P2-07 adaptive inertia ratio P2-08 adaptive speed observer gain P2-12 adaptive stable max inertia ratio
Auto-tuning	Fast adjusting	P2-01.0=0	high	10~50ms	P0-07 first inertia ratio P1-00 speed loop gain P1-01 speed loop integral P1-02 position loop gain P2-35 Torque instruction filtering time constant 1 P2-49 Model loop gain
	Automatic adjustment		high	10ms	
	Manual adjusting		high	Determined by parameters	

6.2 Rotary inertia presumption

6.2.1 Overview

Rotational inertia estimation is the function of automatic operation (forward and reverse) in the driver and estimate the load inertia in operation.

Rotational inertia ratio (the ratio of load inertia to motor rotor inertia) is a benchmark parameter for gain adjustment, and it must be set to the correct value as far as possible.

Parameter	Meaning	Default setting	Unit	Setting range	Modification	Effective
P0-07	First inertia ratio	500	%	0~50000	Anytime	At once

6.2.2 Notes

Occasions where inertia cannot be presumed

- Mechanical systems can only operate in one direction.

The occasion where inertia presumption is easy to fail

- Excessive load moment of inertia.
- The running range is narrow and the travel is less than 0.5 circles.
- The moment of inertia varies greatly during operation.
- Mechanical rigidity is low and vibration occurs when inertia is presumed.

Notes of Inertia Presumption

- Due to the ability to rotate in both directions within the set range of movement, please confirm the range or direction of movement. And ensure that the load runs in a safe journey.
- If the inertia is estimated under default parameters, there will be operational jitter, indicating that the present load inertia is too large. Under larger loads, the initial inertia can also be set to about twice the current value and executed again.
- The recognition upper limit of the driver inertia ratio is 500 times (parameter upper limit value of 20000). If the estimated inertia ratio is exactly 20000, it means that the inertia ratio has reached the upper limit and cannot be used. Please replace the motor with a larger rotor inertia.

Other notes

- At present, the inertia switching function isn't supported, and the second inertia ratio is invalid.
- The inertia ratio upper limit changes to 500 times for the driver firmware 3700 and higher version (parameter upper limit value is 50000).

6.2.3 Operation tool

The presumptive tools of load moment of inertia are driver panel and XinjeServo software.

Operation tool	Description
Driver panel	Driver firmware needs 3700 and higher version
XinJeServo software	All versions of software supported

Note: Driver firmware version can be checked through U2-07.

6.2.4 Operation steps

Estimate the inertia through the driver panel

1. Parameter setting

Parameter	Meaning	Default setting	Unit	Range	Modification	Effective
P2-15	Inertia configured trip	100	0.01 circle	1~3000	Anytime	At once
P2-17	Inertia identification and internal instruction auto-tuning max speed	-	rpm	0~65535	Anytime	At once
P2-18	Inertia identification initial inertia ratio	500	%	1~20000	Anytime	At once

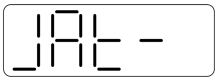
The recommended parameters of P2-17 are 500 rpm or more. Low instruction speed will lead to inaccurate identification of inertia ratio. The default is 1/3 of the rated speed, which will be calculated based on the rated speed in the motor parameters.

2. Execute the inertia identification

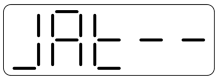
Before inertia identification, please confirm the direction of servo rotation by using F1-00 jog motion function. Initial direction of servo operation is determined by INC or DEC at the beginning of inertia identification.

If the servo jitter is under the adaptive default parameters, please switch to the adaptive large inertia mode (P2-03.3=1) to ensure the basic smooth operation of the servo and then identify the inertia!

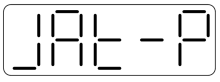
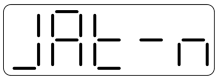
Servo entering parameter F0-07 in BB state:



Press ENTER, servo is enabled:



Press INC or DEC to run forward or reverse (select one of them):

 or 

At this point, start action, under the condition of P-05 = 0 (initial positive direction), if press INC, then turn forward and then reverse. if press DEC, turn reverse and then forward. If the inertia identification is successful, the load inertia ratio is prompted and written to P0-07 automatically after several forward and reverse operations. If the inertia identification error occurs, the error code will be displayed. Press STA/ESC key to exit the panel inertia identification operation.

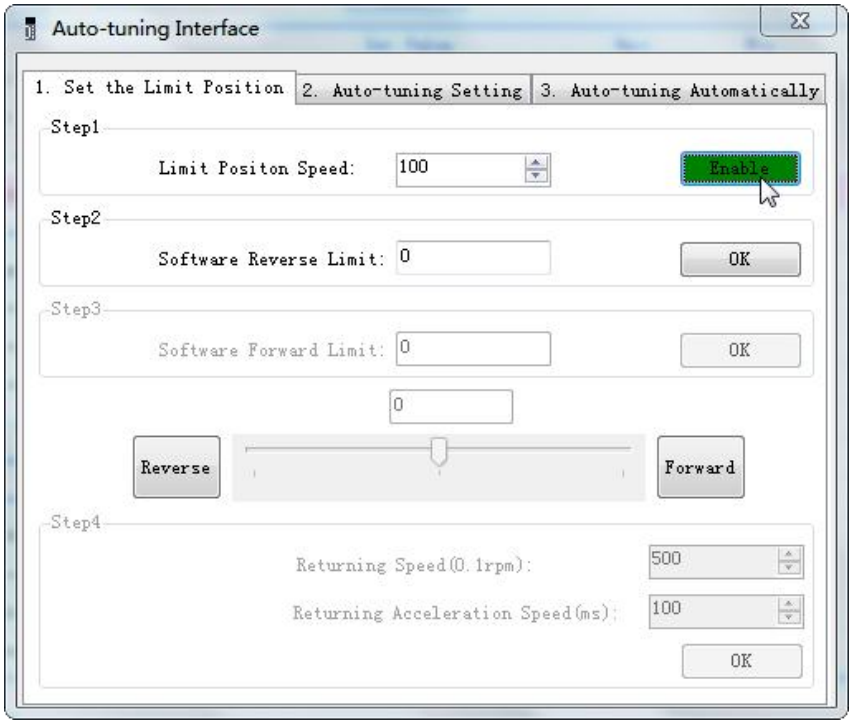
■ Alarm for inertia identification of panel

Error code	Meaning	Reasons and solutions	Reasons
Err-1	Motor Torque Saturation	① Initial inertia is too small. In adaptive mode, switch to large inertia mode P2-03.3=1 or the initial inertia of inertia identification P2-18 set to 2 times of the present value. ② The maximum speed is too high (P2-17), but it is recommended not to be less than 500 rpm. Low instruction speed will lead to inaccurate identification of inertia ratio. ③ torque limit too small(P3-28/29)	Initial inertia too small. Maximum speed too large. Torque limit too small.

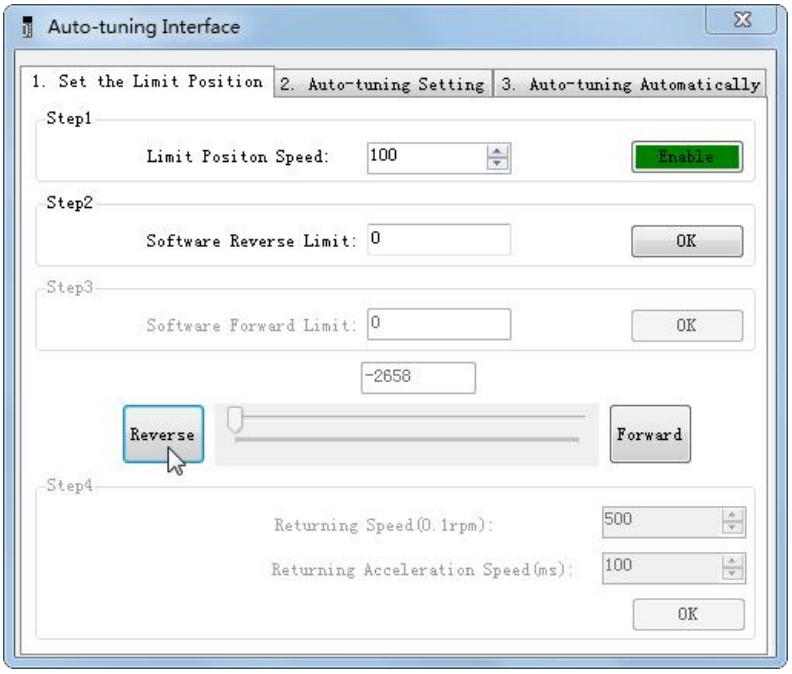
Err-2	Value error is too large when calculating the inertia	① The maximum speed limit is too small (P2-17), but it is recommended not to be less than 500 rpm. Low instruction speed will lead to inaccurate identification of inertia ratio. ② The presumed inertia trip is too small. It is suggested that the minimum for P2-15 should no be less than 50 (0.5 cycles). If the trip is too small, the identification of inertia ratio will be inaccurate. ③ Mechanism friction too large ④ Overshoot	The maximum speed limit is too small. The travel is too small. The friction of the mechanism is too large. The overrun occurs
Err-3	Driver internal trip calculation error	① The presumed inertia trip is too small. It is suggested that the minimum for P2-15 should no be less than 50 (0.5 cycles). If the trip is too small, the identification of inertia ratio will be inaccurate.	Contact us
Err-5	Unrestrained Vibration in the Process of Inertia Identification	Unhandled vibration occurs	Unhandled vibration occurs
Err-6	Driver isn't currently in BB state	① Enable have been opened. P5-20 can be set to 0 first. ② When the driver alarms, it will appear. Press ESC key to exit the auto-tuning interface to see if there is an alarm.	Will occur when enable is turned on or driver has alarm
Err-7	The driver alarms in the process of inertia identification	Driver has alarm, press ESC key to exit the auto-tuning interface, check the alarm code, first solve the alarm and then make inertia estimation.	Driver has alarm

Estimate the inertia through XinJeServo software

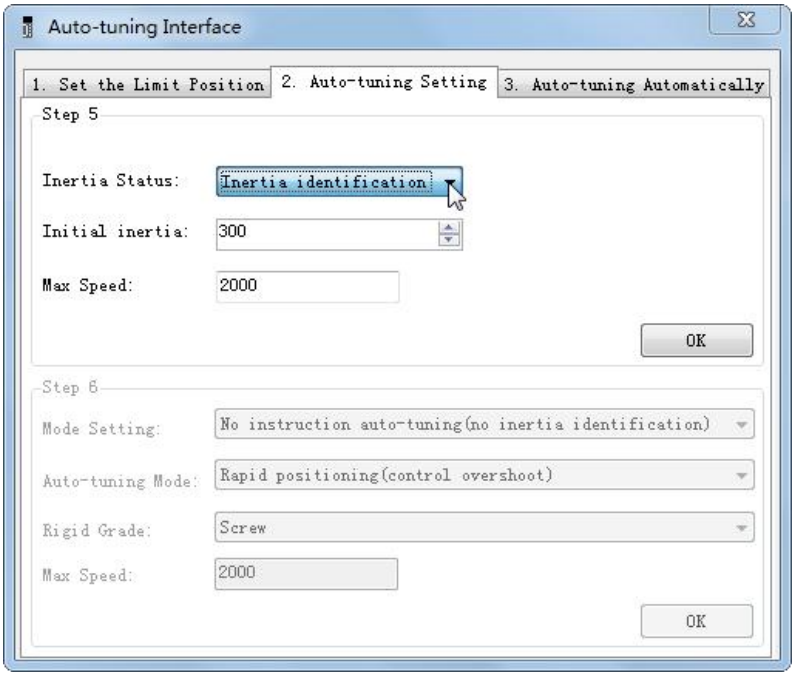
1. Click auto-tuning on the main interface of XinJeServo.



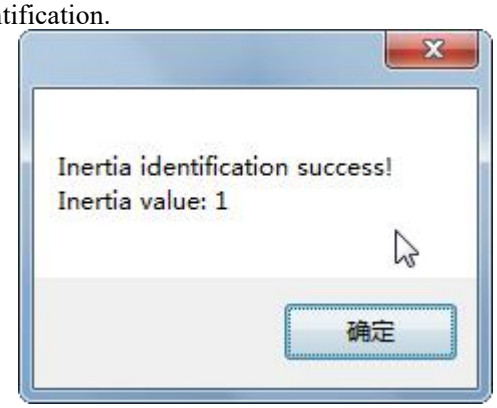
2. Select jog setting or manual setting to configure the inertia estimation trip.



3. Set the auto-tuning interface.



4. Click OK to start inertia identification.



Note:

(1) If the auto-tuning interface is closed directly, the driver only configures inertia ratio parameters.

(2) The detailed steps of XinJeServo's presumptive inertia refer to XinJeServo's help document.

6.3 Fast adjustment

6.3.1 Overview

Fast adjustment needs to set the moment of inertia of load first, then turn off the adaptive function. If the inertia doesn't match, it will cause oscillation alarm. The rapidly adjustable gain parameter belongs to the self-tuning mode.

6.3.2 Fast adjustment steps

1. Estimate the load inertia through servo driver panel or XinJeServo software, refer to 6.2.
2. Set the rigidity level P0-04.

Note: P2-01.0 is the first bit of P2-01

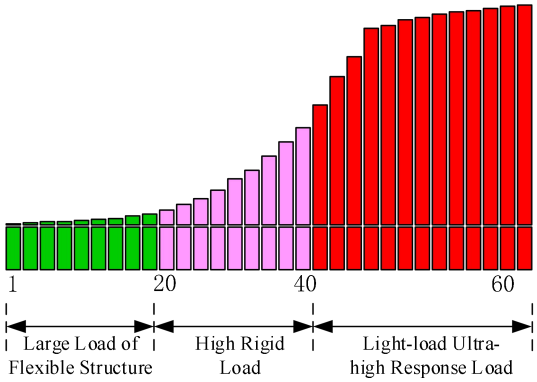
P2-01=n. 0 0 1 0
↳ P2-01.0

6.3.3 Rigidity level corresponding gain parameters

■ **Rigidity level**

P0-04 Rigidity level	P1-00 Speed loop gain	P1-01 Speed loop integral Time constant	P1-02 Position loop gain	P2-35 Torque instruction filter Time constant 1	P2-49 Model loop gain
0	15	50000	24	1326	24
1	20	39789	32	995	32
2	25	31831	40	796	40
3	30	26526	48	663	48
4	35	22736	56	568	56
5	45	17684	72	442	72
6	60	13263	96	332	96
7	75	10610	120	265	120
8	90	8842	144	221	144
9	110	7234	176	181	176
10	140	5684	224	142	224
11	180	4421	288	111	288
12	250	3183	400	80	400
13	300	2653	480	66	480
14	350	2274	560	57	560
15	400	1989	640	50	640
16	500	1592	800	40	800
17	600	1326	960	33	960
18	750	1061	1200	27	1200
19	900	884	1440	22	1440
20	1150	692	1840	17	1840
21	1400	568	2240	14	2240
22	1700	468	2720	12	2720
23	2100	379	3360	9	3360
24	2500	318	4000	8	4000
25	2800	284	4480	7	4480
26	3100	257	4960	6	4960
27	3400	234	5440	6	5440
28	3700	215	5920	5	5920
29	4000	199	6400	5	6400
30	4500	177	7200	5	7200
31	5000	159	8000	5	8000

The rigidity level should be set according to the actual load. The larger the P0-04 value, the greater the servo gain. If there is vibration in the process of increasing the rigidity level, it isn't suitable to continue to increase. If vibration suppression is used to eliminate vibration, it can try to continue to increase. The following is the recommended rigidity level of the load, for reference only.



Flexible structure large load: refers to the type of synchronous belt structure, large load inertia equipment.

High rigid load: refers to the mechanism of screw rod or direct connection, and equipment with strong mechanical rigidity.

Ultra-high response load under light load: refers to equipment with very small inertia, strong mechanical stiffness and high response.

Driver power	Default parameters	Rigidity level for firmware 3700 and up
100w~750w	P1-00=300 P1-01=2653 P1-02=480 P2-35=66 P2-49=480	13

6.3.4 Notes

- The gain parameters corresponding to the rigidity level can be independently fine-tuned in the fast adjustment mode.
- In order to ensure stability, the gain of model loops is small at low rigidity level, which can be added separately when there is high response requirement.
- When vibration occurs in fast adjustment, the torque instruction filter P2-35 can be modified. If it is ineffective, the mechanical characteristic analysis can be used and the relevant notch parameters can be set (refer to chapter 6.7 vibration suppression).
- Fast adjustment mode defaults to set a rigidity level. If the gain doesn't meet the mechanical requirements, please gradually increase or decrease the settings.

6.4 Auto-tuning

6.4.1 Overview

Auto-tuning is divided into internal instruction auto-tuning and external instruction auto-tuning.
Auto-tuning (internal instruction) refers to the function of automatic operation (forward and reverse reciprocating motion) of servo unit without instructions from the upper device and adjusting according to the mechanical characteristics in operation.
Auto-tuning (external instruction) is the function of automatically optimizing the operation according to the instructions from the upper device.
The automatic adjustments are as follows:

- Load moment of inertia
- Gain parameters (speed loop, position loop, model loop gain)
- Filter (notch filter, torque instruction filter)

6.4.2 Notes

Occasions that cannot be auto tuned

- Mechanical systems can only operate in one direction.

Setting occasions that are prone to failure

- Excessive load moment of inertia.
- The moment of inertia varies greatly during operation.
- Low mechanical rigidity, vibration during operation and failure of detection positioning.
- The running distance is less than 0.5 circles.

Preparations before auto-tuning

- Use position mode.
- Driver in bb state.
- Driver without alarm.
- The matching of the number of pulses per rotation and the width of positioning completion should be reasonable.

6.4.3 Operation tools

Internal instruction auto-tuning and external instruction auto-tuning can be executed by driver panel and XinJeServo software.

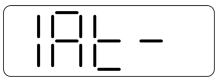
Auto-tuning mode	Operation tools	Limit
Internal instruction auto-tuning external instruction auto-tuning	XinJeServo software	Supported by each version of software
	Driver panel	Driver required firmware version 3700 and up

Note: please check the driver firmware version through U2-07.

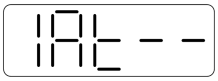
6.4.4 Internal instruction auto-tuning steps

Driver panel auto-tuning steps

1. The inertia identification is carried out, and the inertia estimation steps please refer to 6.2.4 Operation steps.
2. Enter F0-09, panel display is iat-.

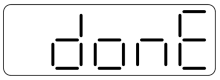


3. Press ENTER, panel display is iat--, servo is in enabled status right now.



4. Press INC or DEC, panel display is tune and flashing, enter auto-tuning status.

5. Driver will automatically send pulse instructions, if the auto-tuning is successful, the panel shows done and flashing.



6. Press STA/ESC to exit internal instruction auto-tuning.

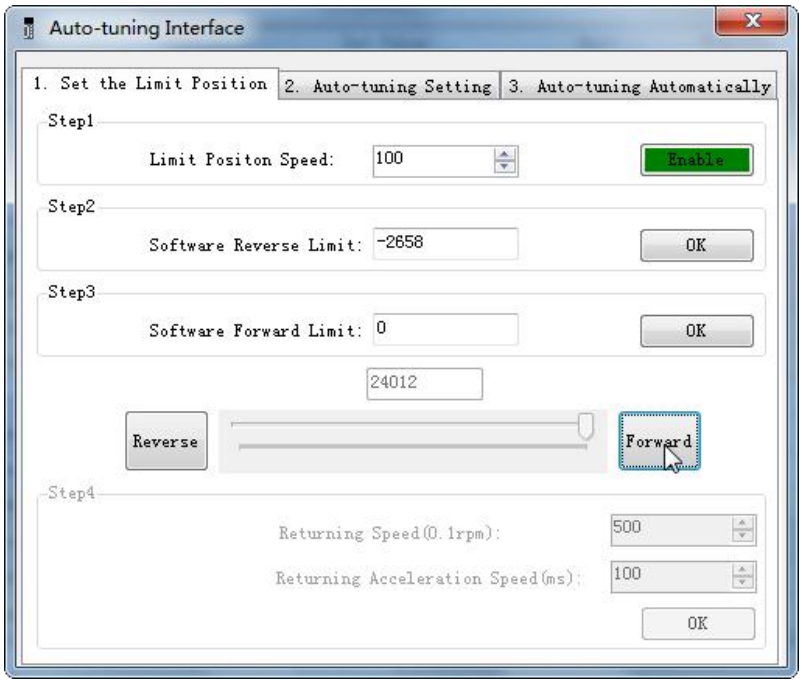
Note: In the process of auto-tuning, press STA/ESC will exit the auto-tuning operation and use the gain parameters at the exit time. If auto-tuning fails, it is necessary to initialize the driver before auto-tuning again.

■ Panel alarm in auto-tuning process

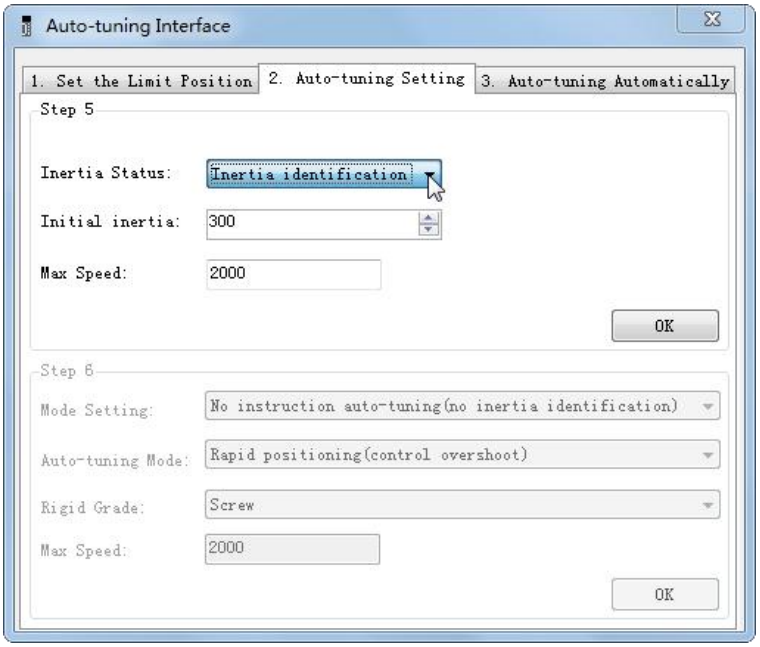
Error code	Meaning	Reasons
Err-1	Failure to search for optimal gain	Too large inertia ratio. Too weak rigidity of mechanism
Err-2	Overtrip alarm in auto-tuning process	Please make sure that there is no overrun and alarm before auto-tuning.
Err-6	Driver isn't in "bb" state at the time of operation	Please make sure the present status of driver
Err-7	Driver alarmed in auto-tuning process	The driver alarm occurs

XinJeServo software auto-tuning steps

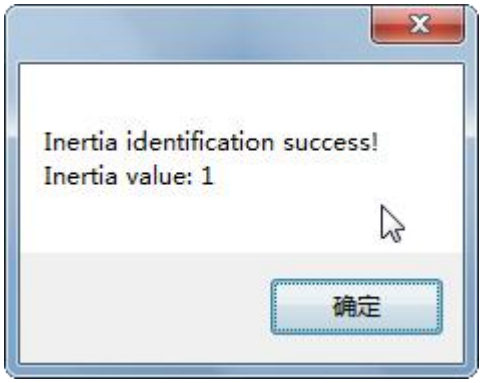
1. Click auto-tuning on the XinJeServo software main interface.
2. Set the auto-tuning trip in jog mode or manually.



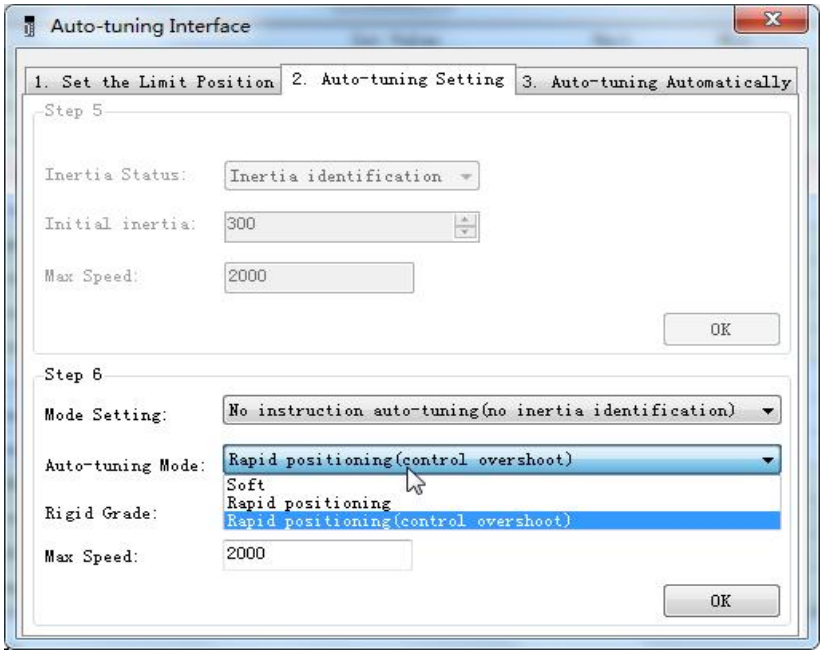
3. Set the auto-tuning interface.



4. Click OK to estimate the inertia.



5. Set the auto-tuning parameters.

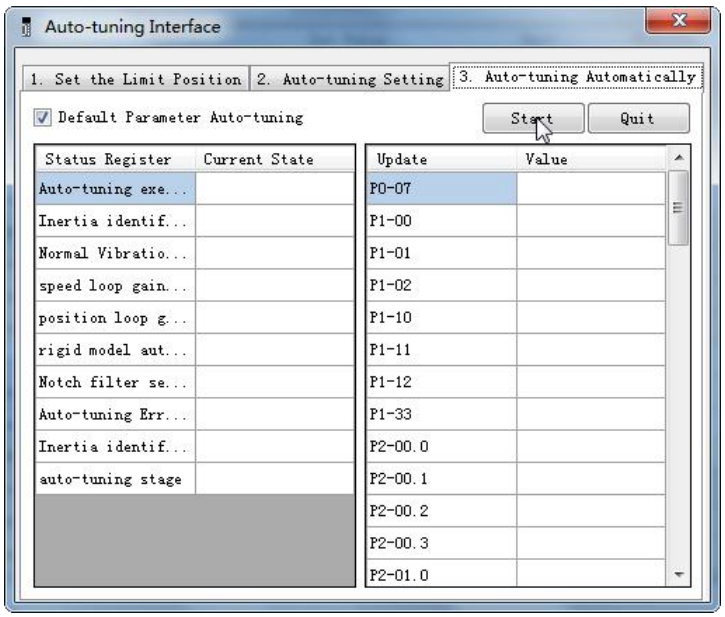


Load type	Description
Synchronous belt	Fit for the adjustment of lower rigidity mechanism such as synchronous belt mechanism.

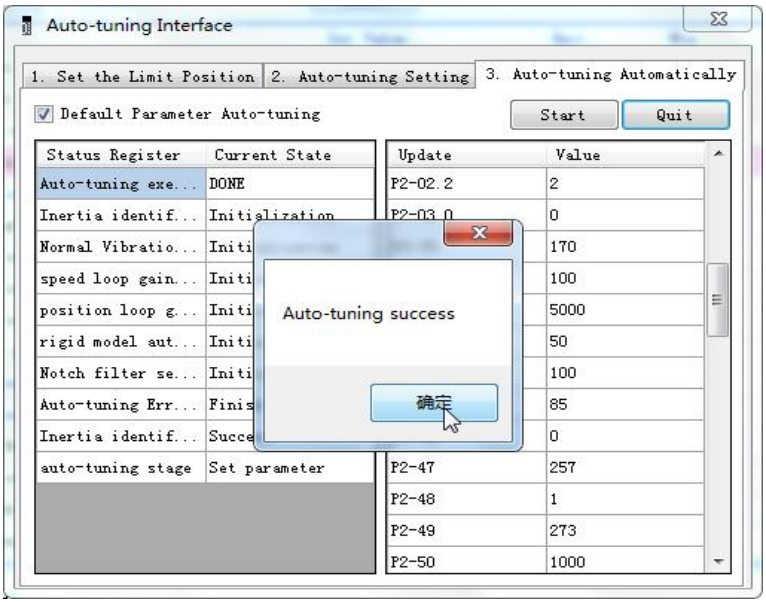
Screw rod	It is suitable for adjustment of higher rigidity mechanism such as ball screw mechanism. If there is no corresponding mechanism, please choose this type.
Rigid connection	It is suitable for the adjustment of rigid body system and other mechanisms with higher rigidity.

Auto-tuning mode	Description
Soft	Make a soft gain adjustment. Besides gain adjustment, notch filter is automatically adjusted.
Fast positioning	Make special adjustment for positioning purpose. Besides gain adjustment, the model loop gain and notch filter are automatically adjusted.
Fast positioning (control overshoot)	In the use of positioning, we should pay attention to adjusting without overshoot. Besides gain adjustment, the model loop gain and notch filter are automatically adjusted.

6. Start auto-tuning



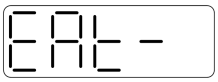
7. Wait for the end of the auto-tuning



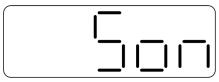
6.4.5 External instruction auto-tuning steps

Driver panel auto-tuning steps

1. The inertia identification is carried out and the step of inertia estimation please refers to the driver panel inertia estimation (6.2.4 Operation steps)
2. Enter parameter F0-08, it will show Eat- (Exteral Refrence Auto-tuning)

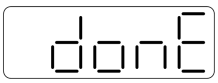


3. Short press ENTER, if the enabler isn't open, the panel displays Son and flickers, waiting for the enabler to open, if the enabler has been opened, skip this step.



4. Turn on the servo enabler, the panel displays tune and flickers, enter auto-tuning status.

5. The upper device starts to send pulse, if the auto-tuning is successful, it displays done and flickers.



6. Press STA/ESC to exit the external instruction auto-tuning.

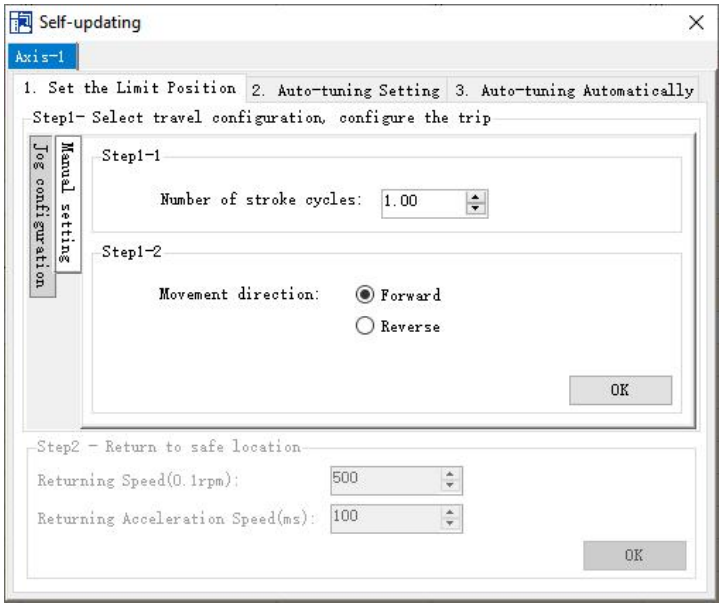
Note: In the auto-tuning process, press STA/ESC will exit the auto-tuning, and use the gain parameters at the exit moment.

■ Panel error alarm in auto-tuning process

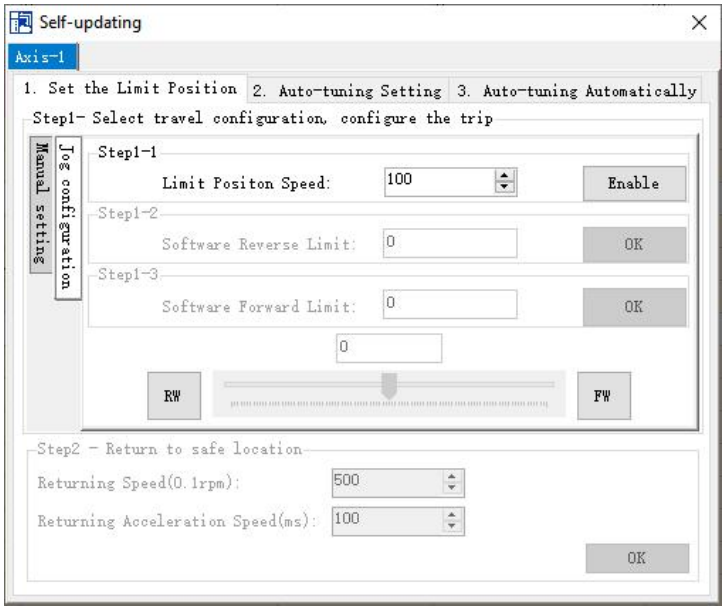
Error code	Meaning	Reasons
Err-1	Failure to search for optimal gain	Too large inertia ratio. Too weak rigidity of mechanism.
Err-2	①Overrun/alarm occurs during auto-tuning ②External instruction auto-tuning /Vibration suppression mode: servo shut down the enabler during auto-tuning	Please make sure that there is no overrun and alarm before auto-tuning. Make sure that the enable isn't closed during auto-tuning
Err-3	Current non-position control mode	Please auto-tune in position mode
Err-4	Unclosed adaptive function	Set P2-01.0 to 0 before auto-tuning
Err-7	Driver alarm during auto-tuning	Driver alarmed
Err-8	Positioning completion signal instability	Short instruction interval

XinJeServo software auto-tuning steps

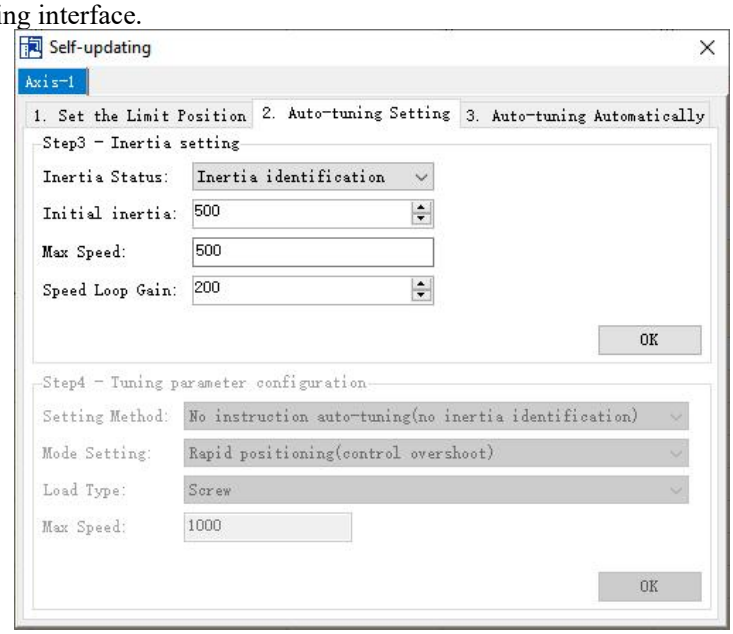
1. Click auto-tuning on the main interface of XinJeServo software.



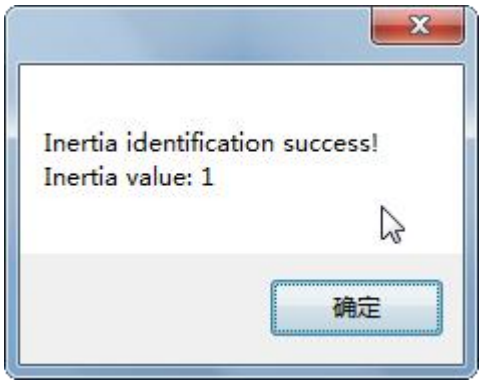
2. Select jog or manual setting to configure the trip of inertia identification.



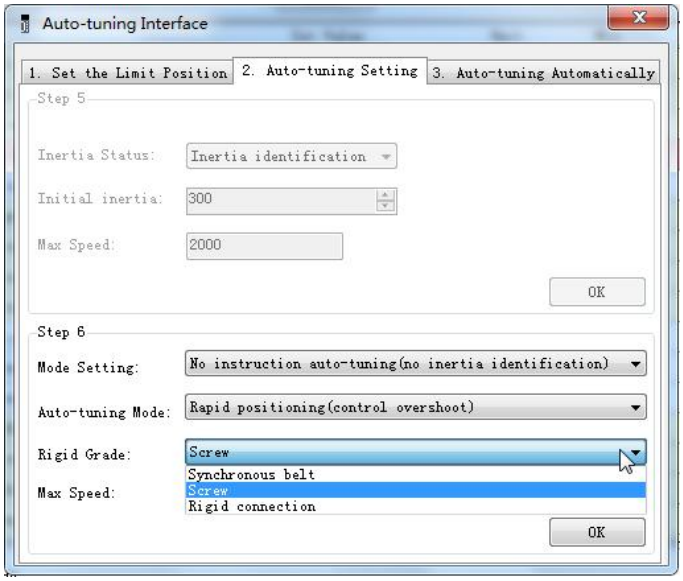
3. Set the auto-tuning interface.



4. Click [OK] to start the inertia identification.



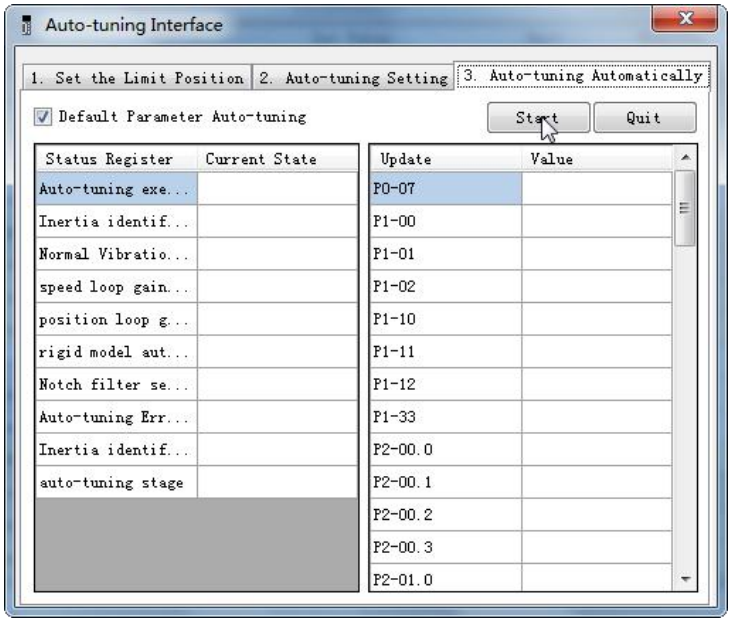
5. Configure the auto-tuning parameters.



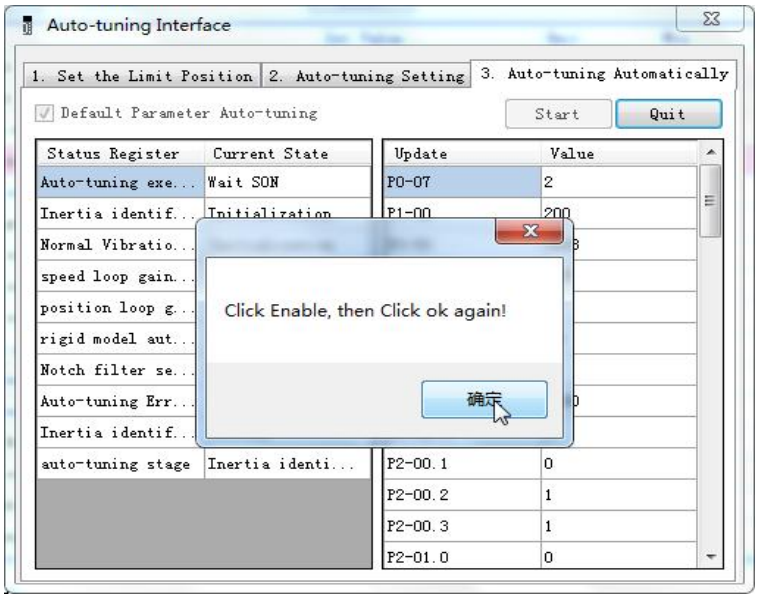
Auto-tuning mode	Description
Soft	Make a soft gain adjustment. Besides gain adjustment, notch filter is automatically adjusted.
Rapid positioning	Make special adjustment for positioning purpose. Besides gain adjustment, the model loop gain and notch filter are automatically adjusted.
Rapid positioning (control overshoot)	In the use of positioning, we should pay attention to adjusting without overshoot. Besides gain adjustment, the model loop gain and notch filter are automatically adjusted.

Load type	Description
Synchronous belt	Adjustment of lower rigidity mechanism such as synchronous belt
Screw	It is suitable for adjusting higher rigidity mechanism such as ball screw mechanism. If there is no corresponding mechanism, please choose this type.
Rigid connection	It is suitable for the adjustment of rigid body system and other mechanisms with higher rigidity.

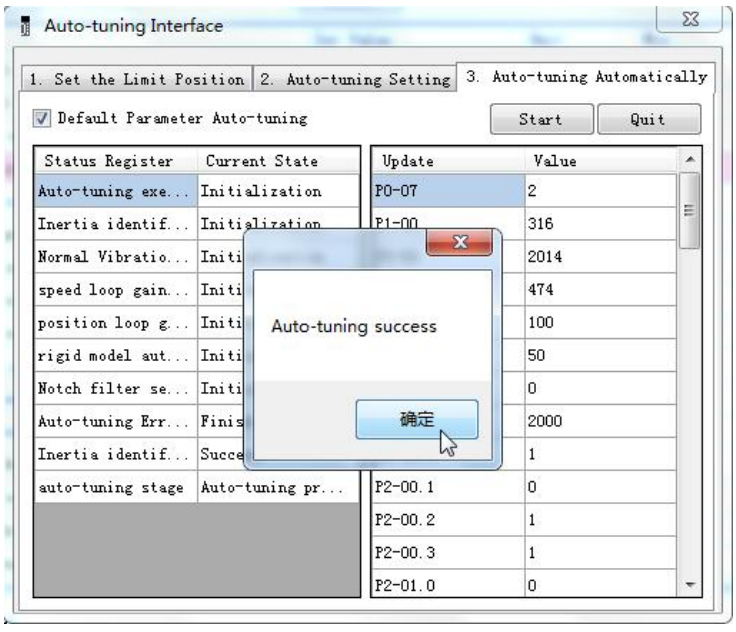
6. Start auto-tune



7. Open the servo enable, then click OK.



8. Auto-tuning is finished, click OK.



6.4.6 Related parameters

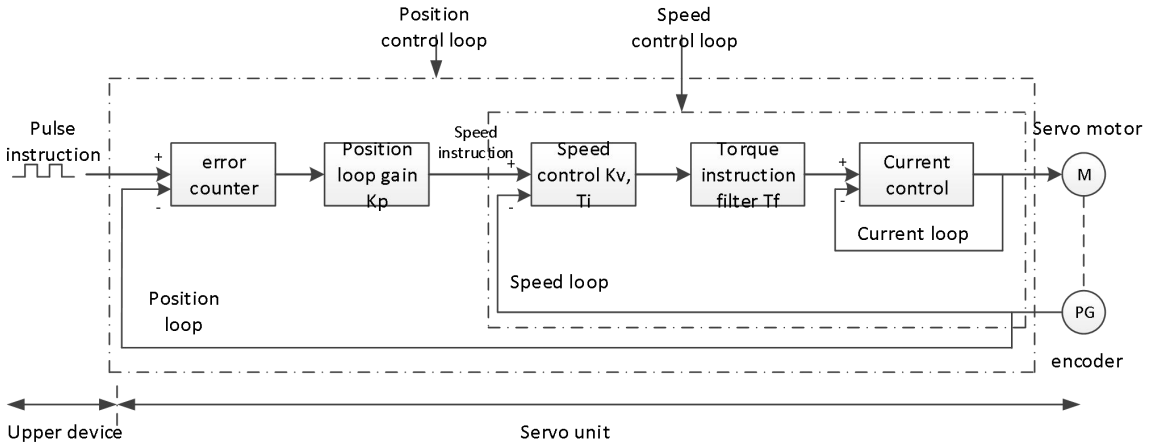
The following parameters may be modified during auto-tuning. Don't change them manually during auto-tuning.

Parameter	Name	Property	The influence of numerical value on gain after auto-tuning
P0-07	First inertia ratio	Gain performance parameters	Yes
P1-00	First speed loop gain		
P1-01	Integral time constant of the first speed loop		
P1-02	First position loop gain		
P2-00.0	Disturbance observer switch		
P2-01.0	Adaptive mode switch		
P2-35	Torque command filter time constant 1		
P2-41	Disturbance observer gain		
P2-47.0	model loop switch		
P2-49	model loop gain		
P2-55	model speed feedforward gain		
P2-60.0	Active vibration suppression switch		
P2-61	Active vibration suppression frequency		
P2-62	Active vibration suppression gain		
P2-63	Active vibration suppression damping		
P2-64	Active vibration suppression filter time 1		
P2-65	Active vibration suppression filter time 2		
P2-66	The second group of active vibration damping		
P2-67	Second group active vibration suppression frequency		
P2-69.0	First notch switch		
P2-69.1	Second notch switch		
P2-71	First notch frequency		
P2-72	First notch attenuation		
P2-73	First notch band width		
P2-74	Second notch frequency		
P2-75	Second notch attenuation		
P2-76	Second notch band width		
P2-17	Inertia identification and internal instruction auto-tuning max speed	Auto-tuning setting parameters	No
P2-86	auto-tuning jog mode		
P2-87	auto-tuning min limit position		
P2-88	auto-tuning max limit position		
P2-89	auto-tuning max speed		
P2-90	auto-tuning acceleration/deceleration time		

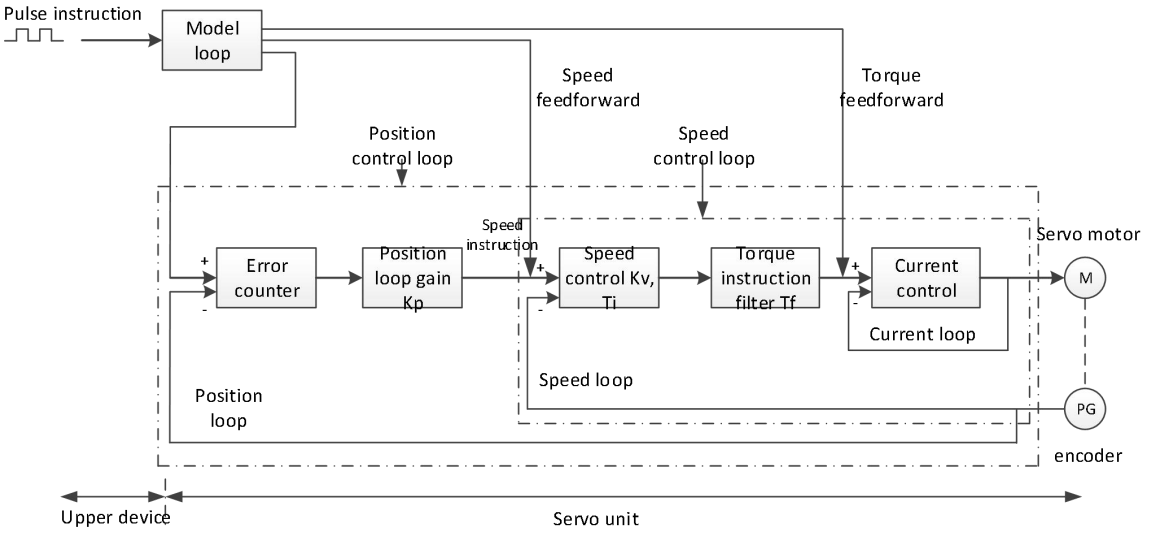
Note: P2-60~P2-63 are automatically modified in auto-tuning process. Users are not allowed to modify them manually. Manual modification may lead to the risk of system runaway.

6.5 Manual adjustment

6.5.1 Overview



Position control loop diagram (turn off the model loop)



Position control loop diagram (turn on the model loop)

The servo unit consists of three feedback loops (from inside to outside: current loop, speed loop, and position loop), and the more inner the loop, the more it needs to improve its responsiveness. If this principle is not followed, it will result in decreased responsiveness or vibration. The current loop parameters are fixed values to ensure sufficient responsiveness, and users don't need to adjust them.
Please use manual adjustment in the following occasions:

- When the expected effect can not be achieved by fast adjusting the gain
- When the expected effect isn't achieved by automatically adjusting the gain

6.5.2 Adjustment steps

In position mode, if the soft mode (P2-02.0=1) is selected by auto-tuning, the function of model loop will be turned off. in speed mode, the gain of position loop will be invalid.

Increasing response time

1. Reducing the filter time constant of torque instruction (P2-35)
2. Increasing Speed Loop Gain (P1-00)
3. Reducing Integral Time Parameter of Speed Loop (P1-01)
4. Increasing the gain of position loop (P1-02)
5. Improving Model Loop Gain (P2-49)

Reduce response, prevent vibration and overshoot

1. Reducing the Speed Loop Gain (P1-00)
2. Increasing Integral Time Constant of Speed Loop (P1-01)
3. Reducing the gain of position loop (P1-02)
4. Increase the filter time constant of the torque instruction (P2-35)
5. Reducing Model Loop Gain (P2-49)

6.5.3 Gain parameters for adjustment

The gain parameters that need to be adjusted:

P1-00 Speed Loop Gain

P1-01 Integral Time Constant of Speed Loop

P1-02 position loop gain

P2-35 Torque Instruction Filtering Time Constant

P2-49 Model Loop Gain

■ **Speed loop gain**

Because the response of the speed loop is low, it will become the delay factor of the outer position loop, so overshoot or vibration of the speed command will occur. Therefore, in the range of no vibration of mechanical system, the larger the setting value, the more stable the servo system and the better the responsiveness.

Parameter	Name	Default setting	Unit	Range	Modification	Effective
P1-00	Speed loop gain	300	0.1Hz	10~20000	Anytime	At once

■ **Integral time constant of speed loop**

In order to respond to small inputs, the speed loop contains integral elements. Because this integral factor is a delay factor for servo system, when the time constant is too large, it will overshoot or prolong the positioning time, which will make the response worse.

The relationship between the gain of the speed loop and the integral time constant of the speed loop is approximately as follows:

P1-00 × P1-01 = 636620

Parameter	Name	Default setting	Unit	Range	Modification	Effective
P1-01	integral time constant of speed loop	2653	0.01ms	15~51200	Anytime	At once

■ **Position loop gain**

When the model loop is invalid (P2-47.0=0), the responsiveness of the position loop of the servo unit is

determined by the gain of the position loop. The higher the position loop gain is, the higher the responsiveness is and the shorter the positioning time is. Generally speaking, the gain of position loop cannot be increased beyond the natural vibration number of mechanical system. Therefore, in order to set the position loop gain to a larger value, it is necessary to improve the rigidity of the machine and increase the number of inherent vibration of the machine.

Parameter	Name	Default setting	Unit	Range	Modify	Effective
P1-02	Position loop gain	480	0.1/s	10~20000	Anytime	At once

■ **Filter time constant of torque instruction**

When machine vibration may be caused by servo drive, it is possible to eliminate vibration by adjusting the filtering time parameters of the following torque instructions. The smaller the numerical value, the better the response control can be, but it is restricted by the machine conditions. When vibration occurs, the parameter is generally reduced, and the adjustment range is suggested to be 10-150.

Parameter	Name	Default setting	Unit	Range	Modify	Effective
P2-35	Filter time constant of torque instruction 1	66	0.01ms	0~65535	Anytime	At once

■ **Model loop gain**

When the model loop is valid (P2-47.0=1), the response of the servo system is determined by the gain of the model loop. If the gain of the model loop is increased, the responsiveness is increased and the positioning time is shortened. At this time, the response of the servo system depends on this parameter, not P1-02 (position loop gain). The gain of the model loop is only valid in position mode.

Parameter	Name	Default setting	Unit	Range	Modify	Effective
P2-49	Model loop gain	480	0.1Hz	10~20000	Anytime	Servo not moving

6.6 Adaptive

6.6.1 Overview

Adaptive function means that no matter what kind of machine and load fluctuation, it can obtain stable response through automatic adjustment. It starts to automatically adjust when servo is ON.

6.6.2 Notes

- When the servo unit is installed on the machine, it may produce instantaneous sound when the servo is ON. This is the sound when the automatic notch filter is set, not the fault. For the next time the servo is ON, no sound will be emitted.
- When the inertia of the motor exceeds the allowable load, the motor may produce vibration. At this time, please modify the adaptive parameters to match the present load inertia.
- In adaptive operation, in order to ensure safety, the adaptive function should be executed at any time when the servo enablement can be stopped or turned off urgently.

6.6.3 Operation steps

The factory settings are self-adaptive effective without modifying other parameters. The effectiveness of self-adaptation is controlled by the following parameters.

Parameter		Meaning	Default setting	Modification	Effective
P2-01	n.□□□0	Adaptive turn off	n.□□□0	Servo bb	Re-power on
	n.□□□1	Adaptive turn on			

6.6.4 Inertia mode and related parameters

The adaptive default parameter is defined as small inertia mode. If the load inertia far exceeds the allowable load inertia of the motor (such as 60 times inertia of the 60 motor), the adaptive large inertia mode can be turned on.

Parameter		Meaning	Default setting	Modification	Effective
P2-03	n.0□□□	Adaptive small inertia mode	n.0□□□	Servo bb	Re-power on
	n.1□□□	Adaptive large inertia mode			

Parameter	Meaning	Default setting	Modification	Effective
P2-05	Adaptive speed loop gain	400[Note1]	Servo bb	At once
P2-10	Adaptive speed loop integral	500	Servo bb	At once
P2-11	Adaptive position loop gain	100	Servo bb	At once
P2-07	Adaptive inertia ratio	0	Servo bb	At once
P2-08	Adaptive speed observer gain	60	Servo bb	At once
P2-12	Adaptive stable max inertia ratio	30	Servo bb	At once
P2-16	Adaptive motor rotor inertia coefficient	100	Servo bb	At once
P2-19	Adaptive bandwidth	50[Note2]	Change anytime	At once
P6-05	Adaptive large inertia mode speed loop gain	200	Servo bb	At once
P6-07	Adaptive large inertia mode inertia ratio	50	Servo bb	At once
P6-08	Adaptive large inertia mode speed observer gain	40	Servo bb	At once
P6-12	Adaptive large inertia mode max inertia ratio	50	Servo bb	At once

Note 1: DS5 series servo 750W and below driver default value is 400. Other power section default value is 200.
Note 2: DS5 series servo 400W and below driver default value is 70. Other power section default value is 50.

6.6.5 Recommended inertia ratio parameters

Under the adaptive default parameters, the load can only run steadily under a certain moment of inertia. If the load inertia is large, some parameters need to be adjusted. The recommended parameters are as follows (the parameters are modified under the default parameters).

Motor flange	Inertia	Parameters
40~90	Within 20 times inertia	Adaptive small inertia mode (default parameters)
	20-30 times inertia	Set P2-08=50, P2-12=40
	30-40 times inertia	Set P2-08=50, P2-12=40, P2-07=10
	40-50 times inertia	Set P2-08=50, P2-12=40, P2-07=30
	50-80 times inertia	Switch to adaptive large inertia mode or set P2-08=40, P2-12=50, P2-07=50
110~130	Within 10 times inertia	Adaptive small inertia mode (default parameters)
	10-15 times inertia	Set P2-08=50, P2-12=40
	15-20 times inertia	Switch to adaptive large inertia mode or set P2-08=40, P2-12=50, P2-07=50
180 and up	Within 5 times inertia	Adaptive small inertia mode (default parameters)
	5-10 times inertia	Set P2-08=50, P2-12=40
	10-20 times inertia	Switch to adaptive large inertia mode or set P2-08=40, P2-12=50, P2-07=50

Note: The large inertia parameters can still drive a smaller inertia load. For example, when the parameters of 50 times inertia are used in the mechanism of 20 times inertia, only the response will become worse.

6.6.6 Adaptive parameters effect

Parameter Small inertia/large inertia	Name	Default value	Range	Effect
P2-05/P6-05	Adaptive speed loop gain	400/200	200-400	Reduction can improve the inertia capability, but it will reduce the responsiveness, which has a greater impact on the responsiveness.
P2-07/P6-07	Adaptive load inertia ratio	0/50	0-200	Increase can greatly improve the inertia capacity without affecting the responsiveness. Too large will produce vibration.
P2-08/P6-08	Speed observer gain	60/40	30-60	Reducing P2-08 and increasing P2-12 can greatly improve the inertia capability, but it will reduce the responsiveness, which has a great impact on responsiveness.
P2-12/P6-12	Adaptive stable max inertia ratio	30/50	30-60	
P2-10	Adaptive speed loop integral time coefficient	500	200-larger	Adjust according to need, generally increase
P2-11	Adaptive	100	50-200	Adjust according to the need, increasing

	position loop gain coefficient			will make the response fast, reducing will make the response slow
P2-16	Adaptive motor rotor inertia coefficient	100	100-200	Increasing will improve the servo rigidity and enhance anti-disturbance ability, can solve operation jitter.
P2-19	Adaptive bandwidth	50~70	40-80	Increasing will improve the inertia capacity slightly, and has little effect on the responsiveness, to be an auxiliary parameter.

6.6.7 Invalid parameters when adaptive effective

When the adaptive function is effective (P2-01.0=1), the invalid parameters are shown as below:

Item	Parameters	Descriptions
Gain	P1-00 P1-05	First speed loop gain Second speed loop gain
	P1-01 P1-06	First speed loop integral time constant Second speed loop integral time constant
	P1-02 P1-07	First position loop gain Second position loop gain
	P2-49	Model loop gain
	P0-07 P0-08	First inertia ratio Second inertia ratio
	P5-36	/I-SEL inertia ratio switch

6.7 Vibration suppression

6.7.1 Overview

The mechanical system has a certain resonance frequency. When the servo gain is increased, the continuous vibration may occur near the resonance frequency of the mechanical system. Generally in the range of 400Hz to 1000Hz, it caused the gain can not continue to increase. Vibration can be eliminated by automatically detecting or manually setting the vibration frequency. After the vibration is eliminated, if the responsiveness needs to be improved, the gain can be further improved.

Note:

(1) Servo responsiveness will change after vibration suppression operation.

(2) Before performing the vibration suppression operation, please set the inertia ratio and gain parameters correctly, otherwise it can not be controlled properly.

6.7.2 Operation tools

Adjustment mode	Operation tools	Control mode	Operation steps	Limit
Adaptive mode	XinJeServo Mechanical Characteristic Analysis	Position mode	6.7.4 Vibration Suppression (PC Software)	Supported by each version of software
Auto-tuning mode	Panel vibration suppression		6.7.3 Vibration Suppression (Panel)	Driver firmware required 3700 and up
	XinJeServo Mechanical Characteristic Analysis		6.7.4 Vibration Suppression (PC Software)	Supported by each version of software
Auto-tuning/adaptive mode	Panel vibration suppression		6.7.6 vibration suppression (easyFFT)	Driver firmware required 3730 and up

Note: The firmware version of the drive is viewed through U2-07.

6.7.3 Vibration suppression (panel)

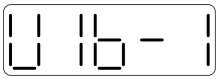
There are two modes of panel vibration suppression, mode 1 (vib-1) and mode 2 (vib-2).

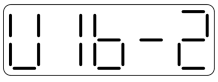
■ Difference between Two Kinds of Vibration Suppression

Mode	Display	Changed parameters
Mode 1	vib-1	Only the parameters related to vibration suppression will be changed.
Mode 2	vib-2	It will change the parameters of vibration suppression and the gain of speed loop.

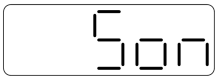
The operation steps:

1. Enter F0-10 in auto-tuning mode, the panel shows vib-1 or enter F0-11, the panel shows vib-2.

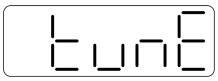


or


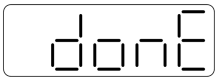
2. Short press ENTER, panel shows Son and flashes, turn on the enabler by manual.



3. After turn on the enabler, panel shows tune and flickers, enter auto-tuning process.



4. The upper device starts to send pulses, then it will show done and flicker.



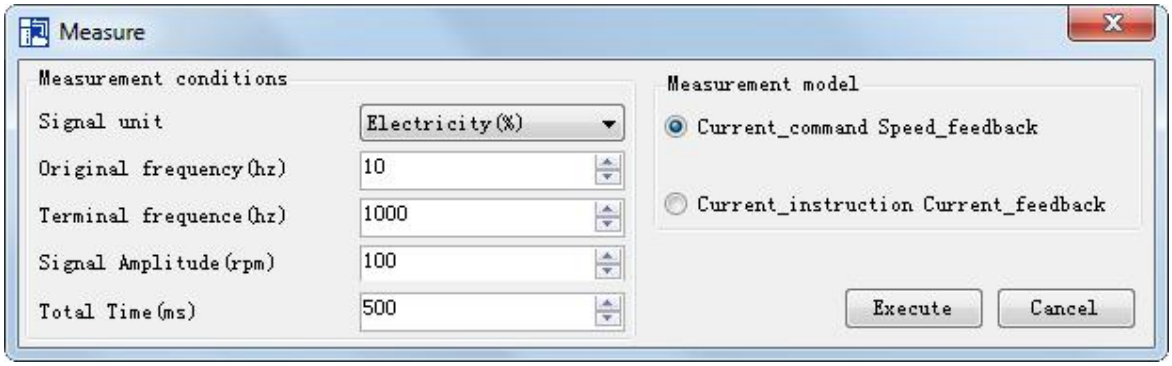
5. Short press STA/ESC to exit.
6. Vibration suppression parameters are automatically written into the second and first notches (the second notches are preferred when there is only one vibration point). The related parameters are detailed in 6.7.7 Notch filter.

■ Fault alarm of panel in vibration suppression process

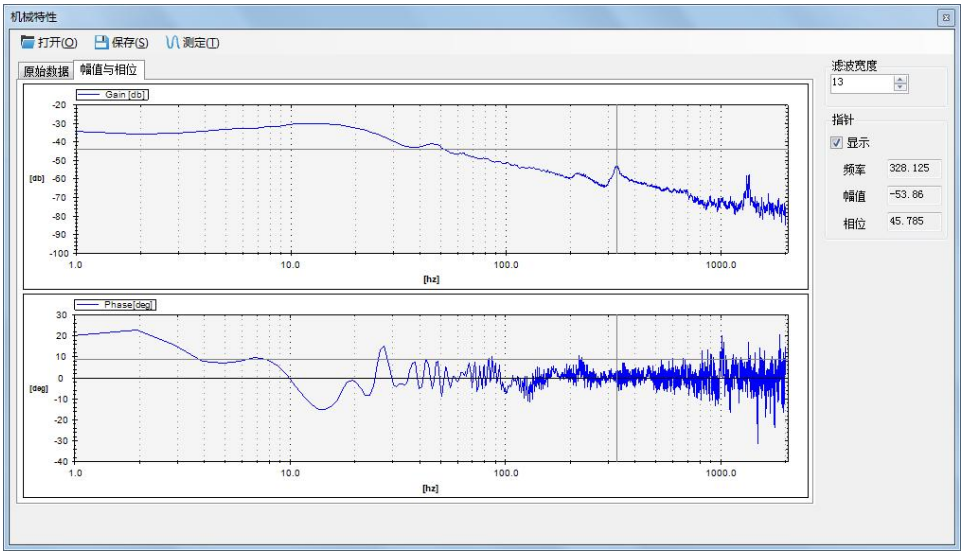
Error code	Meaning	Reasons
Err-1	Failure to search for optimal gain	Too large inertia ratio. Too weak rigidity of mechanism
Err-2	(1) Overrun/alarm occurs during auto-tuning (2)External instruction auto-tuning / Vibration Suppression Mode: Servo turns off the Enabler in auto-tuning process	Please make sure that there is no overrun and alarm before auto-tuning. Make sure that the enabler isn't turned off when auto-tuning
Err-3	Non-position control mode	Please auto-tune in position mode
Err-4	Not turn off the adaptive function	Please set P2-01.0 to 0, then auto-tune
Err-7	Driver alarm in auto-tuning process	Driver alarmed
Err-8	Positioning Completion Signal Instability	Short instruction interval

6.7.4 Vibration suppression (PC software)

1. Open XinJeServo software, click mechanical properties.
2. Click [measure].



3. Set the measure conditions, then click [execute].
4. Select [amplitude and phase].



5. Set the filter width (to see resonance frequencies clearly), find the resonance frequency.
6. Notch parameters need to be set manually. Refer to 6.7.7 Notch filter for details.

As an example, through the analysis of mechanical characteristics, the resonance frequency is 328 Hz, and the third notch filter can be used. The parameters are as follows:

P2-69 = n.1000 P2-77 = 328

Note: In both adaptive and auto-tuning modes, if mechanical characteristic analysis is used, the notch can be set manually. If there are multiple resonance points, the third to fifth notch can be configured in turn.

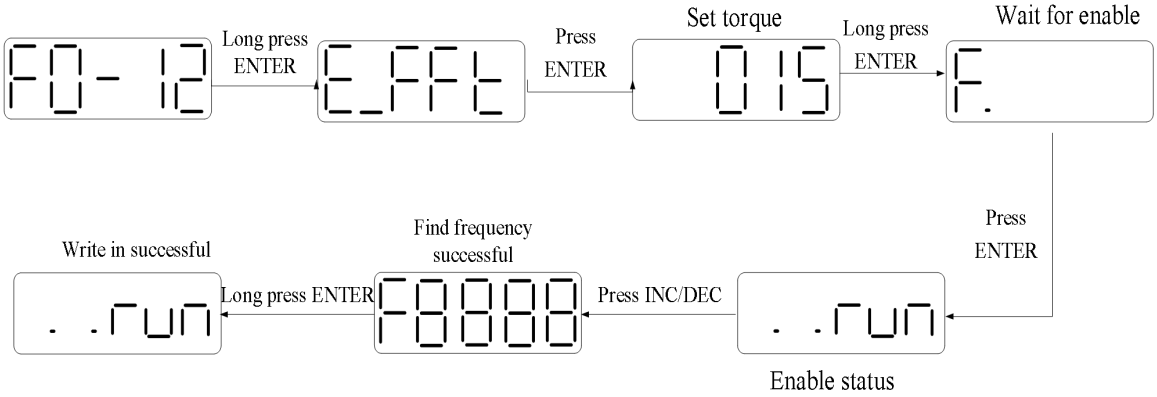
6.7.5 Vibration suppression (manual setting)

If the resonance frequency of the mechanical system is known, the vibration can be eliminated by setting the vibration frequency manually. Please configure the third to fifth notches. The related parameters are detailed in 6.7.7 Notch filter.

6.7.6 Vibration suppression (easyFFT)

This function can analyze the mechanical characteristics through the parameter F0-12 on the servo operate panel, find out the mechanical resonance frequency and realize the vibration suppression.

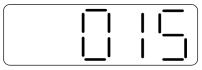
The complete operation process is shown in the figure below:



The operation steps are described as follows:

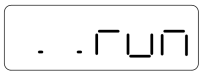
1. F0-12, long press【ENTER】to enter EasyFFT function, it will show "E_FFt".

2. Press 【ENTER】 to enter torque setting interface, it will show the current setting torque, which is the value of P6-89. Press【INC】,【DEC】to increase or decrease torque command. When increasing the torque command, it is recommended to increase it a little bit to avoid severe vibration of the equipment.



3. After setting the torque command, long press【ENTER】, enter "read to enable" status, it will show ‘F".

4. Press【ENTER】, enable, it will show "..run".



5. Press【INC】,【DEC】 to run forward or reverse and find the resonance frequency. "E_FFt" will shining on the panel when operation. If the resonance frequency is found, it will show "Fxxxx", "xxxx" is the resonance frequency. If failed, it will show "F----".

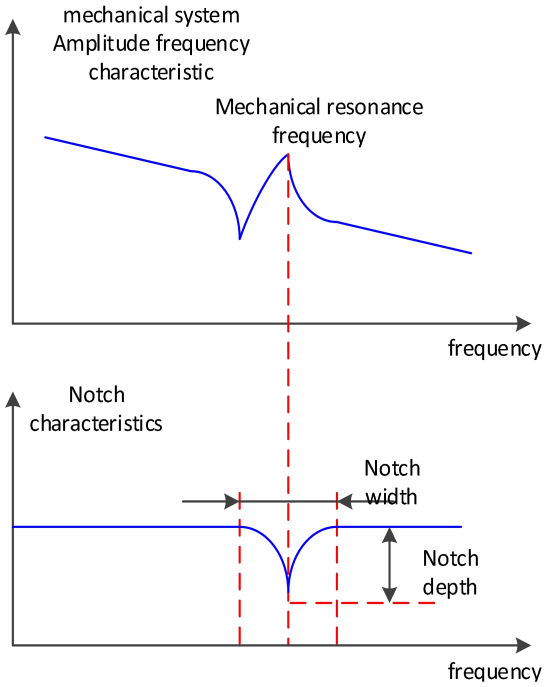
6. Whatever it shown "Fxxxx" or "F----", press【INC】,【DEC】 can find the resonance frequency again. If the resonance frequency is found, long press【ENTER】to set the resonance frequency in the notch filter of servo driver.

Note: For above each step, press STA/ESC can return to the last step or exit.

6.7.7 Notch filter

Notch filter can suppress mechanical resonance by reducing the gain at a specific frequency. After the notch filter is set correctly, the vibration can be effectively suppressed and the servo gain can be continuously increased.

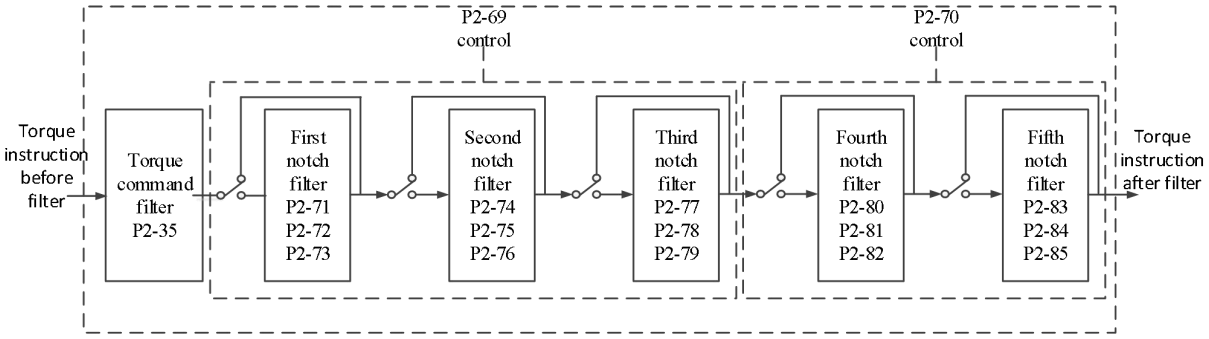
The principle diagram of notch filter is as follows:



Principle diagram of notch filter

The servo driver has five sets of notch filters, each with three parameters, notch frequency, notch attenuation and notch bandwidth. The first and second notches are set automatically, and the third, fourth and fifth are set manually.

The torque instruction filter and notch filter are in series in the system. As shown in the figure below, the switch of the notch filter is controlled by P2-69 and P2-70.



Parameter		Meaning	Default setting	Change	Effective
P2-69	n.□□□0	First notch off	n.□□□0	Anytime	At once
	n.□□□1	First notch on			
	n.□□0□	Second notch off	n.□□0□	Anytime	At once
	n.□□1□	Second notch on			
	n.0□□□	Third notch off	n.0□□□	Anytime	At once
	n.1□□□	Third notch on			
P2-70	n.□□□0	Fourth notch off	n.□□□0	Anytime	At once
	n.□□□1	Fourth notch on			
	n.□□0□	Fifth notch off	n.□□0□	Anytime	At once
	n.□□1□	Fifth notch on			

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P2-71	First notch frequency	5000	Hz	50~5000	Anytime	At once
P2-72	First notch attenuation	70	0.1dB	50~1000	Anytime	At once
P2-73	First notch bandwidth	0	Hz	0~1000	Anytime	At once
P2-74	Second notch frequency	5000	Hz	50~5000	Anytime	At once
P2-75	Second notch attenuation	70	0.1dB	50~1000	Anytime	At once
P2-76	Second notch bandwidth	0	Hz	0~1000	Anytime	At once
P2-77	Third notch frequency	5000	Hz	50~5000	Anytime	At once
P2-78	Third notch attenuation	70	0.1dB	50~1000	Anytime	At once
P2-79	Third notch bandwidth	0	Hz	0~1000	Anytime	At once
P2-80	Fourth notch frequency	5000	Hz	50~5000	Anytime	At once
P2-81	Fourth notch attenuation	70	0.1dB	50~1000	Anytime	At once
P2-82	Fourth notch bandwidth	0	Hz	0~1000	Anytime	At once
P2-83	Fifth notch frequency	5000	Hz	50~5000	Anytime	At once
P2-84	Fifth notch attenuation	70	0.1dB	50~1000	Anytime	At once
P2-85	Fifth notch bandwidth	0	Hz	0~1000	Anytime	At once

Note:

1. In the adaptive mode, if the vibration is detected, the second notch filter will be automatically configured.
2. In the auto-tuning mode, the second and first notches will be automatically configured if the vibration is detected (the second notches will be preferentially opened when there is only one vibration point).
3. Whether in self-adaptive or auto-tuning mode, if the mechanical characteristic analysis is sued, it belongs to manual setting of notches, please configure the third to fifth notches.

6.8 Gain adjustment

6.8.1 Model loop control

In the self-tuning mode, in addition to the gain of speed loop and position loop, there is also the gain of model loop, which has a great influence on the servo response. When the model loop isn't open, the servo responsiveness is determined by the position loop gain. When the model ring is open, the servo responsiveness is determined by the model loop gain. The model loop is equivalent to the feedforward function in the driver control loop. Refer to 6.5 Manual adjustment for its specific function.
When the self-tuning mode is soft, the model loop function will be automatically off. When the self-tuning mode selects fast positioning or fast positioning (control overshoot), the model loop function will be automatically turned on.

Self-tuning mode:

Parameter		Meaning	Default setting	Modify	Effective
P2-02	n.□□□1	Soft	n.□□□3	Any time	At once
	n.□□□2	Fast positioning			
	n.□□□3	Quick positioning (control overshoot)			

Selection of self-tuning mode:
(1) Soft (P2-02.0 = 1):
This mode doesn't turn on the gain of the model loop, and the operation is soft. It is suitable for occasions with insufficient mechanical rigidity and low response requirements.
(2) Quick positioning (P2-02.0 = 2):
This method has the fastest response to setting parameters, but has no special suppression on overshoot.
(3) Quick positioning (control overshoot) (P2-02.0 = 3):
In this way, the setting parameter response is fast, which will inhibit the overshoot.

Load type	Explanation
Synchronous belt	The adjustment is suitable for the mechanism with lower rigidity such as synchronous belt mechanism.
Lead screw	It is suitable for the adjustment of high rigidity mechanism such as ball screw mechanism. Please select this type when there is no corresponding structure.
Rigid connection	The adjustment is suitable for rigid body system and other mechanisms with high rigidity.

Self-tuning mode	Explanation
Soft	Soft gain adjustment. In addition to gain adjustment, the notch filter is also adjusted automatically
Fast positioning	Make special adjustment for positioning purpose. In addition to gain adjustment, the model loop gain and notch filter are also adjusted automatically
fast positioning (control overshoot)	Pay attention to the adjustment of no overshoot in the positioning purpose. In addition to gain adjustment, the model loop gain and notch filter are also adjusted automatically

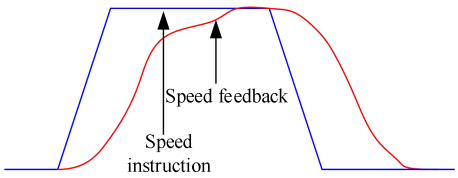
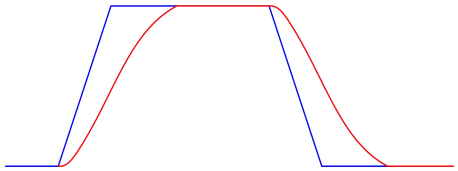
Parameter		Meaning	Default setting	Modification	Effective
P2-02	n.□□□1	Soft	n.□□□3	Anytime	at once
	n.□□□2	Fast positioning			
	n.□□□3	Fast positioning (control overshoot)			

Model loop function

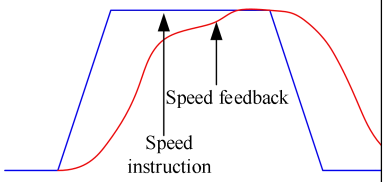
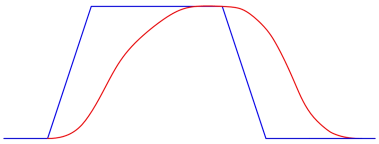
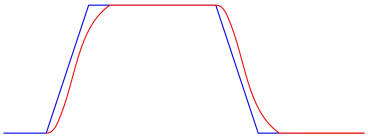
Parameter		Meaning	Default setting	Modification	Effective
P2-47	n.□□□0	Model loop turn off	n.□□□0	Anytime	At once
	n.□□□1	Model loop turn on			

Taking DS5 series servo auto-tuning mode and using 750W servo 5 times load inertia as an example:

■ Model loop function turns off (soft mode)

Low Rigidity and Low Response	High Rigidity and Medium Response
	
Load inertia ratio P0-07: 500%	
speed loop gain P1-00: 200	speed loop gain P1-00: 800
speed loop integral P1-01: 3300	speed loop integral P1-01: 825
position loop gain P1-02: 200	position loop gain P1-02: 700
Phenomenon: running jitter, slow response	Phenomenon: smooth operation and fast response

■ Model loop function turns on (fast positioning or fast position(control overshoot))

Low Rigidity and Low Response	High Rigidity and Low Response	High Rigidity and High Response
		
Load inertia ratio P0-07: 500%		
speed loop gain P1-00: 200	speed loop gain P1-00: 800	speed loop gain P1-00: 800
speed loop integral P1-01: 3300	speed loop integral P1-01: 825	speed loop integral P1-01: 825
position loop gain P1-02: 200	position loop gain P1-02: 700	position loop gain P1-02: 700
Model loop gain P2-49: 300	Model loop gain P2-49: 300	Model loop gain P2-49: 4000
Phenomenon: running jitter, slow response	Phenomenon: smooth operation and slow response	Phenomenon: smooth operation and fast response

Note: The above curves only show the effect of the parameters, not the real running curves.

6.8.2 Torque disturbance observation

Disturbance observer can reduce the influence of external disturbance on servo system and improve the anti-disturbance ability by detecting and estimating the external disturbance torque of the system and compensating the torque command.
If the soft mode is selected in the auto-tuning mode, the disturbance observer will be closed automatically, and the gain of the disturbance observer will not change. If the fast positioning or fast positioning (control overshoot) is selected, the disturbance observer will be opened automatically, and the gain of the disturbance observer will be modified to 85. The relevant parameters of this function no need to be set manually by users.

Parameter		Meaning	Default setting	Modification	Effective
P2-00	n.□□□0	Turn-off of disturbance observer	n.□□□0	Servo bb	At once
	n.□□□1	Turn-on of disturbance observer			

Parameter	Meaning	Default setting	Unit	Setting range	Modify	Effective
P2-41	Disturbance observer gain	85	%	0~100	Anytime	At once

6.8.3 Gain adjustment parameters

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P1-00	First speed loop gain	<=20P7:300 >=21P0:200	0.1Hz	10~20000	Servo bb	At once
P1-01	Integral time constant of the first velocity loop	<=20P7:2122 >=21P0:3183	0.01ms	15~51200	Servo bb	At once
P1-02	First position loop gain	<=20P7:300 >=21P0:200	0.1/s	10~20000	Servo bb	At once
P1-05	Second speed loop gain	200	0.1Hz	10~20000	Servo bb	At once
P1-06	Second velocity loop integral constant	3300	0.01ms	15~51200	Servo bb	At once
P1-07	Second position loop gain	200	0.1/s	10~20000	Servo bb	At once

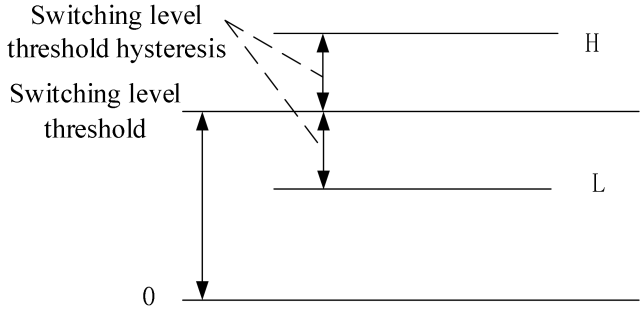
6.8.4 Gain switch

Parameter		Meaning	Default setting	Modify	Effective
P1-14	n.□□□0	0- SI terminal switching gain is valid (the gain switching condition parameter isn't valid) 1- perform gain switching according to gain switching conditions 2 - reserved	0	Servo bb	At once
	n.□□□1	n.□□X□: Gain switching condition selection 0 - first gain fixed 1-switching by external SI terminals 2 - large torque command 3 - large speed command 4 - speed command changes greatly 5 - [reserved]- fixed to the first gain 6 - large position deviation 7 - position command 8 - positioning completed 9 - large actual speed A-position command + actual speed			
P1-15		Gain switching waiting time	5	Servo bb	At once
P1-16		Gain switching level threshold	50	Servo bb	At once
P1-17		Hysteresis of gain switching level threshold	30	Servo bb	At once
P1-18		Position loop gain switching time	2	Servo bb	At once

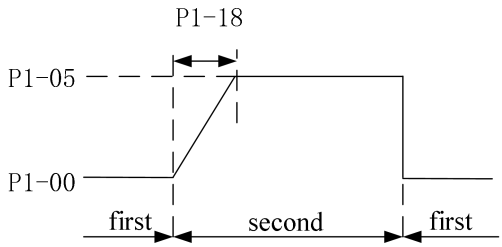
Note:

(1) The gain switching waiting time is effective only when the second gain is switched back to the first gain.

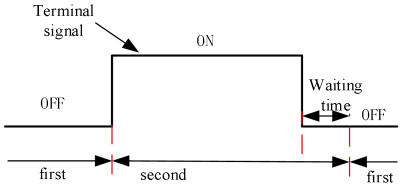
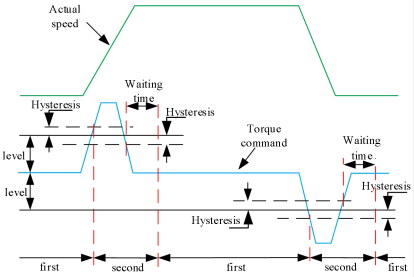
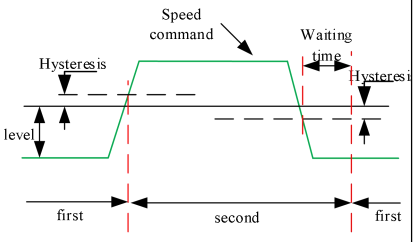
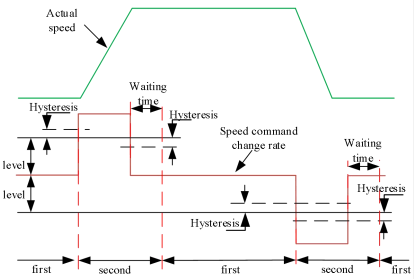
(2) The definition of gain switching level threshold hysteresis:

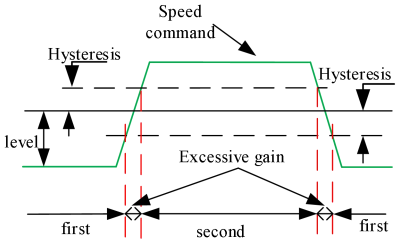
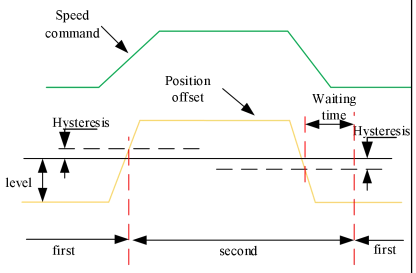
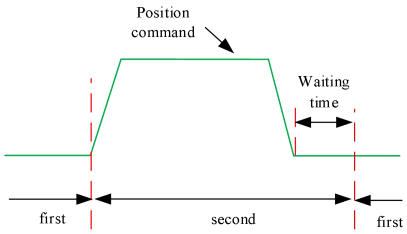
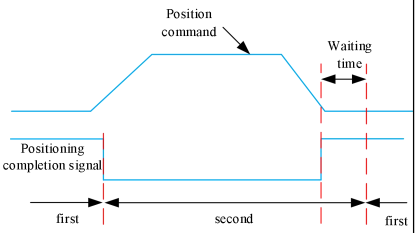


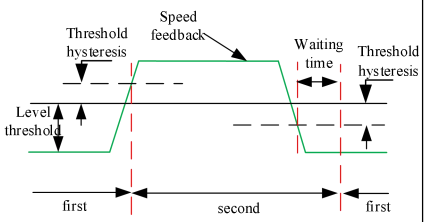
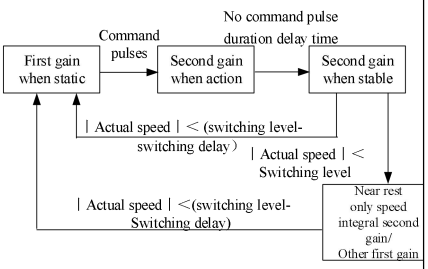
(3) The definition of position gain switching time:



(4) Gain switching conditions:

Gain switching condition				Parameter		
P1-14.1	Condition	Diagram	Notes	P1-15 waiting time	P1-16 Level threshold	P1-17 Threshold hysteresis loop
0	The first gain fixed	-	-	invalid	invalid	invalid
1	Terminal switching		Switch the gain through G-SEL signal: G-SEL invalid, first group of gain, G-SEL valid, second group of gain	valid	invalid	invalid
2	Torque command		When the absolute value of torque command exceeds (level + hysteresis) [%] at the last first gain, switch to the second gain. At the last second gain, the absolute value of the torque command is less than (level - hysteresis) [%], and then wait until P1-15 remain in this state, return to the first gain.	valid	valid (%)	valid (%)
3	Speed command		When the absolute value of the speed command exceeds (level + hysteresis) [RPM] at the last first gain, switch to the second gain. At the last second gain, when the absolute value of the speed command is less than (level - hysteresis) [RPM], wait until P1-15 remain in this state, and return to the first gain.	valid	valid	valid
4	Speed command change rate		At the last first gain, when the absolute value of the speed command change rate exceeds (level + hysteresis) [10rpm/s], switch to the second gain. At the last second gain, when the absolute value of the speed command change rate is less than (level-hysteresis) [10rpm/s], wait until P1-15 remain in this state, and return to the first gain.	valid	valid (10rpm/s)	valid (10rpm/s)

Gain switching condition				Parameter		
5	Speed command high and low speed threshold [not supported temporarily]		At the last first gain, when the absolute value of the speed command exceeds (level-hysteresis) [RPM], switch to the second gain, and the gain gradually changes. When the absolute value of the speed command reaches (level + hysteresis) [RPM], the gain completely changes to the second gain. At the last second gain, when the absolute value of the speed command is lower than (level + hysteresis) [RPM], it starts to return to the first gain, and the gain changes gradually. When the absolute value of the speed command reaches (level-hysteresis) [RPM], the gain completely returns to the first gain.	invalid	valid (rpm)	valid (rpm)
6	Position offset		Valid only in position mode (other modes are fixed as the first gain) When the absolute value of position deviation exceeds (level + hysteresis) [encoder unit] at the last first gain, switch to the second gain. When the absolute value of the position deviation is less than (level-hysteresis) [encoder unit] at the last second gain, wait until P1-15 remain in this state, and return to the first gain.	valid	valid (encoder unit)	valid (encoder unit)
7	Position command		Valid only in position mode (other modes are fixed as the first gain) At the last first gain, if the position command isn't 0, switch to the second gain. At the last second gain, if the position command is in the state of 0 which remains in the waiting time P1-15, it returns to the first gain.	valid	invalid	invalid
8	Positioning completion		Valid only in position mode (other modes are fixed as the first gain) At the last first gain, if the positioning isn't completed, switch to the second gain. At the last second gain, if the state of positioning completion remains in this state for the waiting time	valid	invalid	invalid

Gain switching condition				Parameter		
			P1-15, the first gain is returned. Note: it is necessary to set the positioning completion detection mode according to P5-01.			
9	Actual speed		Valid only in position mode (other modes are fixed as the first gain): At the last first gain, the absolute value of the actual speed exceeds (level + hysteresis) [RPM], switching to the second gain. At the last second gain, when the absolute value of the inter speed is less than (level-hysteresis) [RPM], wait until P1-15 remain in this state, and return to the first gain.	valid	valid (rpm)	valid (rpm)
A	Position command+ actual speed		Valid only in position mode (other modes are fixed as the first gain): At the last first gain, if the position command isn't 0, switch to the second gain. At the last second gain, the state in which the position command is 0 within the waiting time P1-15, maintains the second gain. When the position command is 0 and the waiting time P1-15 reached, if the absolute value of the actual speed is less than (level) [RPM], the speed integral time constant is fixed at the second speed loop integral time constant (P1-07), and the others return to the first gain. If the absolute value of the actual speed is less than (level-hysteresis) [RPM], the speed integral also returns to the integral time constant of the first speed loop (P1-02).	valid	valid (rpm)	valid (rpm)

6.8.5 Speed loop PI-PI mode switching

6.8.5.1 Speed control mode switching

Parameter		Meaning	Default setting	Modify	Effective
P1-26	n.□□□0	0: Don't use mode switching 1: Switching condition based on internal torque command	0	Servo bb	At once

		2: Switching condition based on speed command 3: Switching condition based on acceleration 4: Switching condition based on position deviation			
	n.□□0□	0: Clear the integral of 0asr 1: Keep the points unchanged and no longer accumulate			
P1-27		Mode Switching - Torque Command Threshold	200	Servo bb	At once
P1-28		Mode Switching - Speed Command Threshold	0	Servo bb	At once
P1-29		Mode Switching - Acceleration Threshold	0	Servo bb	At once
P1-30		Mode switching - Position deviation threshold	0	Servo bb	At once

6.8.5.2 IP control selection

Parameter		Meaning	Default setting	Modify	Effective
P2-03	n.□0□□	0: PI control 1: IP control	0	Servo bb	At once
P1-31		I-P control switching threshold	100	Servo bb	At once

P1-31=0, The speed loop is equivalent to PI control.
P1-31=100, The speed loop is equivalent to IP control.

6.9 Gain adjustment

6.9.1 Load shaking

The following causes cause load wobble:

1. The instruction isn't smooth enough when the load inertia is too large.
Countermeasure:
    (1) Use position instruction smoothing filter P1-25.
    (2) Optimizing the instructions of the upper device to reduce the acceleration of the instructions.
    (3) Replace the motor with greater inertia.

2. Servo gain is too small, resulting in insufficient rigidity
Countermeasure:
    (1) Increase the gain parameters and rigidity to enhance the anti-disturbance ability.

3. Insufficient rigidity of mechanism and equipment sloshing
Countermeasure:
    (1) Reducing gain parameters.
    (2) Optimize the instructions of the upper device and reduce the acceleration of the instructions.

6.9.2 Vibration

The following causes cause machine vibration:

(1) Vibration due to inappropriate servo gain
Countermeasure: Reduce gain

(2) Mechanical resonance point
Countermeasure: Setting notch parameters manually or through mechanical characteristic analysis

6.9.3 Noise

In adaptive mode:

(1) Inappropriate servo gain

Countermeasure: Reduce the adaptive control bandwidth (P2-19).

In auto-tuning mode:
(1) Inappropriate servo gain

Countermeasure: Under the mode of rapid adjustment, reduce the rigidity level.

Automatic Adjustment Mode: Reducing Model Loop Gain P2-49
(1) Noise due to mechanical resonance

Countermeasure: Refer to 6.9.2 when vibration occurs.

7 Alarm

7.1 Alarm code list

Historical record: "√" means that historical alarms can be recorded. "○" isn't recorded.
The column that can be cleared: "√" represents the alarm that can be cleared. "○" represents the alarm that cannot be cleared.

Alarm code		Code	Explanation	Property			Servo status when alarming
				Historical records	Can be cleared	Whether power on is needed to clear the alarm	
EEEE	1	EEEE1	Communication error between panel and CPU	○	○	No	Servo run
	2	EEEE2			○	No	Servo run
	3	EEEE3			○	No	Servo run
	4	EEEE4			○	No	Servo run
01	0	E-010	Firmware version mismatch	○	○	Yes	Servo run
	3	E-013	FPGA Loading Error	○	○	Yes	Servo run
	5	E-015	Program running error	○	○	Yes	Servo run
	6	E-016	Hard Error	○	○	No	Servo run
	7	E-017	Processor Running Timeout	○	○	Yes	Servo run
	9	E-019	System password error	○	○	Yes	Servo run
02	0	E-020	Parameter loading error	○	○	Yes	Servo run
	1	E-021	Parameter range beyond limit	○	√	No	Servo run
	2	E-022	Parameter conflict	√	√	No	Servo run
	3	E-023	Sampling channel setting error	○	○	Yes	Servo run
	4	E-024	Parameter lost	√	√	No	Servo run
	5	E-025	Erase FLASH error	√	√	No	Servo run
	6	E-026	Initialization FLASH error	√	√	No	Servo run
	8	E-028	EEPROM write in error	√	√	No	Servo run
	9	E-029	EEPROM write too frequently	√	√	No	Servo run
03	0	E-030	Bus voltage overvoltage	√	√	No	Servo off
04	0	E-040	Bus voltage under voltage ①Low grid voltage	√	√	No	Servo run
			Bus voltage under voltage ② Bus voltage undervoltage caused by power failure of driver	○	√	No	Servo off
	1	E-041	Driver power down	○	√	No	Servo run
	3	E-043	Bus Voltage Charging Failure	√	√	No	Servo off
	4	E-044	Three phase voltage input phase loss	√	√	No	Servo off
06	0	E-060	Module temperature too high	√	√	No	Servo run
	1	E-061	Motor overheating	√	√	Yes	Servo run
	3	E-063	Thermocouple disconnection alarm	√	√	No	Servo run
08	0	E-080	Overspeed alarm	√	√	No	Servo off
	2	E-082	Encoder zero position deviation protection 1	√	√	No	Servo off
09	2	E-092	Analog Tref Zero-Calibration Over limit	√	√	No	Servo run
	3	E-093	Analog Vref Zero-Calibration Over limit	√	√	No	Servo run

10	0	E-100	Excessive position deviation	√	√	No	Servo run
11	0	E-110	External UVW Short Circuit Discovered in Self-Inspection	√	√	No	Servo off
	1	E-111	P+current overcurrent protection	√	√	No	Servo off
	2	E-112	U phase overcurrent protection	√	√	No	Servo off
	3	E-113	V phase overcurrent protection	√	√	No	Servo off
13	0	E-150	Power cable disconnection	√	√	No	Servo off
16	1	E-161	Driver thermal power overload	√	√	No	Servo run
	5	E-165	Anti-blocking alarm	√	√	No	Servo run
20	0	E-200	Regenerative resistance overload	√	√	No	Servo run
22	0	E-220	Communication error of absolute servo encoder	√	√	No	Servo off
	1	E-221	Too many CRC errors in encoder communication	√	√	No	Servo off
	2	E-222	Absolute value servo encoder battery low voltage alarm	√	√	No	Servo off
	3	E-223	Absolute value servo encoder data access alarm	√	√	No	Servo off
	7	E-227	Power on encoder multi-turn signal data error	√	√	No	Servo off
	8	E-228	Absolute Servo Encoder Value Overflow	√	√	No	Servo off
	9	E-229	Encoder electrical angle deviation protection	√	√	No	Servo off
24	0	E-240	Timing error in fetching encoder position data	√	√	No	Servo off
	1	E-241	Encoder reponse data is error code	√	√	No	Servo off
25	0	E-250	Homing error	√	√	No	Servo off
26	0	E-260	Over range alarm	√	√	No	Servo run
	1	E-261	Overrun signal connection error	√	√	No	Servo run
	2	E-262	Control stop timeout	√	√	No	Servo off
	4	E-264	Excessive vibration	√	√	No	Servo run
	5	E-265	Motor vibration too large	√	√	No	Servo run
28	0	E-280	Failed to access motor parameters	√	○	Yes	Servo off
	1	E-281	Error writing data to encoder EEPROM	√	○	Yes	Servo off
31	0	E-310	Motor power mismatch	○	○	Yes	Servo off
	1	E-311	Motor code missing	√	○	Yes	Servo off
	2	E-312	Reading motor parameter is damaged	√	○	Yes	Servo off
	3	E-313	Encoder software version mismatch	√	○	Yes	Servo off
	4	E-314	Encoder software version not supported	√	○	Yes	Servo off
	5	E-315	Unable to read valid motor parameters	√	○	Yes	Servo off
	6	E-316	Reading motor code is inconsistent with setting code	√	○	Yes	Servo off

7.2 Analysis of alarm types

DS5 alarm code format is E-XX□, "XX" means main type, "□" means sub-type.

Type		Code	Description	Reasons	Solutions
EE EE	1	EEEE 1	Communication error between panel and CPU	(1) Voltage fluctuation of power supply is large, and low voltage leads to failure of panel refresh. (2) Damage of panel program (3) Communication enters a dead loop	(1) Stable power supply to ensure the stability of power supply voltage. (2) After repower on the driver, if the alarm cannot be removed, please contact the agent or the manufacturer. (3) Unplug the communication terminal and then run to confirm
	2	EEEE 2			
	3	EEEE 3			
	4	EEEE 4			
01	0	E-010	Firmware version mismatch	Downloaded firmware version error	Please contact the agent or the manufacturer
	3	E-013	FPGA loading error	①Program damaged ②Device damaged	Please contact the agent or the manufacturer
	4	E-014	FPGA access error	(1) Program damage (2) Device damage (3) Serious external interference	Please contact the agent or the manufacturer
	5	E-015	Program running error	Program damage	Please contact the agent or the manufacturer
	6	E-016	Hardware error	①program damaged ②hardware damaged ③Excessive intensity of external interference	① Check the input voltage, whether the input phase is missing or the supply voltage is too low ② Contact agent or manufacturer
	7	E-017	Processor Running Timeout	Program damage	Please contact the agent or the manufacturer
	9	E-019	System password error	Program damage	Please contact the agent or the manufacturer
02	0	E-020	Parameter loading error	Failure of parameter self-checking	Re-energizing can restore default parameters, if there are repeated problems, please contact the agent or manufacturer.
	1	E-021	Parameter range beyond limit	Setting values are not within the prescribed range	Check parameters and reset them
	2	E-022	Parameter conflict	Conflict of TREF or VREF Function Settings	(1) Check if the parameter settings meet the requirements (2) P0-01=4, P3-00 set to 1 will alarm
	3	E-023	Sampling channel setting error	Error setting of custom output trigger channel or data monitoring channel	Check that the settings are correct
	4	E-024	Parameter lost	Low voltage of power grid	(1) If it is single-phase 220V power supply, please connect L1 and L3. (2) show E-024 immediately after power failure (3) Resetting parameters
	5	E-025	Erase FLASH error	Abnormal parameter preservation during power failure	Please contact the agent or the manufacturer
	6	E-026	Initialization FLASH error	Power supply instability of FLASH chip	Please contact the agent or the manufacturer

	8	E-028	EEPROM write in error	Voltage instability or chip abnormality	Please contact the agent or the manufacturer
	9	E-029	EEPROM write too frequently	Pararmeter write in too frequenctly	① Reduce the frequency of parameter erasure. ② Contact agents or manufacturers
03	0	E-030	Bus voltage U0-05 is higher than the actual preset threshold, 220V Power Supply Machine (U0-05≥402V)	High voltage of power grid	Check the fluctuation of the power grid. The normal voltage range of the 220V driver is 200V~240V. If the voltage fluctuation is large, it is recommended to use the correct voltage source and regulator.
				Excessive load moment of inertia (insufficient regeneration capacity)	(1) connect external regenerative resistor, resistance specifications can be found in1.4 (220V: bus voltage U0-05 = 392 discharge starts, U-05 = 377 discharge ends.) (2) Increasing Acceleration and deceleration Time (3) Reducing load inertia (4) Reduce start-stop frequency (5) Replacement of larger power drivers and motors
				Brake resistance damage or excessive resistance value	Check the regenerative resistor and replace the external resistor with the appropriate resistance value. See 1.4.1 for the selection of the external resistor.
				Acceleration and deceleration time is too short	Extending Acceleration and Deceleration Time
				Hardware Fault of Driver Internal Sampling Circuit	Measure the servo LN (R/S/T) incoming line value with a multimeter in AC mode, which is normally 220V ± 10%. If it is greater than 220V+10%, check the power supply voltage. If the power supply voltage is normal, the servo BB status will be monitored. If the voltage measured by the multimeter is 1.414 < U0-05 (with an error of 10V), then the servo drive has a fault and needs to be sent back for maintenance.
04	0	E-040	Bus voltage U0-05 is lower than the actual preset threshold. 220V power supply machine (U0-05 ≤ 150V)	Low voltage of power grid when normal power on	(1) Check the fluctuation of power grid. The normal voltage range of 220V driver is 200V~240V. If the voltage fluctuation is large, the voltage regulator is recommended. (2) Replacement of larger capacity transformers
				Instantaneous power failure	Re-energize after voltage stabilization
				Hardware Fault of Driver Internal Sampling Circuit	Measure the servo LN (R/S/T) incoming line value with a multimeter in AC mode, which is

					normally 220V ± 10%. If it is greater than 220V+10%, check the power supply voltage. If the power supply voltage is normal, the servo BB status will be monitored. If the voltage measured by the multimeter is 1.414 < U0-05 (with an error of 10V), then the servo drive has a fault and needs to be sent back for maintenance.
	1	E-041	Driver power down	Driver power off	Check the power supply
	3	E-043	Bus Voltage Charging Failure	Low voltage of power grid when normal power on	Low voltage of power grid when normal power on
				Hardware damage	When the driver is on, please pay attention to whether there is relay actuation sound
	4	E-044	Three phase voltage input phase loss	Three phase input power supply is lack of phase	Check the power supply
06	0	E-060	Module temperature is too high (Module temperature U-06 ≥90℃ alarm, U-06 ≥ 70℃ Warning)	Running under heavy load for a long time	Re-consider the capacity of the motor, monitor the U0-02 torque during operation, whether it is in the value of more than 100 for a long time, if yes, please chose the large-capacity motor or load reduction.
				Excessive ambient temperature	(1) Enhance ventilation measures to reduce ambient temperature. (2) Check whether the fan rotates when the servo is enabled. when the module temperature U-06 ≥45℃, the fan opens.
				Fan damage	Replace the fan
	1	E-061	Motor overheat	Alarm when motor temperature is higher than 95℃	① Check whether the motor fan is abnormal ② Contact the manufacturer for technical support
	3	E-063	Thermocouple disconnection alarm	①The motor thermocouple of 11kw and above power is disconnected ②False opening detection and disconnection alarm of motor below 11kw	Check the external thermocouple connection. Shield thermocouple disconnection alarm: P0-69.1 = 1
08	0	E-080	Overspeed (actual speed ≥ P3-21/P3-22) The maximum forward speed is P3-21 and the maximum reverse speed is P3-22.	Motor code not match	Check if the motor code (number after MOTOR CODE) on drive U3-70 matches the motor label. If not, modify it to match and power it on again.
				UVW wiring error	Inspection of motor UVW wiring, need to be connected in phase sequence.
				Motor speed too fast	(1) The maximum speed limit value P3-21/P3-22 was reduced. (2) To confirm whether the external force makes the motor

					rotate too fast, whether the pulse input frequency is too high, and whether the electronic gear ratio is too large.
				Encoder fault	(1) Check the encoder cable or change a new one (2) Set the servo driver to BB state and the driver to U-10. Rotate the motor shaft slowly by hand to see if the value of U-10 changes normally, increasing in one direction and decreasing in one direction (0-9999 cycle display).
				Parameter settings	When the actual speed is greater than the values of P3-21/P3-22, an alarm will be triggered
	2	E-082	Encoder zero position deviation protection 1	(1) UVW phase sequence dislocation (2) Zero position deviation of motor encoder	(1) Check whether the three phases of the power cable are connected according to the phase sequence of UVW (2) Check the encoder zero position, please contact the manufacturer's technical support
09	2	E-092	Analog Tref Zero-Calibration Over limit	Analog Zero Calibration Operation Error	Please correct zero without analog voltage
	3	E-093	Analog Vref Zero-Calibration Over limit	Analog Zero Calibration Operation Error	Please correct zero without analog voltage
10	0	E-100	Position offset too large	In position control, the difference between the given position and the actual position exceeds the limit value.	(1) Observe whether the motor is blocked or not. (2) Reducing the given speed of position. (3) Increase the deviation pulse limit P0-23.
11	0	E-110	External UVW Short Circuit Discovered in Self-Inspection	Not match the motor code	Check if the motor code (number after MOTOR CODE) on drive U3-70 matches the motor label. If not, modify it to match and power it on again.
				UVW wiring error	Inspection of motor UVW wiring, need to be in phase sequence (brown U, black V, blue W)
				Driver UVW Output Short Circuit or Motor Failure	(1) Measure whether the UVW phase resistance of the motor is balanced. If the phase resistance is unbalanced, replace the motor. (2) Measure whether there is short circuit between UVW and PE of the motor. If there is short circuit, replace the motor. (3) Measure the driver side UVW output through multimeter (diode gear), black pen P+, red pen to measure UVW. red pen P-, black pen to measure UVW. if anyone is 0 in 6 groups of value, replace the driver.
				Load part is blocked	It is suggested that the motor

					should be operated on an empty shaft to eliminate the load problem.
				High-speed start-stop instantaneous alarm	Increasing Acceleration and Deceleration Time
				Encoder problem	(1) Check the encoder cable or change a new one (2) Set the servo driver to BB state and the driver to U-10. Rotate the motor shaft slowly by hand to see if the value of U-10 changes normally, increasing in one direction and decreasing in one direction (0-9999 cycle display).
11	1	E-111	P+ over current protection	U, V, W wiring error	Check the motor UVW wiring and connect it according to the phase sequence (brown U, black V, blue W)
				Driver U, V, W output short circuit or motor fault	(1) Measure whether the UVW interphase resistance of the motor is balanced. If the interphase resistance is unbalanced, replace the motor (2) Measure whether there is a short circuit between UVW and PE of the motor. If there is a short circuit, replace the motor (3) UVW output measurement at driver side: measure UVW with multimeter (diode gear), black probe tests P+ and red probe tests UVW. Then red probe tests P-, black probe tests UVW. If any of the 6 groups values is 0, replace the driver
				Load part has stalled	It is recommended that the motor run without load to eliminate the load problem
				Alarm at the moment of high-speed start stop	Increase acceleration and deceleration time
				Encoder problem	(1) Check the encoder cable or replace the encoder cable (2) Set the servo driver to bb state, adjust the driver to U0-10, slowly rotate the motor shaft by hand to see whether the value change of U0-10 is normal, increasing in one direction and decreasing in the other (0~9999 cycle display).
	2	E-112	U phase overcurrent protection	U, V, W wiring error	Check the motor UVW wiring and connect it according to the phase sequence (brown U, black V, blue W)
				Driver U, V, W output short circuit or motor fault	(1) Measure whether the UVW interphase resistance of the motor is balanced. If the interphase resistance is unbalanced, replace the motor

					(2) Measure whether there is a short circuit between UVW and PE of the motor. If there is a short circuit, replace the motor (3) UVW output measurement at driver side: measure UVW with multimeter (diode gear), black probe tests P+ and red probe tests UVW. Then red probe tests P-, black probe tests UVW. If any of the 6 groups values is 0, replace the driver
				Load part has stalled	It is recommended that the motor run without load to eliminate the load problem
				Alarm at the moment of high-speed start stop	Increase acceleration and deceleration time
				Encoder problem	(1) Check the encoder cable or replace the encoder cable (2) Set the servo driver to bb state, adjust the driver to U0-10, slowly rotate the motor shaft by hand to see whether the value change of U0-10 is normal, increasing in one direction and decreasing in the other (0~9999 cycle display).
11	3	E-113	V phase overcurrent protection	U, V, W wiring error	Check the motor UVW wiring and connect it according to the phase sequence (brown U, black V, blue W)
				Driver U, V, W output short circuit or motor fault	(1) Measure whether the UVW interphase resistance of the motor is balanced. If the interphase resistance is unbalanced, replace the motor (2) Measure whether there is a short circuit between UVW and PE of the motor. If there is a short circuit, replace the motor (3) UVW output measurement at driver side: measure UVW with multimeter (diode gear), black probe tests P+ and red probe tests UVW. Then red probe tests P-, black probe tests UVW. If any of the 6 groups values is 0, replace the driver
				Load part has stalled	It is recommended that the motor run without load to eliminate the load problem
				Alarm at the moment of high-speed start stop	Increase acceleration and deceleration time
				Encoder problem	(1) Check the encoder cable or replace the encoder cable (2) Set the servo driver to bb state, adjust the driver to U0-10, slowly rotate the motor shaft by hand to see whether the value change of U0-10 is normal,

					increasing in one direction and decreasing in the other (0~9999 cycle display).
15	0	E-150	Power cable disconnection	Any phase in UVW of driver, cable or motor broken	Disconnect the power supply of the driver and check the connection of the power cable. It is suggested that the multimeter be used to test the condition. After eliminating the errors, the driver should be re-energized.
16	1	E-161	Driver thermal power overload	Not match the motor code	Check if the motor code (number after MOTOR CODE) on drive U3-70 matches the motor label. If not, modify it to match and power it on again.
				Overload, the actual operating torque exceeds the rated torque, and continuous operation for a long time. (Monitor U0-02 to check the actual operating torque. If the motor is in normal operation, it will not jam or jitter. If the U0-02 is longer than 100, it will be considered improper selection of the motor.)	Increase the capacity of drivers and motors. Extend the acceleration and deceleration time and reduce the load. Monitor the U0-00, whether it is running over speed.
				Mechanisms are impacted, suddenly weighted and distorted.	Eliminate mechanical distortion. Reduce load
				Motor action when motor brake isn't opened	Measure the voltage of the brake terminal and decide to open the brake. It is suggested to use servo BK signal to control the brake lock. If it isn't servo control, attention must be paid to the timing of brake opening and motor action.
				Wrong wiring of encoder cable, power cable or broken wire or loose pin of connector plug	Check the UVW connection of power cable to see if there is any phase sequence error. The multimeter is used to measure whether all the encoder cable are on. Check whether the plug is loose, for machine vibration, whether the plug has shrinkage pin, virtual welding, damage.
				In multiple mechanical wirings, incorrect connection of motor cable to other shafts leads to incorrect wiring.	Detection of servo wiring, the motor cable, encoder cable are correctly connected to the corresponding shaft.
				Poor gain adjustment results in motor vibration, back and	Readjustment of gain parameters

				forth swing and abnormal noise.	
				Driver or motor hardware failure.	There are servo cross test or motor empty shaft on site, F1-01 trial operation, F1-00 jog run can not rotate uniformly. Replace the new driver or motor and send the malfunction machine back to the manufacturer for repair.
	5	E-165	Anti-blocking alarm Judging that the current motor output torque is greater than P3-28/P3-29 (internal forward/reverse torque limit), and the time reaches P0-74 (unit ms), and the speed is lower than P0-75 (unit 1 rpm).	(1) Machinery is impacted, suddenly becomes heavier and distorted. (2) When the brake of the motor isn't opened, the motor moves. (3) The parameter setting is unreasonable.	(1) Eliminate the factors of mechanical distortion. Reduce load (2) Measure the voltage of the brake terminal and determine the opening of the brake. It is suggested to use servo BK brake signal to control the brake lock. If it isn't servo control, attention must be paid to the timing of brake opening and motor action. (3) Monitor the actual output torque range of U0-02 and check whether the setting of P3-28/29 torque limit is reasonable. (After version 3760, the output torque limit setting parameters of anti locked rotor alarm are P3-38 and P3-39
20	0	E-200	Regenerative resistance overload	High Voltage Fluctuation in Power Grid	Stable the input voltage
				Selection of regenerative resistance is too small	Replacement of higher power regenerative resistors (refer to chapter 1.4)
				Acceleration and deceleration time is too short	Extending Acceleration and deceleration Time
				Hardware damage	The AC gear of the multimeter measures the input value of the servo LN (R/S/T), which is 220V ± 10% of the normal value. If the power supply voltage is more than 220V+10% (380V+10%), check the power supply voltage. If the power supply voltage is normal, then in servo bb state, monitor U0-05, the voltage measured by the multimeter * 1.414 < U0-05 (within 10V error), then the servo driver is faulty and needs to be sent back for repair.
22	0	E-220	Communication error of absolute servo encoder	Motor matching error	Check if the motor matches correctly
				Unconnected encoder cable or poor contact	Check whether the value of U0-54 increases rapidly. If yes, the encoder circuit is disconnected.Disconnect the

					power supply of the driver, check the connection of the encoder cable, if there is cable loosening, it is recommended to use the multimeter to test the conduction condition. after eliminating errors, power on again Hot plugging is strictly prohibited, and special cables are required for tank chains.
				The received encoder data is incorrect, and the number of errors exceeds the value in the encoder error retry register P0-56 (error count P0-68.0~P0-68.1 is set after version 3770)	Check whether the value of U0-79 and U0-54 increase. If yes, the encoder is interfered. Encoder wire and strong power don't have the same pipeline wiring. install filter on servo driver power input side. encoder wire sleeves magnetic ring. shut down welding machine type of equipment with large interference
	1	E-221	Too many CRC errors in encoder communication	The received encoder data is wrong and the number of errors exceeds the value in encoder error retry number register P0-56 (error count P0-68.0~P0-68.1 is set after version 3770)	Encoder interfered, isolate interference source
	2	E-222	Absolute value servo encoder battery low voltage alarm (can shield this alarm)	Battery Voltage in Battery Box of Encoder cable is less than 3V	Please replace the battery while keeping the power supply ON of the servo driver in order to avoid the error of encoder position information. Battery specification: No.5 battery, 3.6V (model CP-B-BATT, CPT-B-BATT)
				Power on alarm for new machine	(1) When the absolute value motor is powered off, the memory position depends on the battery on the encoder cable. Once the encoder cable and the motor are disconnected, the power supply can not be carried out, which will lead to the loss of the current position of the motor, it will alarm E-222. Please set F0-00=1 to clear the alarm, it can be used normally. (2) The alarm can be shielded by using P0-79. When P0-79 is set to 1, it will be used as a single-loop absolute value motor, and the current position will not be remembered when power off.
	3	E-223	Data access alarm of absolute value servo encoder	Encoder cable with battery box isn't used for multi-turn absolute motor	① Please use an encoder cable with a battery pack. Or replace the encoder cable used normally for cross testing.
				Generally, it is the	② The encoder itself is abnormal

				problem of the encoder itself, or the power supply of the encoder is unstable	and the servo motor needs to be replaced
	7	E-227	Power on encoder multi turn signal data error	Generally, it is the problem of the encoder itself, or the power supply of the encoder is unstable	In the case of no battery, unplugging the encoder cable may cause this alarm.
	8	E-228	Absolute value servo encoder value overflow	The motor runs in one direction continuously, the encoder data value is too large, overflow	① Set F1-06 = 1, clear the absolute encoder's multiple turns. ② Set P0-79 = 2, the alarm can be shielded.
	9	E-229	Encoder electrical angle deviation protection	① The phase sequence of the motor power line is connected incorrectly. ② Encoder zero offset	(1) Check whether the three phases of the power cable are connected according to the phase sequence of UVW (2) Check the encoder zero position, please contact the manufacturer's technical support
24	0	E-240	Timing error in fetching encoder position data	① Communication abnormality of servo drive encoder ② Encoder signal is interfered with ③ Encoder malfunction	① Restart driver ② Check the arrangement of transmission cables to ensure that the strong and weak current are wired separately. ③ High current equipment is supplied separately. ④ The grounding is good.
	1	E-241	Encoder responding data scrambling	① Received encoder data error ② Encoder signal is interfered with ③ Encoder malfunction	① Check the arrangement of transmission cables to ensure that the strong and weak current are wired separately. ② High current equipment is supplied separately. ③ The grounding is good.
25	0	E-250	Homing error	1. P9-15 isn't 0 and the total time taken to return to the origin exceeds the time set in P9-15. 2.New homing function parameter setting error	① Increase P9-15. ② Ensure that the direction of the mechanical offset (P9-19, P9-20) is opposite to the direction of the return to the origin. ③ Check if there are any issues with the origin signal. ④ Check the parameter settings for the new homing function
26	0	E-260	Over range alarm	Overrun signal was detected and the overrun processing mode was configured to alarm	If you don't want to alarm immediately when the overrun occurs, you can change the overrun signal processing mode.
	1	E-261	Overrun signal connection error	(1) When the motor is in forward rotation, it encounters reverse overrun signal. (2) When the motor is in reverse rotation, it encounters forward overrun signal.	Check over-run signal connection and over-run terminal allocation.
	2	E-262	Control stop timeout	(1) Excessive inertia (2) Stop timeouts too short	(1) Reduce inertia or use brake motor. (2) Increase the stop timeout time

					P0-30.
	4	E-264	Excessive vibration	(1) Oscillation caused by external forces (2) Load inertia is large and the setting of load inertia ratio is wrong or the gain is too small, which leads to the oscillation of positioning.	(1) Check the source of external force to see if there are any problems in mechanical installation. (2) Increase the servo gain to improve the anti-disturbance ability. (3) Acquisition speed curve analysis. When the first three peaks are convergenced after pulse instruction completed (0.8* | first peak | > | second peak | and 0.8* | second peak | > | third peak |), the driver should not alarm, which can adjust the relevant threshold. When the first three peaks speed are not less than 300 rpm for three consecutive times after the completion of the pulse instruction, the driver will alarm. (4) Contact manufacturers for technical support
	5	E-265	Excessive motor vibration	Mechanical vibration	Check the motor installation
28	0	E-280	Failed to read motor parameters	Request to read EEPROM failed	①Professional personnel confirm that the driver and motor are compatible and can be used together ② Check the connection of the encoder cable, measure the continuity of the encoder cable, or replace the encoder cable to check ③Check if the driver and motor are functioning properly, which can be determined by replacing the driver or motor with a new one. If it is a problem with the driver or motor itself, it needs to be sent back to the manufacturer for inspection
	1	E-281	Error writing data to encoder EEPROM	Request to write EEPROM failed	On the premise that the driver and motor are matched by professionals and can be used together, P0-53=1 (shielding automatic reading of motor parameter alarm) can be used, and the P0-33 motor code can be correctly set before use
31	0	E-310	Power mismatch between driver and motor	Such as 750W driver with 200W motor	Match the correct motor and driver, and use it after setting the P0-33 motor code correctly
	1	E-311	When the motor code is read automatically, the motor parameter is 0, and the driver P0-33 = 0	Motor code not set	On the premise that the driver and motor are matched by professionals and can be used together, P0-53=1 (shielding automatic reading of motor parameter alarm) can be used, and

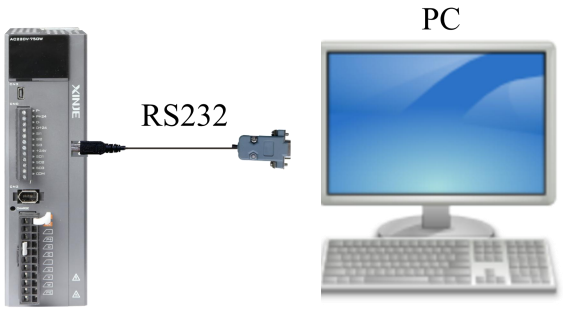
					the P0-33 motor code can be correctly set before use
	2	E-312	Reading motor parameter is damaged	Parameter CRC verification failed	On the premise that the driver and motor are matched by professionals and can be used together, P0-53=1 (shielding automatic reading of motor parameter alarm) can be used, and the P0-33 motor code can be correctly set before use
	3	E-313	Encoder software version mismatch	Encoder software version mismatch	① Update driver firmware to maximize current motor parameter performance ② Read the alarm shielding position of motor parameters through p0-53=1, and set the motor code of P0-33 correctly. At this time, the motor parameters are in the driver, which can work normally, but may affect some performance
	4	E-314	Motor code doesn't match software version	Encoder hardware version is higher than driver firmware version	Contact the manufacturer's technical support to update the driver firmware
	5	E-315	When the motor code is read automatically, the motor parameter is 0, and the driver P0-33 ≠ 0	Read the motor code is 0	On the premise that the driver and motor are matched by professionals and can be used together, P0-53=1 (shielding automatic reading of motor parameter alarm) can be used, and the P0-33 motor code can be correctly set before use
	6	E-316	Auto-read code error	The auto read motor code is inconsistent with the motor code set in P0-33	Check U3-00 and MOTOR CODE. ① If the two values are the same, change P0-33 motor code or set P0-33 to 0 to read motor code automatically. ② If the two values are different, contact the manufacturer for technical support

8 Modbus-RTU communication

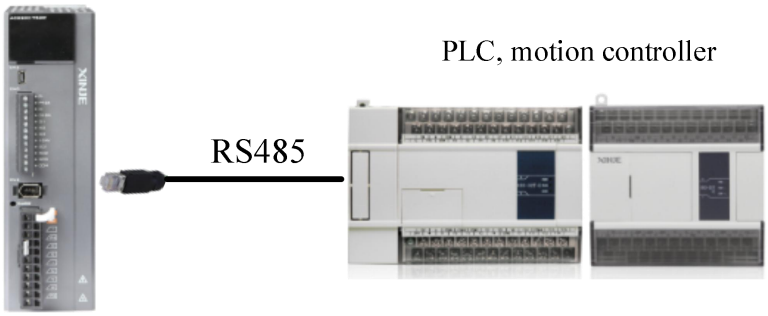
The company provides users with the general RS485 communication interface in industrial control. The communication protocol adopts MODBUS standard communication protocol, and the servo can be used as the slave station to communicate with the master device (such as PLC controller and PC) with the same communication interface and the same communication protocol, and the HMI can also be connected through the communication interface. Realize the remote operation of the frequency converter by the user.
This series of servo Modbus communication protocol supports RTU mode. The following is a detailed description of the communication protocol.

8.1 Communication wiring

1. RS-232 communication wiring

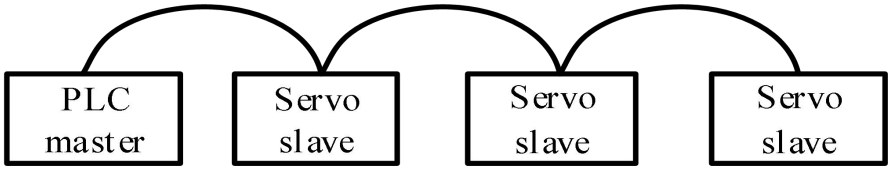


2. RS-485 communication wiring

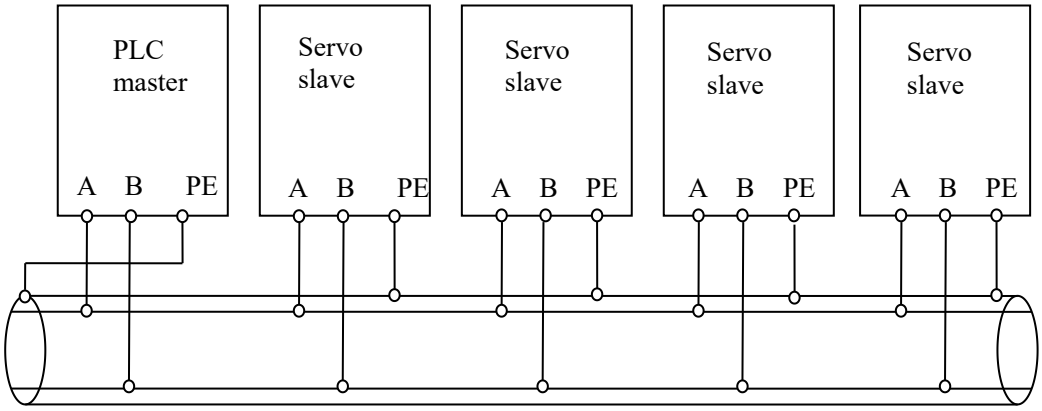


3. PLC and servo communication (Servo driver and motor are all well grounded)

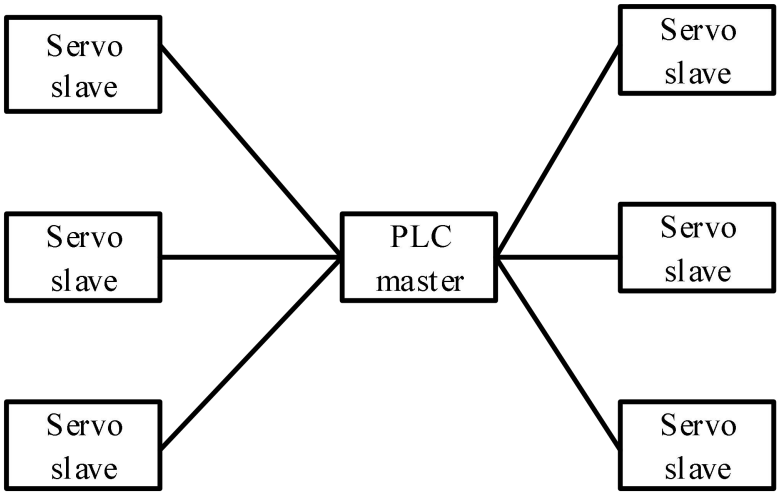
(1) Best recommendation: hand in hand mode



(2) General recommendation: branch structure



(3) Not recommended: star connection



8.2 Communication parameters

1. RS485 communication parameters

Parameter	Meaning	Default setting	Range	Modify	Effective
P7-00	RS485 station number	1	0~100	Servo bb	At once

Parameter	Function	Unit	Default setting	Suitable mode	Modify	Effective
P7-01	Communication setting	-	n.2206	All	Servo bb	At once
	Setting		Default setting	Range		
	n.□xxx	Parity bit	2	0: no parity 1: odd 2: even		
	n.x□xx	Stop bit	2	2: 1 bit		
	n.xx□□	Baud rate	06	00:300 01:600 02:1200 03:2400 04:4800 05:9600 06:19200 07:38400 08:57600 09:115200 0A:192000		

				0B:256000 0C:288000 0D:384000 0E:512000 0F:576000 10:768000 11:1M 12:2M 13:3M 14:4M 15:5M 16:6M

Parameter	Meaning	Default setting	Setting range	Modify	Effective
P7-02	RS485 communication protocol	1	1-Modbus Rtu protocol 2-Xnet bus protocol 3-Read Xnet bus torque	Servo bb	At once

2. RS232 communication parameter setting

Parameter	Meaning	Default setting	Range	Modify	Effective
P7-10	RS232 station no.	1	0~100	Servo bb	At once

Parameter	Parameter	Setting unit	Default setting	Suitable mode	Modify	Effective
P7-11	Communication configuration	-	n.2206	All	Servo bb	At once
	Parameter setting	Function	Default setting	Range		
	n.□xxx	Parity bit	0	0: no parity 1: odd 2: even		
	n.x□xx	Stop bit	0	0: 2-bit 2: 1-bit		
	n.xx□□	Baud rate	06	00:300 01:600 02:1200 03:2400 04:4800 05:9600 06:19200 07:38400 08:57600 09:115200 0A:192000 0B:256000 0C:288000 0D:384000 0E:512000 0F:576000 10:768000 11:1M 12:2M 13:3M 14:4M 15:5M 16:6M		

8.3 Communication protocol

When communicating in a MODBUS network, this protocol determines that each controller needs to know their device address, identify messages sent by address, and decide what actions to take. If a response is needed, the controller generates the feedback and sends it out using Modbus protocol. In other networks, messages containing Modbus protocol are converted to frame or packet structure which can be used in this network. This conversion also extends the method of solving node address, routing path and error detection according to specific network.

8.3.1 Character structure

(1－8－2 format, no parity)

Start bit	0	1	2	3	4	5	6	7	Stop bit	Stop bit

(1－8－1 format, odd parity)

Start bit	0	1	2	3	4	5	6	7	Odd parity	Stop bit

(1－8－1 format, even parity)

Start bit	0	1	2	3	4	5	6	7	Even parity	Stop bit

(1－8－1 format, no parity)

Start bit	0	1	2	3	4	5	6	7	Stop bit

The default data format of servo driver is: 1-bit start bit, 8-bit data bit, 1-bit stop bit.

8.3.2 Communication data structure

1. RTU mode:

START	Keep no input signal greater than or equal to 10ms
Address	Communication address: 8-bit binary address
Function	Function code: 8-bit binary address
DATA (n – 1)	Data content: N*8-bit data, N<=8, max 8 bytes
……	
DATA 0	
CRC CHK Low	CRC parity
CRC CHK High	16-bit CRC parity code consists of two 8-bit binary combinations
END	Keep no input and output signal greater than or equal to 10ms

2. Communication address:

Modbus address is provided in the manual, and the corresponding table of Modbus address is queried in Appendix 4.

3. Function code and data:

Function code	Explanation
03H	Read out the contents of registers, read out multiple registers, but not more than 31 at a time, and only read the data in the same group at a time
06H	Write the data to register

■ Function code 03H: read register data

For example: read the U0-05 register address H1005 (bus voltage).
RTU mode:

Inquiry information format		Response message format	
Address	01H	Address	01H
Function code	03H	Function code	03H
Register address	10H	Byte quantity	02H
	05H		
Register quantity	00H	Data content	01H
	01H		34H

CRC CHECK Low	90H	CRC CHECK Low	B8H
CRC CHECK High	CBH	CRC CHECK High	03H

■ Function code06H: write the data in the register

For example: write 300 rpm to the address of P3-18 register of inching speed.
RTU mode:

Inquiry information format		Response message format	
Address	01H	Address	01H
Function code	06H	Function code	06H
register address	03H	register address	03H
	12H		12H
Data content	01H	Data content	01H
	2CH		2CH
CRC CHECK Low	29H	CRC CHECK Low	29H
CRC CHECK High	C6H	CRC CHECK High	C6H

4. Parity code

RTU mode: double byte hexadecimal number.
The CRC field is a two-byte, 16-bit binary value. It is calculated by the sender and added to the message. when it is added, it is first the low byte and then the high byte, so the high byte of CRC is the last byte of the sent message. The receiving device recalculates the CRC of the received message and compares it with the value in the received CRC field. If the two values are different, there is an error in the received message, discards the message frame, makes no response, and continues to receive the data of the next frame. Refer to the description of Modbus protocol for CRC verification calculation method.

8.4 Communication example

8.4.1 Communication with Xinje PLC

Xinje PLC communicates with Xinje two drivers through 485, reads the speed of motor and writes the torque limit of motor.

1. Hardware wiring
If the customer uses the AB terminal of Xinje PLC for 485 communication, connect the CN4 port of the driver through a network cable, and connect the 485-A and 485-B pins to the AB terminal of the PLC respectively.

2. Parameter setting
The communication parameters of the driver and PLC are set in the same way, such as baud rate, parity, data bit, slave station, etc. the communication protocols of the Xinje PLC and servo are standard Modbus RTU, namely 19200bps, 1-8-1-even parity.

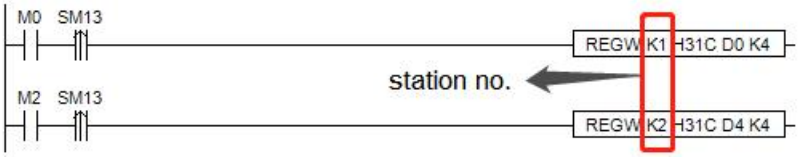
The setting parameters are as follows:

P7-00 Station No.	1, 2
P7-01.0 ~ 1 baud rate	06
P7-01.2 stop bit	2
P7-01.3 check bit	2

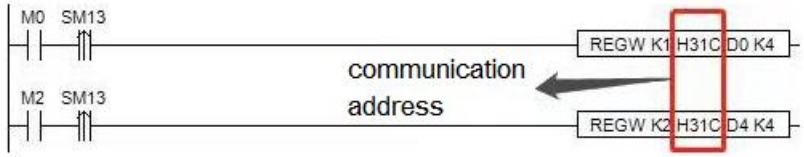
Note: If the communication parameter settings of the upper computer and the lower computer are inconsistent, the communication will fail.

3. Software program: the register in which the station number, communication address and contents are marked when writing instructions.

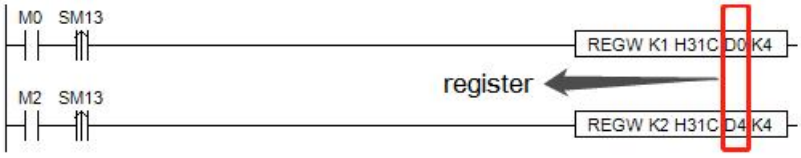
(1) Station number: the value set for servo driver P7-00. K1 indicates that P7-00 is set to 1. K2 indicates that P7-00 is set to 2.



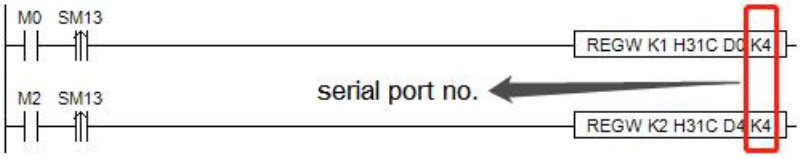
(2) Communication address: the address of the servo slave station. For the address of a register, please refer to Appendix 4. MODBUS address table.



(3) Register: to store the paramter value of write in address.



(4) Serial port no.: PLC RS485 serial port number.



Appendix

Appendix 1. Group P parameters

Modification and effective:

"○" means modifying when servo OFF and take effect at once.

"√" means modifying anytime and take effect at once.

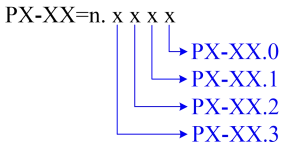
"●" means modifying when servo OFF and take effect when power on again.

"△" means modifying anytime and take effect when the motor doesn't rotate.

"▲" means modifying at any time and take effect when power on again.

For parameters set in hexadecimal system, the prefix "n." is added to the setting value to indicate that the current setting value is hexadecimal number.

Composition of parameters:



P0-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P0-01	Control mode 1 1: Internal torque mode 3: Internal speed mode 5: Internal position mode 6: External pulse position mode 7: External pulse speed mode	-	6	1~10	○	1|3|5|6|7	5.1.1
P0-02	Control mode 2 (ditto)	-	6	1~10	○	1|3|5|6|7	5.1.1
P0-03	Enabling mode 0-not enabled 1-IO enable 2-Software Enable 3-XNET Bus Enable	-	1	0~3	○	1|3|5|6|7	5.2.2
P0-04	Rigidity grade	-	13	0~31	△	1|3|5|6|7	6.3.3
P0-05	Definition of rotation direction 0- positive mode 1- negative mode	-	0	0~1	●	1|3|5|6|7	5.2.3
P0-07	First inertia ratio	1%	200	0~50000	√	1|3|5|6|7	6.2.1
P0-09.0	Forward Direction of Input Pulse Instruction 0-Forward Pulse Counting 1-Reverse Pulse Counting	-	0	0~1	●	6|7	5.4.2
P0-09.2	Input pulse command filter time	-	F	0~F	●	6|7	5.4.2
P0-09.3	Predistribution of input pulse command filter	-	0	0~7	○	6|7	5.4.2

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P0-10.0	0-CW/CCW 1-AB 2-P+D	-	2	0~2	○	6|7	5.4.1.1
P0-11~P0-12	Number of instruction pulses per cycle 0: Electronic gear ratio Non-0:Number of command pulses required for motor rotation	1 pul	10000	0~99999999	○	5|6	5.4.1.1
P0-13	Electronic Gear Numerator	-	1	0~65535	√	5|6	5.4.1.1
P0-14	Denominator of Electronic Gear	-	1	0~65535	○	5|6	5.4.3.2
P0-15	Pulse frequency corresponding to rated speed	100Hz	1000	1~10000	○	7	5.4.3.3
P0-16	Speed command pulse filter time	0.01ms	100	0~10000	○	7	5.4.1.6
P0-23	Pulse offset limit	0.01 turns	2000	0~65535	○	5|6	5.4.2
P0-24	Discharge resistor power protection method 0-cumulative discharge time 1: Average power mode 1 2: Average power mode 2	-	0	0~1	○	1|3|5|6|7	5.2.6
P0-25	Power Value of discharge resistance	W	Set as the model	1~65535	○	1|3|5|6|7	5.2.6
P0-26	Discharge resistance value	Ω	Set as the model	1~500	○	1|3|5|6|7	5.2.6
P0-27	Servo shutdown the enable stop mode 0: Free stop, maintain free running state after stopping 1: Free stop, maintain DB status after stopping 2: Slow down and stop, maintain free running state after stopping 3: Slow down and stop, maintain DB status after stopping 4: DB stops and remains in free running state after stopping 5: DB stopped, maintain DB status after stopping	-	0	0~5	○	All	5.2.4

P0-28	Servo overrun stop mode (P0-28.0) 0-deceleration stop 1 1-Inertial stop 2-deceleration stop 2 3-Alarm Stop Overtravel alarm shield switch (P0-28.1) 0-not shield the alarm 1-shield the alarm	-	2 0	0~3 0~1	○	1|3|5|6|7	5.2.4
P0-29	Stop Mode 0: Free stop, maintain free running state after stopping 1: Free stop, maintain DB status after stopping 2: DB/deceleration stop, maintain free running state after stopping 3: DB/deceleration stop, maintain DB status after stopping 4: DB stops and remains in free running state after stopping 5: DB stopped, maintain DB status after stopping	-	2	0~2	○	All	5.2.4
P0-30	Stop timeout time	1ms	20000	0~65535	○	1|3|5|6|7	5.2.3
P0-31	Deceleration stop time	1ms	25	0~5000	○	1|3|5|6|7	5.2.3
P0-33	Set the motor code	-	0	0~ffff	●	1|3|5|6|7	-
P0-53	Read motor parameter alarm shield bit 0-not shield alarm shield alarm 1- Shield the alarm of not read valid motor parameter	-	0	0~1	●	1|3|5|6|7	-
P0-55	Open loop rotation speed	-	0	-6000~6000	●	1|2|3|4|5|6|7	-
P0-56	Encoder communication attempts	-	10	1~65535	●	1|2|3|4|5|6|7	-
P0-68 xx□□	Number of consecutive error alarms for encoding data update timing	-	0x05	0x01~0xFF	●	1|2|3|4|5|6|7	-
P0-68 □□xx	E-241 Alarm Filtering Times	-	0	0~0xFF	●	1|2|3|4|5|6|7	-
P0-69	Fan switch (P0-69.0) 0- Turn on the fan when the temperature greater than 45℃ and turn off the fan when less than 42℃ (hysteresis 3℃) 1 - Turn on the fan after	-	1 0	0~1 0~1	√	1|3|5|6|7	-

	enabling, turn off the fan when not enabling Large motor thermocouple break alarm shield switch (P0-69.1) 0 - not shield thermocouple disconnection alarm 1 - shield thermocouple disconnection alarm						
P0-74	Blocking alarm time	ms	As the model	0~5000	√	1|3|5|6|7	5.8.1
P0-75	Blocking alarm speed	rpm	50	5~9999	√	1|3|5|6|7	5.8.1
P0-79	Absolute value encoder setting 0-used as absolute value encoder 1-used as incremental encoder 2-used as absolute value encoder, ignoring multi turn overflow alarm	-	1	0~2	●	1|3|5|6|7	5.7.1
P0-80	Thermal power protection of motor 0-current protection 1-Average Thermal Power Protection 2-Analog Thermal Power Protection	-	2	0~2	●	1|3|5|6|7	-
P0-86.2	Motor thermal power protection method 0-1 internal parameters	-	0	0~1	●	1|2|3|4|5|6|7	-
P0-92~P0-93	32-bit electronic gear ratio numerator. Take effect when P0-11 ~ P0-14 is 0. P0-92*1 + P0-93 *10000	-	1	1~9999 0~65535	○(Mode 5) √(Mode 6)	5|6	5.4.1.1
P0-94~P0-95	32-bit electronic gear ratio denominator. Take effect when P0-11 ~ P0-14 is 0. P0-94*1 + P0-95 *10000	-	1	1~9999 0~65535	○	5|6	5.4.1.1

P1-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P1-00	First speed loop gain	0.1Hz	<=20P7:300 >=21P0:200	10~20000	√	1|3|5|6|7	6.5.3
P1-01	Integral time constant of the first speed loop	0.01ms	2653	15~51200	√	1|3|5|6|7	6.5.3
P1-02	First position loop gain	0.1/s	480	10~20000	√	1|3|5|6|7	6.5.3
P1-05	Second speed loop gain	0.1Hz	200	10~20000	√	1|3|5|6|7	6.8.4
P1-06	Integral time constant of the second speed loop	0.01ms	3300	15~51200	√	1|3|5|6|7	6.8.4
P1-07	Second position loop	0.1/s	200	10~20000	√	1|3|5|6|7	6.8.4

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
	gain						
P1-10	Speed feedforward gain	1%	0	0~300	√	5|6|7	-
P1-11	Speed feedforward filter time	0.01ms	50	0~10000	√	5|6|7	-
P1-14	Gain switching mode setting	-	0	0~0x00A2	√	1|2|3|4|5|6|7	6.8.4
P1-15	Gain switching waiting time	-	5	0~1000	√	1|2|3|4|5|6|7	6.8.4
P1-16	Gain switching level threshold	-	50	0~20000	√	1|2|3|4|5|6|7	6.8.4
P1-17	Gain switching level hysteresis	-	30	0~20000	√	1|2|3|4|5|6|7	6.8.4
P1-18	Position loop gain switching time	-	3	0~1000	√	1|2|3|4|5|6|7	5.4.1.4
P1-22	Speed Instruction Filter Selection 0-first order low pass filter 1-Smooth average filter	-	0	0~1	○	3|7	5.4.1.4
P1-23	Speed instruction filter time	0.1ms	0	0~65535	○	3|7	5.4.1.4
P1-24	Position command acceleration and deceleration filtering time	0.1ms	0	0~65535	△	5|6	5.3.1.7
P1-25	position instruction smooth filter time	0.1ms	0	0~65535	△	5|6	6.8.5
P1-26.0	Switching conditions for speed control mode		0	0~4	△	|3|4|5|6|7	6.8.5
P1.26.1	Speed control mode switching, integral holding selection		0	0、1	△	|3|4|5|6|7	6.8.5
P1-27	Mode Switching - Torque Command Threshold	%	200	0-800	△	|3|4|5|6|7	6.8.5
P1-28	Mode Switching - Speed Command Threshold	rpm	0	0-10000	△	|3|4|5|6|7	6.8.5
P1-29	Mode Switching - Acceleration Threshold	rpm/s	0	0-30000	△	|3|4|5|6|7	6.8.5
P1-30	Mode switching - Position deviation threshold	Instruction unit	0	0-10000	△	|3|4|5|6|7	6.8.5
P1-31	I-P control switching threshold	%	100	0-100	△	3|4|5|6|7	6.8.5
P1-74	Encoder zero offset detection cycle	-	1000	0~65535	√	1|2|3|4|5|6|7	-
P1-75.0~1	Encoder zero offset detection threshold	-	0A	0~500	√	1|2|3|4|5|6|7	-
P1-75.2~3	Electric angle deviation detection filtering times	-	06	0~500	√	1|2|3|4|5|6|7	-

P2-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P2-00.0	Disturbance observer switch 0- OFF 1- ON	-	0	0~1	○	1|3|5|6|7	6.1.4
P2-01.0	Adaptive mode switch 0-OFF 1-ON	-	0	0~1	●	1|3|5|6|7	6.6.3
P2-01.1	Adaptive level 0-high response 1-low noise	-	As the model	0~1	●	1|3|5|6|7	-
P2-02.0	Auto-tuning mode 1-soft 2-fast positioning 3-fast positioning, control the overshoot	-	3	1~3	√	1|3|5|6|7	6.1.3
P2-02.2	Load type (valid only during auto-tuning) 1- synchronous belt 2- screw rod 3-Rigid Connection	-	2	1~3	√	1|3|5|6|7	6.1.3
P2-03.2	I-P control switch	-	0	0,1	△	|3|4|5|6|7	6.8.5
P2-03.3	Adaptive load type 0-Small Inertia Mode 1-Large Inertia Mode	-	0	0~1	●	1|3|5|6|7	6.6.4
P2-05	Adaptive mode speed loop gain (standard)	0.1Hz	<=20P7:400 >=21P0:200	1~65535	○	1|3|5|6|7	6.6.4
P2-07	Adaptive mode inertia ratio (standard)	%	0	0~10000	○	1|3|5|6|7	6.6.4
P2-08	Gain of adaptive mode speed observer (standard)	Hz	20P1/20P2/ 20P4/20P7:60 >=21P5:40	10~1000	○	1|3|5|6|7	6.6.4
P2-12	Maximum Inertia Ratio of Adaptive Mode (Standard)	-	30	1~10000	○	1|3|5|6|7	6.6.4
P2-15	Inertia Identification Maximum Travel	0.01r	100	1~300	√	1|3|5|6|7	6.2.4
	Internal Instruction Auto-tuning Maximum Travel			1~3000			
P2-16	Adaptive motor rotor inertia coefficient	-	100	10~1000	○	1|3|5|6|7	6.2.4
P2-17	Maximum Speed of Inertia Identification and Internal Instruction Auto-tuning	rpm	0	0~65535	√	1|3|5|6|7	6.2.4
P2-18	Initial inertia ratio of inertia identification	%	500	1~20000	√	1|3|5|6|7	6.2.4
P2-19	Adaptive mode bandwidth	%	20P1:100	1~100	○	1|3|5|6|7	6.2.4

			20P2/20P4:70 >=20P7:50				
P2-35	Torque Instruction Filtering Time Constant 1	0.01 ms	66	0~65535	√	1|3|5|6|7	6.5.3
P2-41	Disturbance Torque Compensation Coefficient (Non-adaptive Mode Effective)	%	85	0~100	√	1|3|5|6|7	6.1.4
P2-47.0	Model Loop Switch 0-OFF 1-ON	-	1	0~f	√	1|3|5|6|7	6.1.3
P2-49	Model loop gain	0.1Hz	480	10~20000	△	3|5|6|7	6.5.4
P2-60.0	Active Vibration Suppression Switch 0-OFF 1-ON	-	0	0~1	√	3|5|6|7	6.4.6
P2-60.1	Active Suppression Auto-tuning Switch 0-Active Vibration Suppression isn't Configured in auto-tuning 1- configure the Active Vibration Suppression when auto-tuning	-	1	0~1	√	3|5|6|7	6.4.6
P2-61	Active Vibration Suppression frequency	0.1Hz	1000	10~20000	√	1|3|5|6|7	6.5
P2-62	Active Vibration Suppression gain	%	100	1~1000	√	1|3|5|6|7	6.4.6
P2-63	Active Vibration Suppression damping	%	100	0~300	√	1|3|5|6|7	6.4.6
P2-64	Filtering time of active vibration suppression 1	-	0	-5000~5000	√	1|3|5|6|7	6.4.6
P2-65	Filtering time of active vibration suppression 2	-	0	-5000~5000	√	1|3|5|6|7	6.4.6
P2-66	The second group of active vibration damping	-	0	0~1000	√	1|3|5|6|7	6.4.6
P2-67	Second group active vibration suppression frequency	Hz	20000	10~50000	√	1|3|5|6|7	6.4.6
P2-69.0	Notch filter 1 switch	-	0	0~1	√	1|3|5|6|7	6.4.6
P2-69.1	Notch filter 2 switch	-	0	0~1	√	1|3|5|6|7	6.4.6
P2-69.3	Notch filter 3 switch	-	0	0~1	√	1|3|5|6|7	-
P2-70.0	Notch filter 4 switch	-	0	0~1	√	1|3|5|6|7	-
P2-70.1	Notch filter 5 switch	-	0	0~1	√	1|3|5|6|7	-
P2-71	First notch frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-72	First notch attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-73	First notch band width	Hz	0	0~1000	√	1|3|5|6|7	6.7.7
P2-74	Second notch frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-75	Second notch attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-76	Second notch band width	Hz	0	0~1000	√	1|3|5|6|7	6.7.7
P2-77	Third notch frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7

P2-78	Third notch attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-79	Third notch band width	Hz	0	0~1000	√	1|3|5|6|7	6.7.7
P2-80	Fourth notch frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-81	Fourth notch attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-82	Fourth notch band width	Hz	0	0~1000	√	1|3|5|6|7	6.7.7
P2-83	Fifth notch frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-84	Fifth notch attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-85	Fifth notch band width	Hz	0	0~1000	√	1|3|5|6|7	6.7.7

P3-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P3-00	V-REF Function Allocation 0-V-REF as Speed Instruction Input 1-V-REF will be used as input reference value of external speed limit. The actual speed limit depends on the speed limit of external analog quantity. 2-Speed Feedforward	-	0	0~2	○	1	5.5
P3-05	Preset speed 1	rpm	0	-9999~9999	√	3	5.4.2
P3-06	Preset speed 2	rpm	0	-9999~9999	√	3	5.4.2
P3-07	Preset speed 3	rpm	0	-9999~9999	√	3	5.4.2
P3-09	Acceleration time	ms	3720 and before:0 3730:200	0~65535	○	3|7	5.4.1.1
P3-10	Deceleration time	ms	3720 and before:0 3730:200	0~65535	○	3|7	5.4.1.1
P3-11	Speed instruction sliding average filtering time (supported in versions 3770 and later)	ms	0	0~65535	√	1|2|3|4|5|6|7	5.4.1.4
P3-12	Zero-speed clamping mode	-	0	0~3	○	3|7	5.4.1.2
P3-13	Zero-speed clamping speed	rpm	10	0~300	○	3|7	5.4.1.2
P3-14	Forward Maximum Speed Instruction Limit	rpm	4000	0~10000	○	1|3|5|6|7	5.7.3
P3-15	Reverse Maximum Speed Instruction Limit	rpm	4000	0~10000	○	1|3|5|6|7	5.7.3
P3-16	Internal Forward Speed Limitation in Torque Control	rpm	2000	5~10000	√	1	5.5.1.2
P3-17	Internal Reverse Speed Limitation in Torque Control	rpm	2000	5~10000	√	1	5.5.1.2
P3-18	Jogging speed	rpm	100	0~1000	○	1|3|5|6|7	4.4.2
P3-19	forward warning speed	rpm	3000	0~10000	○	1|3|5|6|7	5.8.5.4
P3-20	reverse warning speed	rpm	3000	0~10000	○	1|3|5|6|7	5.8.5.4
P3-21	forward alarming speed	rpm	4000	0~10000	○	1|3|5|6|7	-

P3-22	reverse alarming speed	rpm	4000	0~10000	○	1|3|5|6|7	-
P3-23	T-REF Function Allocation 0 -Input as Torque Instruction 1 - As a necessary condition for limiting input of external torque, the minimum value is valid compared with P3-28/P3-29. 2-Torque Feedforward	-	0	0~2	○	1|3|5|6|7	-
P3-28	Internal forward torque limit	%	As the model	0~Motor overload multiple	√	1|3|5|6|7	5.8.2
P3-29	Internal reverse torque limit	%	As the model	0~Motor overload multiple	√	1|3|5|6|7	5.8.2
P3-30	External forward torque limit	%	As the model	0~Motor overload multiple	√	1|3|5|6|7	5.8.2
P3-31	External reverse torque limit	%	As the model	0~Motor overload multiple	√	1|3|5|6|7	5.8.2
P3-33	Preset torque	%	0	-1000~1000	√	1	5.5.1.1
P3-38	Anti blocking alarm internal forward torque limit	%	As the model	0~Motor overload multiple	√	1|3|5|6|7	5.8.2
P3-39	Anti blocking alarm internal reverse torque limit	%	As the model	0~Motor overload multiple	√	1|3|5|6|7	5.8.2
P3-37	Delay in switching torque mode	ms	40	0~9999	√	1	-

P4-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P4-00.0	Z phase signal numbers The Z phase signal numbers after leaving the limit switch (note: stop when N+1 Z phase signal reached)	pcs	2	0~f	○	5|6	5.4.1.8
P4-00.1	Search the origin function 0-OFF 1-ON	-	0	0~1	○	5|6	5.4.1.8
P4-00.2	return to zero overrun prohibition 0-not prohibit 1-prohibit	-	0	0~1	○	5|6	5.4.1.8
P4-01	Speed of hitting the proximity switch	rpm	600	0~65535	○	5|6	5.4.1.8
P4-02	Speed of leaving proximity switch	rpm	100	0~65535	○	5|6	5.4.1.8
P4-03.0	Internal Location Given Mode Sets Location Mode 0-relative positioning 1-Absolute positioning	-	0	0~1	○	5	5.4.3.1

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P4-03.1	Internal Position-Given Mode Sets Step Change Mode 0-step-changing when signal is ON, recyclable 1-change step at signal rising edge, single step execution 2-starting at Signal rising edge, sequential execution of all, no cycle 3-set segment no. through communication 4-/CHSTP dual edge triggerring 5-terminal/PREFA(P5-57), /PREFB(P5-58), /PREFC(P5-59) select the segment no., range 1~3 6-terminal/PREFA (P5-57), /PREFB(P5-58), /PREFC(P5-59),/PREFD(P5-60) select segment no., range 1~16	-	0	0~6	○	6	5.4.3.1
P4-03.2	Internal position mode sets waiting mode 0-wait positioning completion 1-not wait positioning completion	-	0	0~1	○	5	5.4.3.1
P4-04	Valid segment number	-	0	0~35	○	5	5.4.3.2
P4-10~P4-11	First segment pulse	1pul	0	-327689999 ~327679999	√	5	5.4.3
P4-12	First segment speed	0.1rpm	0	0~65535	√	5	5.4.3
P4-13	First segment acceleration time	1ms	0	0~65535	√	5	5.4.3
P4-14	First segment deceleration time	1ms	0	0~65535	√	5	5.4.3
P4-16	Adjusting time	1ms	0	0~65535	√	5	5.4.3
P4-10+(n-1)*7 ~ P4-16+(n-1)*7	segment 1 to 35 pulse parameters (n is segment number)	-	-	-	√	5	5.4.3

P5-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P5-00	Positioning completion width/COIN	Command unit	11	1~65535	√	5|6	5.4.1.2
P5-01	Location completion detection mode	-	0	0~3	√	5|6	5.4.1.2
P5-02	Location completion retention time	ms	0	0~65535	√	5|6	5.4.1.2
P5-03	Rotation detection speed	rpm	50	0~10000	√	1|3|5|6|7	5.7.5.2
P5-04	Same speed detection speed	rpm	50	0~10000	√	1|3|5|6|7	5.7.5.4
P5-05	Reached detection speed	rpm	1000	0~10000	√	1|3|5|6|7	5.4.1.3
P5-06	Positioning near output width	Command unit	50	1~65535	√	5|6	5.4.1.3

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P5-07	Servo OFF delay time	ms	500	0~65535	○	1|3|5|6|7	5.2.5
P5-08	Brake instruction output speed	rpm	30	20~10000	○	1|3|5|6|7	5.2.5
P5-09	Brake instruction waiting time	ms	500	0~65535	○	1|3|5|6|7	5.2.5
P5-10	user-defined output 1 trigger condition	-	0	0~ffff	√	1|3|5|6|7	5.7.5.7
P5-11	Set a value that compares with the trigger condition of custom output 1	Relating to trigger condition	0	-9999~9999	√	1|3|5|6|7	5.7.5.7
P5-12	Select custom output 1 mode	-	0	0~3	√	1|3|5|6|7	5.7.5.7
P5-13	Setting custom output 1 hysteresis	Relating to trigger condition	0	0~65535	√	1|3|5|6|7	5.7.5.7
P5-14	Custom Output 2 Trigger Condition	-	0	0~ffff	√	1|3|5|6|7	5.7.5.7
P5-15	Set a value that compares with the trigger condition of custom output 2	Relating to trigger condition	0	-9999~9999	√	1|3|5|6|7	5.7.5.7
P5-16	Select custom output 2 mode	-	0	0~3	√	1|3|5|6|7	5.7.5.7
P5-17	Setting custom output 2 hysteresis	Relating to trigger condition	0	0~65535	√	1|3|5|6|7	5.7.5.7
P5-18	SI filter time multiple	-	1	0~10000	√	1|3|5|6|7	5.7.4.1
P5-19	Z phase output maintain time	ms	2	1~65535	√	1|3|5|6|7	5.7.6.1
P5-20.0~1	/S-ON: servo signal 00: Set the signal to be invalid all the time. 01: Input positive signal from SI1 terminal. 02: Input positive signal from SI2 terminal. 03: Input positive signal from SI3 terminal. 04: Input positive signal from SI4 terminal. 05: Input positive signal from SI5 terminal. 10: Set the signal to always be "valid". 11: Inverse signal is input from SI1 terminal. 12: Inverse signal is input from SI2 terminal. 13: Inverse signal is input from SI3 terminal. 14: Inverse signal is input	-	01	0~ff	√	1|3|5|6|7	5.2.2

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
	from SI4 terminal. 15: Inverse signal is input from SI5 terminal.						
P5-20.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-21.0~1	/P-CON proportion action instruction	-	00	0~ff	√	1|3|5|6|7	5.8.6.1
P5-21.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-22.0~1	/P-OT: Forbidden forward driving	-	03	0~ff	√	1|3|5|6|7	5.2.4
P5-22.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-23.0~1	/N-OT: forbidden reverse driving	-	Decided by the model	0~ff	√	1|3|5|6|7	5.2.4
P5-23.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-24.0~1	/ALM-RST: alarm clear	-	02	0~ff	√	1|3|5|6|7	5.7.6.2
P5-24.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.11
P5-25.0~1	/P-CL:External Torque Limitation at Forward Rotation Side	-	00	0~ff	√	1|3|5|6|7	5.8.2
P5-25.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-26.0~1	/N-CL:External Torque Limitation at Reverse Rotation Side	-	00	0~ff	√	1|3|5|6|7	5.7.2
P5-26.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-27.0~1	/SPD-D: Internal Speed Direction Selection	-	00	0~ff	√	1|3|7	5.4.2
P5-27.2	SI terminal filtering time	ms	0	0~f	√	1|3|7	5.7.4.1
P5-28.0~1	/Speed mode: /SPD-A: Internal setting speed selection New Return to Original Mode: /SPD-A: Trigger the return to original action Old Return Mode: /SPD-A: Find the origin in the forward direction	-	00	0~ff	√	3|5	5.4.2
P5-28.2	SI terminal filtering time	ms	0	0~f	√	3|5	5.7.4.1
P5-29.0~1	Speed mode: /SPD-B: Internal Setting Speed Selection Old Return Mode: /SPD-B: Reverse direction to find origin	-	00	0~ff	√	3|5	5.4.2
P5-29.2	SI terminal filtering time	ms	0	0~f	√	3|5	5.7.4.1
P5-30.0~1	/C-SEL: Control mode selection	-	00	0~ff	√	1|3|5|6|7	5.1.2
P5-30.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-31.0~1	/ZCLAMP: zero position clamping	-	00	0~ff	√	3|7	5.4.1.2
P5-31.2	SI terminal filtering time	ms	0	0~f	√	3|7	5.7.4.11
P5-32.0~1	/INHIBIT: Instruction pulse prohibition	-	00	0~ff	√	5	5.4.1.4

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P5-32.2	SI terminal filtering time	ms	0	0~f	√	5	6.6.7
P5-33.0~1	/G-SEL: Gain Switching	-	00	0~ff	√	1|3|5|6|7	6.8.4
P5-33.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	6.8.4
P5-34.0~1	/CLR: pulse offset clear	-	00	0~ff	√	5|6	5.4.1.5
P5-34.2	SI terminal filtering time	ms	0	0~f	√	5|6	5.7.4.1
P5-35.0~1	/CHGSTP: internal position mode change step signal	-	00	0~ff	√	5	5.4.3
P5-35.2	SI terminal filtering time	ms	0	0~f	√	5	5.7.4.1
P5-36.0~1	/I-SEL: inertia ratio switching	-	00	0~ff	√	1|3|5|6|7	6.6.7
P5-36.2	SI terminal filtering time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-37	/COIN_HD: Location Completion Maintenance 00: No output to terminal 01: Output positive signal from SO1 terminal 02: Output positive signal from SO2 terminal 03: Output positive signal from SO3 terminal 11: Output reverse signal from SO1 terminal 12: Output reverse signal from SO2 terminal. 13: Output reverse Signal from SO3 terminal	-	0000	0~ffff	√	5|6	5.4.1.2
P5-38	/COIN: positioning completion	-	0001	0~ffff	√	5|6	5.4.1.2
P5-39	/V-CMP: same speed detection	-	0000	0~ffff	√	3|7	5.7.5.4
P5-40	/TGON: rotation detection	-	0000	0~ffff	√	1|3|5|6|7	5.7.5.2
P5-41	/S-RDY: ready	-	0000	0~ffff	√	1|3|5|6|7	5.7.5.1
P5-42	/CLT: torque limit	-	0000	0~ffff	√	1|3|5|6|7	5.7.2
P5-43	/VLT:speed limit detection	-	0000	0~ffff	√	1	5.5.1.3
P5-44	/BK: brake locking	-	0000	0~ffff	○	1|3|5|6|7	5.2.5
P5-45	/WARN: warning	-	0000	0~ffff	√	1|3|5|6|7	5.12.2
P5-46	/NEAR: near	-	0000	0~ffff	√	1|3|5|6|7	5.4.7
P5-47	/ALM: alarm	-	0002	0~ffff	√	1|3|5|6|7	5.2.6
P5-48	/Z: encoder Z phase signal output	-	0000	0~ffff	√	1|3|5|6|7	5.12.5
P5-50	/MRUN: internal position mode motion starting signal	-	0000	0~ffff	√	3|7	5.4.1.3
P5-51	/V-RDY: speed reached	-	0000	0~ffff	√	1|3|5|6|7	5.7.5.7
P5-52	/USER1: user-defined output 1	-	0000	0~ffff	√	1|3|5|6|7	5.7.5.7
P5-53	/USER2: user-defined output 2	-	0000	0~ffff	√	1|3|5|6|7	5.12.2
P5-54	Return to origin to complete signal	-	0000	0~ffff	√	5|6	
P5-57.0~1	/PREFA: intenral position selection signal A	-	00	0~ff	√	5	5.4.3.1

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P5-57.2	SI terminal filtering time	ms	0	0~f	√	5	5.7.4.1
P5-58.0~1	/PREFB: intenral position selection signal B	-	00	0~ff	√	5	5.4.3.1
P5-58.2	SI terminal filtering time	ms	0	0~f	√	5	5.7.4.1
P5-59.0~1	/PREFC: internal position selection signal C	-	00	0~ff	√	5	5.4.3.1
P5-59.2	SI terminal filtering time	ms	0	0~f	√	5	5.7.4.1
P5-60.0~1	/PrefD: Internal Position Selection Signal D	-	00	0~ff	√	5	5.3.3.1
P5-60.2	SI terminal filtering time	ms	0	0~f	√	5	5.7.4.1
P5-61.0~1	/TRAJ-START: Motion start trigger signal	-	00	0~ff	√	5	-
P5-61.2	SI terminal filtering time	ms	0	0~f	√	5	-
P5-70	/SRDY: Output Conditions Selection 0: This terminal is turned on after initialization of the driver is completed 1: This terminal will not turn on until enabled.	-	0	0~1	√	1|3|5|6|7	5.7.5.1
P5-71	Function Selection of Directional Terminal of Pulse Speed Mode	-	0	0~1	○	7	5.4.3.4

P6-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P6-05	Adaptive Mode Speed Loop Gain (Large Inertia)	0.1Hz	200	1~65535	○	1|3|5|6|7	6.6.4
P6-07	Adaptive mode inertia ratio (Large inertia)	%	50	0~10000	○	1|3|5|6|7	6.6.4
P6-08	Gain of adaptive mode speed observer (large inertia)	Hz	40	10~1000	○	1|3|5|6|7	6.6.4
P6-12	Maximum Inertia Ratio of Adaptive Mode (Large Inertia)	-	50	1~10000	○	1|3|5|6|7	6.6.4

P7-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P7-00	RS485 station no.	-	1	0~100	○	1|2|3|4|5|6|7|8|9|10	8.2
P7-01.0~1	RS485 baud rate 00:300 01:600 02:1200 03:2400 04:4800 05:9600 06:19200 07:38400 08:57600 09:115200	Baud rate	06	0~16	○	1|2|3|4|5|6|7|8|9|10	8.2

	0A:192000 0B:256000 0C:288000 0D:384000 0E:512000 0F:576000 10:768000 11:1M 12:2M 13:3M 14:4M 15:5M 16:6M						
P7-01.2	RS485 stop bit 2:1 bit	Stop bit	2	0~2	○	1|2|3|4|5|6|7|8|9|10	8.2
P7-01.3	RS485 parity bit 0:none 1:odd 2:even	Parity bit	2	0~2	○	1|2|3|4|5|6|7|8|9|10	8.2
P7-02	RS485 communication protocol 1:Modbus Rtu	-	1	1~255	○	1|2|3|4|5|6|7|8|9|10	8.2
P7-03	Xnet Synchronous sampling time	1ms	9	1~500	○	10	5.6.2.1
P7-04	Xnet slave station data	-	15	1~500	○	10	5.6.2.1
P7-05	Xnet slave station quantity	-	10	1~20	○	10	5.6.2.1
P7-06	Communication timeout retry count	times	10	1~500	○	10	5.6.2.1
P7-08	Position deviation compensation threshold	-	0	0~0	√	10	5.6.2.1
P7-09	Number of compensation times for position deviation	-	0	0~0	√	10	5.6.2.1
P7-10	RS232 station no.	-	1	0~100	√	1|2|3|4|5|6|7|8|9|10	8.2
P7-11.0~1	RS232 baud rate 00:300 01:600 02:1200 03:2400 04:4800 05:9600 06:19200 07:38400 08:57600 09:115200 0A:192000 0B:256000 0C:288000 0D:384000 0E:512000 0F:576000 10:768000 11:1M 12:2M 13:3M 14:4M 15:5M	Baud rate	09	0~16	√	1|2|3|4|5|6|7|8|9|10	8.2

	16:6M						
P7-11.2	RS232 stop bit 0:2 bits 2:1 bit	Stop bit	2	0~2	√	1|2|3|4|5|6|7|8|9|10	8.2
P7-11.3	RS232 parity bit 0:none 1:odd 2:even	Parity bit	2	0~2	√	1|2|3|4|5|6|7|8|9|10	8.2
P7-20	Return to zero point direction (bus)	-	1	-9999~99999	√	10	5.6.2.1
P7-21	Filter time after returning to zero point completion (bus)	ScanA Cycle	400	1~65535	√	10	5.6.2.1

P8-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P8-25	Panel display selection	-	0	0~2	▲	1|2|3|4|5|6|7	4.2

P9-XX:

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P9-11.0	Homing find Z phase quantity	-	0	0~f	○	5|6	5.4.1.9
P9-11.1	New homing trigger mode 0: Prohibit triggering homing 1: Trigger the homing through the SI terminal 2: Immediately homing after the first power on activation	-	0	0~2	○	5|6	5.4.1.9
P9-11.2	New homing mode 0:Homing mode 0 1:Homing mode 1 2:Homing mode 2 3:Homing mode 3 4:Homing mode 4 5:Homing mode 5 6:Homing mode 6 7:Homing mode 7	-	0	0~7	○	5|6	5.4.1.9
P9-12	Homing high speed	-	200	0~3000	○	5|6	5.4.1.9
P9-13	Homing low speed	-	20	0~1000	○	5|6	5.4.1.9
P9-14	Homing acceleration time	-	1000	0~5000	○	5|6	5.4.1.9
P9-15	Homing timeout time	-	0	0~12000	○	5|6	5.4.1.9
P9-16	Touch stop homing speed threshold	-	2	0~1000	○	5|6	5.4.1.9
P9-17	Touch stop homing torque threshold	-	100	0~300	○	5|6	5.4.1.9
P9-18	Touch stop homing time threshold	-	500	10~1500	○	5|6	5.4.1.9
P9-19	Quantitative pulse number low bit	-	0	-9999~9999	○	5|6	5.4.1.9
P9-20	Quantitative pulse number high bit	-	0	-9999~9999	○	5|6	5.4.1.9
P9-21	Homing selection	-	0	0~1	●	5|6	5.4.1.9
P9-22	Homing completed filter time	-	500	50~10000	○	5|6	5.4.1.9

Appendix 2. UX-XX monitoring parameters

U0-XX:

Code	Contents		Unit
U0-00	Servo motor speed		Rpm
U0-01	Input speed instruction		Rpm
U0-02	Torque instruction		% rated
U0-03	Mechanical angle		1°
U0-04	Electric angle		1°
U0-05	Bus voltage		V
U0-06	IPM temperature		℃
U0-07	Torque feedback		% rated
U0-08	Pulse offset	(-9999~9999)*1	Instruction pulse
U0-09		(-32768~32767)*10000	
U0-10	Encoder feedback	(0000~9999)*1	Encoder pulse
U0-11		(0000~65535)*10000	
U0-12	Input instruction pulse numbers	(-9999~9999)*1	Instruction pulse
U0-13		(-32768~32767)*10000	
U0-14	Position feedback	(-9999~9999)*1	Instruction pulse
U0-15		(-32768~32767)*10000	
U0-18	Torque current		0.01A
U0-19	Analog input V-REF value		0.001V
U0-20	Analog input T-REF value		0.001V
U0-21	Input signal status 1		-
U0-22	Input signal status 2		-
U0-23	Output signal status 1		-
U0-24	Output signal status 2		-
U0-25	Input pulse frequency	(0000~9999)*1	Hz
U0-26		(0000~9999)*10000	
U0-41	Instantaneous output power		1W
U0-42	Average output power		1W
U0-43	Instantaneous thermal power		1W
U0-44	Average thermal power		1W
U0-49	Position feedforward		1 command unit
U0-50	Speed feedforward		rpm
U0-51	Torque feedforward		% rated
U0-52	Instantaneous Bus Capacitor Power		1W
U0-53	Average Bus Capacitor Power		1W
U0-54	Encoder error count		-
U0-55	Discharge power of instantaneous regenerative braking		1W
U0-56	Average regenerative brake discharge power		1W
U0-57	Absolute encoder present position feedback low 32-bit		Encoder position
U0-58			
U0-59	Absolute encoder present position feedback high 32-bit		Encoder position
U0-60			
U0-62	Xnet Communication Waiting Synchronization Frame State Interference		-
U0-63	Xnet Communication Waiting for Synchronization Frame State Receiving Data Frame		-

U0-64	Xnet Communication Waiting Data Frame State Interference		-
U0-65	Xnet Communication Waiting for Data Frame Status Receive Synchronized Frame		-
U0-66	Xnet communication CRC parity error		-
U0-67	Xnet communication UART error		-
U0-68	Xnet communication timeout counting		-
U0-69	Communication encoder timeout counting		-
U0-79	Encoder CRC error count		-
U0-80	Internal position mode error segment number		-
U0-81	Internal position mode current segment number		-
U0-82	Analog input V-REF raw value		-
U0-83	Analog input T-REF raw value		-
U0-88	Reading and writing motor parameter result flag		-
U0-89	Real-time speed feedback (displaying range -99.99~99.99rpm)		0.01rpm
U0-90	Maximum position deviation starting from a stationary state		-
U0-91	Multi-turn absolute motor circles		-
U0-94	Encoder feedback position after calibration	(0000~65535)*1	Encoder pulses
U0-95		(0000~65535)*2^{16}	
U0-96		(0000~65535)*2^{32}	
U0-97		(-32768~32767)*2^{64}	

U1-XX:

Code	Contents	Unit
U1-00	Present alarm code	
U1-01	Present warning code	
U1-02	U phase current when alarming	0.01A
U1-03	V phase current when alarming	0.01A
U1-04	Bus voltage when alarming	V
U1-05	IGBT temperature when alarming	0.1 ℃
U1-06	Torque current when alarming	0.01A
U1-07	Excitation current when alarming	A
U1-08	Position offset when alarming	Instruction pulse
U1-09	Speed when alarming	rpm
U1-10	Seconds(low 16-bit) when alarming, cumulated seconds from the first time power-on	s
U1-11	Seconds(high 16-bit) when alarming, cumulated seconds from the first time power-on	s
U1-12	This time running error numbers, counting after power on this time	-
U1-13	This time operation warning numbers, counting after power on this time	-
U1-14	Historical alarm amounts	-
U1-15	Historical warning amounts	-
U1-16	Recent 2nd alarm code	-
U1-17	Recent 3rd alarm code	-
U1-18	Recent 4th alarm code	-
U1-19	Recent 5th alarm code	-
U1-20	Recent 6th alarm code	-
U1-21	Recent 7th warning code	-
U1-22	Recent 8th warning code	-
U1-23	Recent 9th warning code	-
U1-24	Recent 10th warning code	-

U1-25	Recent 11th warning code	-
U1-26	Recent 12th warning code	-

U2-XX:

Code	Contents		Unit
U2-00	Power on times		-
U2-01	Series		-
U2-02	Model (low 16-bit)		-
U2-03	Model (high 16-bit)		-
U2-04	Out of factory date: year		-
U2-05	Out of factory date: month		-
U2-06	Out of factory date: day		-
U2-07	Firmware version		-
U2-08	Hardware version		-
U2-09	Total running time (from the first time power on)		hour
U2-10	Total running time (from the first time power on)		minute
U2-11	Total running time (from the first time power on)		second
U2-12	This time running time (from this time power on)		hour
U2-13	This time running time (from this time power on)		minute
U2-14	This time running time (from this time power on)		second
U2-15	Average output power (from the first time enabled, average power in the process of enabling)		1W
U2-16	Average thermal power (from the first time enabled, average power in the process of enabling)		1W
U2-17	Average bus capacitor filter power (from the first time power on, average power in the process of power on)		1W
U2-18	Motor accumulated turns	(0000~9999)*1	Turn
U2-19		(0000~9999)*10000	Turn
U2-20	Device serial no.: low 16-bit		-
U2-21	Device serial no.: high 16-bit		-
U2-22	Firmware generation date: year		-
U2-23	Firmware generation date: month/day		-
U2-24	Firmware generation date: hour/minute		-

U3-XX:

Code	Contents	Unit
U3-00	Motor code read automatically by driver	-
U3-01	Motor version	-
U3-02	Encoder version	-
U3-70	Automatically read the motor code of the encoder in the motor parameters (only related to the motor code)	-

U4-XX:

Code	Content	Unit
U4-10	Resonance frequency detected by fast FFT	Hz
U4-16	Accumulated value of continuous overload operation for thermal power protection (supported in versions 3770 and later)	-
U4-17	Accumulated value of instantaneous overload operation for thermal power protection (supported in versions 3770 and later)	-

Appendix 3. FX-XX auxiliary function parameters

Code	Contents	Refrence chapter
F0-00	Clear the alarm	4.4.1
F0-01	Restore to out of factory settings	4.4.1
F0-02	Clear the position offset	4.4.1
F0-07	Panel inertia identification	6.3.4
F0-08	Panel external command auto-tuning	6.5.5
F0-09	Panel internal command auto-tuning	6.5.4
F0-10	Panel vibration suppression 1	6.7.4
F0-11	Panel vibration suppression 2	6.7.4
F0-12	Panel vibration suppression (Quick FFT)	6.7.6
F1-00	Jog run	4.4.2
F1-01	Test run	4.4.2
F1-02	Current Sampling Zero-correction	4.4.2
F1-05	Software enable	4.4.2
F1-06	Absolute encoder position clear	4.4.2
F2-09	The segment setting through communication	5.4.3.5

Appendix 4. Modbus address list

1. Address correspondence rules

For the allocation rules of servo Modbus addresses, refer to this address allocation rule for parameter addresses that are not involved in the future.

Parameter	Modbus address	Notes
P0-00~P0-xx	0x0000~0x0063	Modbus address is added 1 in turn from 0x0000, for example, Modbus address of P0-23 is 0x0017
P1-00~P1-xx	0x0100~0x0163	Modbus address is added 1 in turn from 0x0100, for example, Modbus address of P1-10 is 0x010A
P2-15~P2-xx	0x020F~0x0263	Modbus address is added 1 in turn from 0x020F, for example, Modbus address of P2-16 is 0x0210
P3-00~P3-xx	0x0300~0x0363	Modbus address is added 1 in turn from 0x0300, for example, Modbus address of P3-13 is 0x030D
P4-00~P4-xx	0x0400~0x0463	Modbus address is added 1 in turn from 0x0400, for example, Modbus address of P4-25 is 0x0419
P5-00~P5-xx	0x0500~0x0563	Modbus address is added 1 in turn from 0x0500, for example, Modbus address of P5-20 is 0x0514
P6-00~P6-xx	0x0600~0x0663	Modbus address is added 1 in turn from 0x0600, for example, Modbus address of P6-05 is 0x0605
P7-00~P7-xx	0x0700~0x0763	Modbus address is added 1 in turn from 0x0700, for example, Modbus address of P7-11 is 0x070B
P8-00~P8-xx	0x0800~0x0863	The Modbus address starts from 0x0800 and increases by 1 in sequence. For example, the Modbus address corresponding to P8-25 is 0x019
P9-00~P9-xx	0x0900~0x0963	The Modbus address starts from 0x0900 and increases by 1 in sequence. For example, the Modbus address corresponding to P9-12 is 0x090C
U0-00~U0-xx	0x1000~0x1063	Modbus address is added 1 in turn from 0x1000, for example, Modbus address of U0-05 is 0x1005
U1-00~U1-xx	0x1100~0x1163	Modbus address is added 1 in turn from 0x1100, for example, Modbus address of U1-14 is 0x110E
U2-00~U2-xx	0x1200~0x1263	Modbus address is added 1 in turn from 0x1200, for example, Modbus address of U2-08 is 0x1208
F0-00~F0-xx	0x2000~0x2063	Modbus address is added 1 in turn from 0x2000, for example, Modbus address of F0-01 is 0x2001
F1-00~F1-xx	0x2100~0x2163	Modbus address is added 1 in turn from 0x2100, for example, Modbus address of F1-03 is 0x2103

2. Example of Address

■ Group P parameter address

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P0-00	0x0000	0	P0-17	0x0011	17
P0-01	0x0001	1	P0-18	0x0012	18
P0-02	0x0002	2	P0-19	0x0013	19
P0-03	0x0003	3	P0-20	0x0014	20
P0-04	0x0004	4	P0-21	0x0015	21
P0-05	0x0005	5	P0-22	0x0016	22

P0-06	0x0006	6	P0-23	0x0017	23
P0-07	0x0007	7	P0-24	0x0018	24
P0-08	0x0008	8	P0-25	0x0019	25
P0-09	0x0009	9	P0-26	0x001A	26
P0-10	0x000A	10	P0-27	0x001B	27
P0-11	0x000B	11	P0-28	0x001C	28
P0-12	0x000C	12	P0-29	0x001D	29
P0-13	0x000D	13	P0-30	0x001E	30
P0-14	0x000E	14	P0-31	0x001F	31
P0-15	0x000F	15	P0-32	0x0020	32
P0-16	0x0010	16	P0-33	0x0021	33

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P1-00	0x0100	256	P1-15	0x010F	271
P1-01	0x0101	257	P1-16	0x0110	272
P1-02	0x0102	258	P1-17	0x0111	273
P1-03	0x0103	259	P1-18	0x0112	274
P1-04	0x0104	260	P1-19	0x0113	275
P1-05	0x0105	261	P1-20	0x0114	276
P1-06	0x0106	262	P1-21	0x0115	277
P1-07	0x0107	263	P1-22	0x0116	278
P1-08	0x0108	264	P1-23	0x0117	279
P1-09	0x0109	265	P1-24	0x0118	280
P1-10	0x010A	266	P1-25	0x0119	281
P1-11	0x010B	267	P1-26	0x011A	282
P1-12	0x010C	268	P1-27	0x011B	283
P1-13	0x010D	269	P1-28	0x011C	284
P1-14	0x010E	270			

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P2-00	0x0200	512	P2-15	0x20F	527
P2-01	0x0201	513	P2-16	0x210	528

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P3-00	0x0300	768	P3-19	0x0313	787
P3-01	0x0301	769	P3-20	0x0314	788
P3-02	0x0302	770	P3-21	0x0315	789
P3-03	0x0303	771	P3-22	0x0316	790
P3-04	0x0304	772	P3-23	0x0317	791
P3-05	0x0305	773	P3-24	0x0318	792
P3-06	0x0306	774	P3-25	0x0319	793
P3-07	0x0307	775	P3-26	0x031A	794
P3-08	0x0308	776	P3-27	0x031B	795
P3-09	0x0309	777	P3-28	0x031C	796
P3-10	0x030A	778	P3-29	0x031D	797
P3-11	0x030B	779	P3-30	0x031E	798
P3-12	0x030C	780	P3-31	0x031F	799
P3-13	0x030D	781	P3-32	0x0320	800
P3-14	0x030E	782	P3-33	0x0321	801

P3-15	0x030F	783	P3-34	0x0322	802
P3-16	0x0310	784	P3-35	0x0323	803
P3-17	0x0311	785	P3-36	0x0324	804
P3-18	0x0312	786			

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P4-00	0x0400	1024	P4-15	0x040F	1039
P4-01	0x0401	1025	P4-16	0x0410	1040

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P5-00	0x0500	1280	P5-27	0x051B	1307
P5-01	0x0501	1281	P5-28	0x051C	1308
P5-02	0x0502	1282	P5-29	0x051D	1309
P5-03	0x0503	1283	P5-30	0x051E	1310
P5-04	0x0504	1284	P5-31	0x051F	1311
P5-05	0x0505	1285	P5-32	0x0520	1312
P5-06	0x0506	1286	P5-33	0x0521	1313
P5-07	0x0507	1287	P5-34	0x0522	1314
P5-08	0x0508	1288	P5-35	0x0523	1315
P5-09	0x0509	1289	P5-36	0x0524	1316
P5-10	0x050A	1290	P5-37	0x0525	1317
P5-11	0x050B	1291	P5-38	0x0526	1318
P5-12	0x050C	1292	P5-39	0x0527	1319
P5-13	0x050D	1293	P5-40	0x0528	1320
P5-14	0x050E	1294	P5-41	0x0529	1321
P5-15	0x050F	1295	P5-42	0x052A	1322
P5-16	0x0510	1296	P5-43	0x052B	1323
P5-17	0x0511	1297	P5-44	0x052C	1324
P5-18	0x0512	1298	P5-45	0x052D	1325
P5-19	0x0513	1299	P5-46	0x052E	1326
P5-20	0x0514	1300	P5-47	0x052F	1327
P5-21	0x0515	1301	P5-48	0x0530	1328
P5-22	0x0516	1302	P5-49	0x0531	1329
P5-23	0x0517	1303	P5-50	0x0532	1330
P5-24	0x0518	1304	P5-51	0x0533	1331
P5-25	0x0519	1305	P5-52	0x0534	1332
P5-26	0x051A	1306	P5-53	0x0535	1333

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P6-00	0x0600	1536	P6-10	0x060A	1546
P6-01	0x0601	1537	P6-11	0x060B	1547

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P7-00	0x0700	1792	P7-10	0x070A	1802
P7-01	0x0701	1793			

Parameter	Modbus address	Parameter	Modbus address

	Hex	Decimal		Hex	Decimal
P8-25	0x0819	2073			

■ Monitoring status address of group U

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
U0-00	0x1000	4096	U0-32	0x1020	4128
U0-01	0x1001	4097	U0-33	0x1021	4129
U0-02	0x1002	4098	U0-34	0x1022	4130
U0-03	0x1003	4099	U0-35	0x1023	4131
U0-04	0x1004	4100	U0-36	0x1024	4132
U0-05	0x1005	4101	U0-37	0x1025	4133
U0-06	0x1006	4102	U0-38	0x1026	4134
U0-07	0x1007	4103	U0-39	0x1027	4135
U0-08	0x1008	4104	U0-40	0x1028	4136
U0-09	0x1009	4105	U0-41	0x1029	4137
U0-10	0x100A	4106	U0-42	0x102A	4138
U0-11	0x100B	4107	U0-43	0x102B	4139
U0-12	0x100C	4108	U0-44	0x102C	4140
U0-13	0x100D	4109	U0-45	0x102D	4141
U0-14	0x100E	4110	U0-46	0x102E	4142
U0-15	0x100F	4111	U0-47	0x102F	4143
U0-16	0x1010	4112	U0-48	0x1030	4144
U0-17	0x1011	4113	U0-49	0x1031	4145
U0-18	0x1012	4114	U0-50	0x1032	4146
U0-19	0x1013	4115	U0-51	0x1033	4147
U0-20	0x1014	4116	U0-52	0x1034	4148
U0-21	0x1015	4117	U0-53	0x1035	4149
U0-22	0x1016	4118	U0-57	0x1039	4153
U0-23	0x1017	4119	U0-58	0x103A	4154
U0-24	0x1018	4120	U0-59	0x103B	4155
U0-25	0x1019	4121	U0-60	0x103C	4156
U0-26	0x101A	4122	U0-91	0x105B	4187
U0-27	0x101B	4123	U0-94	0x105E	4190
U0-28	0x101C	4124	U0-95	0x105F	4191
U0-29	0x101D	4125	U0-96	0x1060	4192
U0-30	0x101E	4126	U0-97	0x1061	4193
U0-31	0x101F	4127			

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
U1-00	0x1100	4352	U2-00	0x1200	4608
U1-01	0x1101	4353	U2-01	0x1201	4609
U1-02	0x1102	4354	U2-02	0x1202	4610
U1-03	0x1103	4355	U2-03	0x1203	4611
U1-04	0x1104	4356	U2-04	0x1204	4612
U1-05	0x1105	4357	U2-05	0x1205	4613
U1-06	0x1106	4358	U2-06	0x1206	4614
U1-07	0x1107	4359	U2-07	0x1207	4615
U1-08	0x1108	4360	U2-08	0x1208	4616
U1-09	0x1109	4361	U2-09	0x1209	4617
U1-10	0x110A	4362	U2-10	0x120A	4618
U1-11	0x110B	4363	U2-11	0x120B	4619
U1-12	0x110C	4364	U2-12	0x120C	4620

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
U1-13	0x110D	4365	U2-13	0x120D	4621
U1-14	0x110E	4366	U2-14	0x120E	4622
U1-15	0x110F	4367	U2-15	0x120F	4623
U1-16	0x1110	4368	U2-16	0x1210	4624
U1-17	0x1111	4369	U2-17	0x1211	4625
U1-18	0x1112	4370	U2-20	0x1214	4628
U1-19	0x1113	4371			
U1-20	0x1114	4372			
U1-21	0x1115	4373			
U1-22	0x1116	4374			
U1-23	0x1117	4375			
U1-24	0x1118	4376			
U1-25	0x1119	4377			

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
F0-00	0x2000	8192	F1-00	0x2100	8448
F0-01	0x2001	8193	F1-01	0x2101	8449
F0-02	0x2002	8194	F1-02	0x2102	8450
F2-09	0x2209	8713	F1-03	0x2103	8451
			F1-04	0x2104	8452
			F1-05	0x2105	8453
			F1-06	0x2106	8454

Appendix 5. Q&A

Q1: What is bb and run on the panel?
1. bb standby state, without enabling, the motor is in the state of power failure.
2. Run running state, with enabling, the motor is in the power on state.

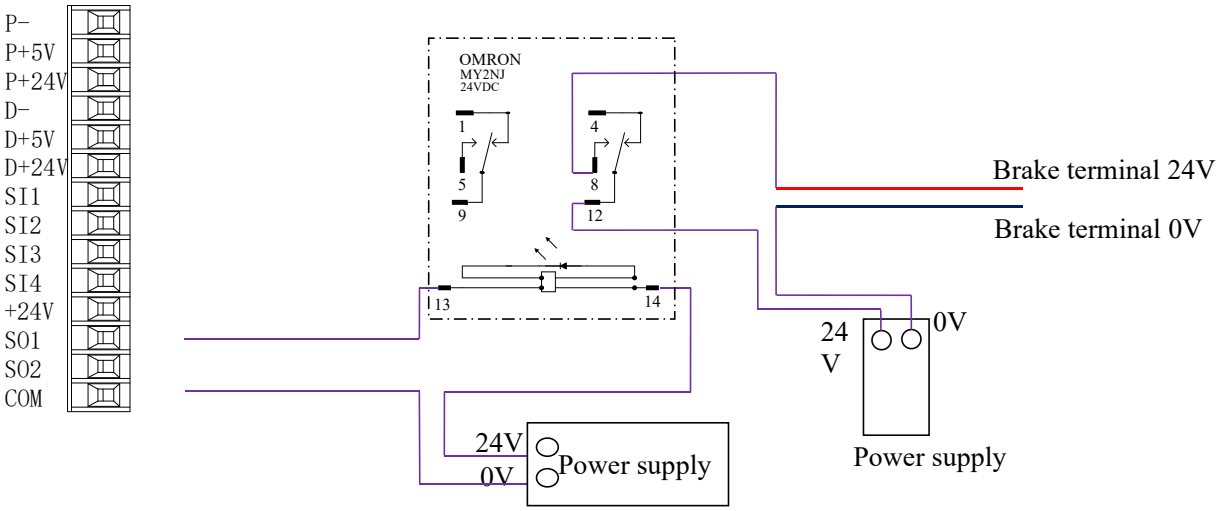
Q2: How to check and set the parameters?
Refer to 4.2.

Q3: How to change the parameters in enabled status?
P5-20=0000, enabling is invalid, P5-20=0010, enabling when power on, no need to power on again.
The default value is 0001, which means input signal from SI1, SI1 connects to low voltage, +24V connects to high voltage (refer to chapter 5.2.2)

Q4: How to restore out of factory settings?
P5-20=0000 enabling is invalid, F0-01=1.

Q5: Which model supports bus mode?
DS5E series supports XNET communication (max 20-axis)
DS5C series supports EtherCAT communication (max 32-axis)

Q6: How to wiring for brake motor? How to modify parameters for slight slip of brake motor after power failure?



1. P5-44 defines the terminal of the brake output signal. As shown in the figure above, the SO1 controls brake, that is, P5-44 = 0001.
2. Extend the delay time of servo OFF P5-07 (default 500ms), and the waiting time of braking instruction P5-09 is set to 0, which can be responded.

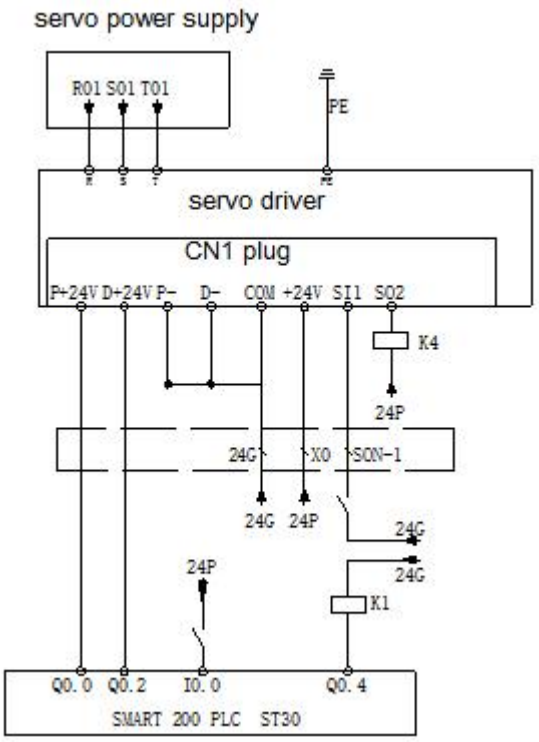
Q7: The initial direction isn't what I want. How can I change it through a servo driver?
Change the initial direction by modifying P0-05, set the value to 0 or 1, and take effect after re-energizing. (For mode 2, 4, 6, 7 only). If the internal speed mode (mode 3) is used, the positive and negative values of the speed setting can be changed.

Q8: How do the two modes switch to each other?
Both P0-01 main mode and P0-02 sub-mode set the required mode. P5-30=0002 and SI2 are defined as mode switching terminals. When the SI2 terminal has no signal, it runs according to the set mode in the main mode P0-01. When the SI2 terminal has signal input, it runs according to the set mode in the sub-mode P0-02.

Note: SI2 terminal signal can be switched only if it is a constant ON signal.

Q9: What is the connection mode between PLC and servo?
1. NPN low-level output PLC: Y0 pulse connects P-, Y1 direction connects D-, +24V connects P+24,

D+24. (Xinje PLC as an example)
PNP high-level output PLC: Q0.0 pulse connects P+24, Q0.2 direction connects D+24, 0V connects P-, D-. (Siemens PLC as an example) as follows:



Q10: What is the external connection method and parameter setting of regenerative resistance?
There are P+, D, C terminals on the servo interface. There are short connectors between P+ and D (using built-in resistor). When the built-in resistor specifications are insufficient, the external resistor should be replaced. The specifications of the external regenerative resistor please refer to 1.4.1.
(1) P+, D, C interface model: Remove the short joint between P+, D, and connect the external regenerative resistance to P+, C.
(2) P+, PB interface model: connect external regenerative resistance to P+, PB.
(3) Version number parameter U2-07 < 3700, set P0-24 = 1, P0-25 = power value, P0-26 = resistance value.
(4) Version number parameter U2-07 ≥ 3700, P0-24 need not be set, P0-25 = power value, P0-26 = resistance value.
Note: Before 3700 version, P0-24 should be set. Value 0 is for built-in resistance and value 1 is for external resistance.

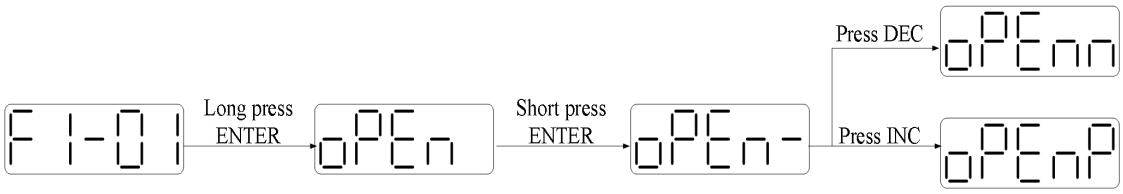
Q11: The service life of tank chain?
The bending resistance is 5 million times and the bending radius is 50 mm.

Appendix 6. General debugging steps

1. Motor empty shaft, preliminary debugging

A. Connect the cable correctly. Pay attention to the one-to-one connection of U, V, W and PE terminals, and the phase sequence can not be crossed.

B. Open-loop test run: The test run mainly checks the power cable and the encoder feedback cable to determine whether the connection is normal. According to the following operation, the motor can normally achieve positive and negative rotation. If the motor shaft shakes or prompts the alarm, it needs to cut off the power supply immediately, and re-check the wiring situation.



C.Jog run: Enter F1-00.

Short press ENTER to enable the motor. In the enabled status, press INC for run forward, press DEC to run reverse. Press STATUS/ESC to exit.

Four status when jog running:

status	Panel display	status	Panel display
Idle	JoG-	Forward run	JoG-P
Enabled	JoG--	Reverse run	JoG-n

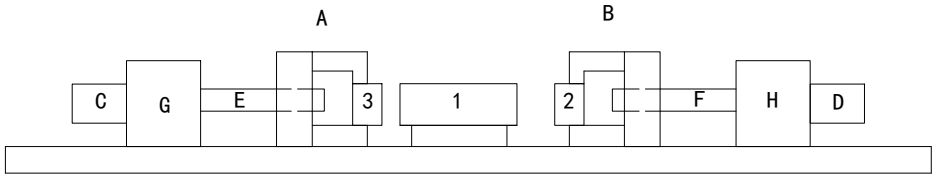
2. Debug the motor with the machine

A. Observe the operating direction of the machine head. If it is contrary to the actual need, after the servo OFF, set the parameter P0-05 to 1, and then re-energize to make the change effective.

B. During the operation, observe the stability and responsiveness of the operation, and adjust the servo control parameters appropriately.

Appendix 7. Application example

Mode 6: Pulse instruction position mode



Equipment introduction:

This is a welder. Workpiece 1, 2, 3 are the object to be operated. 2 and 3 is fixed on B and A individually. A and B can whole move and be pushed by ball screw E and F. The screw pitch is 5mm. C. D is a servo motor with a 17 bit resolution, G and H are reducers with a reduction ratio of 10.
It needs to adjust the machine with standard dimension workpiece and find the origin of A and B.
Workpiece 1 lies on the worktable and moves left and right. Its dimension is positive tolerance, cannot shorter than standard workpiece. The process to put the workpiece is random. It requires that the left and right soldering is symmetrical.
A and B move in the direction of 1 with workpieces 3 and 2 at the same speed. Regardless of the position of 1, there will always be one side of the workpiece that touches 1 first, and then pushes 1 towards the other side until both 2 and 3 touch 1. The result of pushing each other is that the motor output torque will increase. At this point, 1 must be in a symmetrical position.
A and B will return to the origin position after soldering is finished.

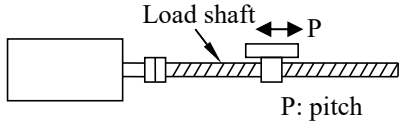
Analysis

1. Make sure the work mode: 6
2. When searching for symmetry points for the first time, it is necessary to determine whether they have all been touched. This is indicated by the increase in servo output torque, which requires the use of torque limits (P3-28, P3-29) and torque upper limit output signals/CLT.
3. As the dimension of workpiece 1 is larger than standard, offset pulse will remain in servo when the symmetrical point is found. /CLR signal can clear the pulse. The servo motor running distance is different from PLC pulse number. If it needs to know the actual distance, servo encoder feedback /A+, /A-, /B+, /B- and AB phase count are needed.
4. The machine motion direction of A and B.

Signal and terminal

/COIN positioning finished signal: SO1
/CLT torque up to upper limit output: SO2
/CLR pulse offset clear input: SI1
Encoder feedback signal /A+, /A-, /B+, /B-

Calculate the electronic gear ratio

Step	Explanation	Ball screw
		 $1\ \text{rotation} = \frac{P}{\text{Command unit}}$
1	Confirm the mechanical specification	Ball screw pitch: 5mm Reduction ratio: 10/1
2	Confirm the encoder pulse number	131072
3	Decide the command unit	1 command unit: 0.001mm
4	Calculate the motion value of load shaft rotate 1 circle	5mm/0.001mm=5000
5	Calculate the number of pulses	5000/10=500

	required for one rotation of the motor shaft	
6	Calculate the electronic gear ratio	$\frac{B}{A}=\frac{2^{17}}{500}=\frac{32768}{125}$
7	Set the user parameters	P0-13=32768 P0-14=125

Parameter setting

Running mode: P0-01=6
Pulse command state: P0-10=2
Electronic gear ratio: P0-11=0 P0-12=0 P0-13=32768 P0-14=125
Forward torque limit: P3-28=150
Reverse torque limit: P3-29=150
Positioning finished width: P5-00=7
/S-ON: P5-20=0010
/CLR: P5-34=0001
/COIN: P5-38=0001
/CLT: P5-42=0002

Appendix 8. Servo general mode parameters

Appendix 8.1 Basic parameters

Basic parameters	
Parameter	Overview
P0-03 enable mode P5-20 servo ON signal /S-ON	Enable mode selection, generally P0-03 is default, P5-20 sets n.0010 as enable on after power on
P0-04 Rigidity grade	Adjust servo gain in auto-tuning fast adjustment mode
P0-05 Definition of rotation direction	Determine the motor direction, generally 0/1 by default
P0-25 Power value of discharge resistance P0-26 Discharge resistance value	Set the specification parameters of external regeneration resistance to ensure that they are the same as the actual ones
P3-28 internal forward torque limit P3-29 internal reverse torque limit P3-30 external forward torque limit P3-31 external reverse torque limit	Set servo torque limit source and limit value. The unit of default value is the percentage of servo torque
P5-44 power loss brake / BK P5-07 servo off delay time P5-08 brake command output speed P5-09 brake command waiting time	The motor with holding brake adopts servo SO terminal to control the setting parameters of holding brake
P5-47 alarm output /ALM	Output alarm function setting through the SO terminal, SO2 terminal default output is dynamic closing signal.
P7-00 RS485 Station No P7-01 communication configuration P7-02 RS485 communication protocol	Communication setting related parameters

Appendix 8.2 External pulse position mode general parameters

External pulse position mode general parameters	
Parameter	Overview
P0-01 control mode selection	Set to 6: external pulse mode
P0-10 pulse instruction format	Set pulse format 0-CW/CCW 1-AB 2-P+D
P0-11 set motor pulses per revolution * 1 P0-12 set motor pulses per revolution * 10000 P0-13 electronic gear ratio (numerator) P0-14electronic gear ratio (denominator) P0-92~P0-93 32-bit electronic gear ratio numerator P0-94~P0-95 32-bit electronic gear ratio denominator	Setting of command pulse number required for one revolution of motor When P0-11 / P0-12 are all zero, P0-13 / P0-14 takes effect When P0-11-P0-14 is zero, P0-92~P0-95 is effective 32-bit gear ratio numerator: P0-92 * 1 + P0-93 * 10000 32-bit gear ratio denominator: P0-94 * 1 + P0-95 * 10000
P0-09 pulse instruction setting	Each bit can set the command direction and filter time of low-speed pulse respectively

Appendix 8.3 Internal position mode general parameters

Internal position mode general parameters	
Parameter	Overview
P0-01 control mode selection	Set to 5: internal position mode
P4-03 internal position setting mode P4-04 number of effective segments P4-10 ~ P4-254 internal section 1 to section 35 position parameter setting	Control mode setting of internal position mode: including step change mode, positioning mode and adjustment time Configuration of pulse displacement, speed, acceleration and deceleration time of each section
P5-35 step change signal /GHGSTP P5-32 suspend the current signal /Inhibit	Common terminal function assignment

P5-31 skip current segment No. /Z-Clamp	
P4-00 Number of Z-phase signals after leaving limit switch P4-01 speed of collision with proximity switch P4-02 speed of leaving proximity switch P5-28 find reference origin in forward side under position mode /SPD-A P5-29 find reference origin in forward side under position mode /SPD-B	Internal position back to origin setting parameters
F2-09 35 Any setting of segment position	Set the segment no. through communication

Appendix 8.4 Internal torque control general parameters

Internal torque control	
Parameter	Overview
P0-01 control mode selection	Set to 1: internal torque mode
P3-33 internal torque command given	The given value is the percentage value of the rated torque
P3-16 internal forward speed limit for torque control P3-17 internal reverse speed limit for torque control P3-14 forward maximum speed limit (max speed) P3-15 reverse maximum speed limit (max speed)	Speed limit in torque mode
P5-27 speed direction switch /SPD-D	Change direction, default is n.0000. If the direction changing is given through SI2 terminal, p5-27 can be set to n.0002.

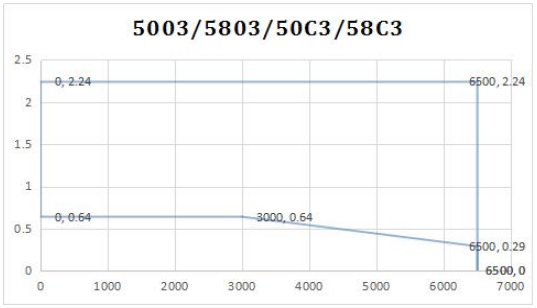
Appendix 8.5 Internal speed control general parameters

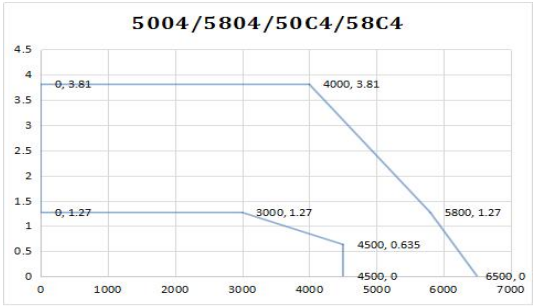
Internal speed control	
Parameter	Overview
P0-01 control mode selection	Set to 3: internal speed control mode
P3-05 internal set speed 1 P3-06 internal set speed 2 P3-07 internal set speed 3	Speed value setting of internal 3-segment speed in rpm
P5-28 internal speed selection /SPD-A P5-29 internal speed selection /SPD-B	The combination of terminals determines the speed of corresponding section
P5-27 internal speed direction selection /SPD-D	Change direction, default is n.0000. If the direction changing is given through SI2 terminal, P5-27 can be set to n.0002.
P3-09 soft start acceleration time P3-10 soft start deceleration time	Set acceleration and deceleration time in ms

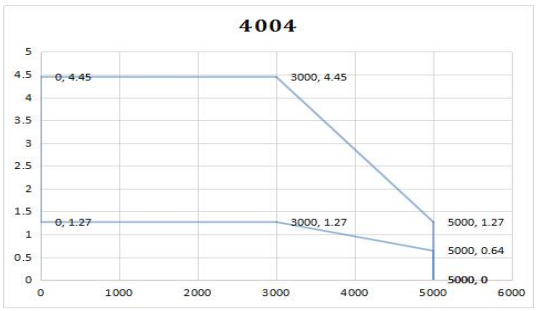
Appendix 8.6 External pulse speed control general parameters

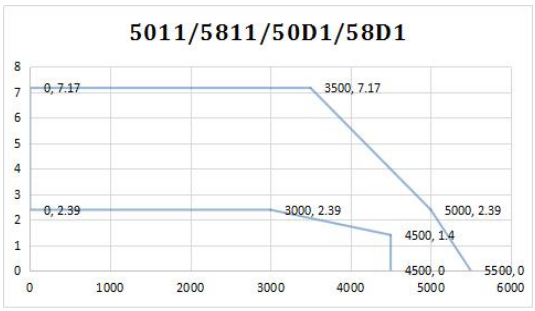
External pulse speed control	
Parameter	Overview
P0-01 control mode selection	Set to 7: external pulse speed mode
P0-10 pulse command format	Set the pulse format 0-CW/CCW 1-AB 2-P+D
P0-15 Command pulse frequency at rated speed	Determine the linear relationship between the command pulse frequency and the speed
P0-16 Speed command pulse filtering time	When the command pulse frequency is relatively low, setting this parameter properly can reduce the speed fluctuation

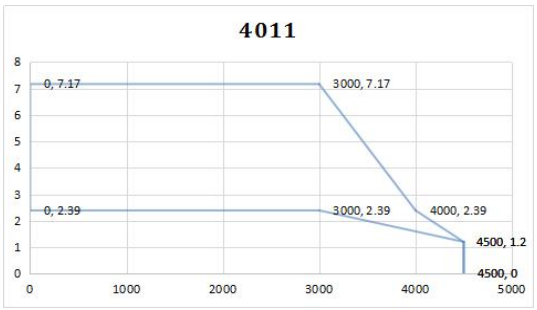
Appendix 9. Torque-speed characteristic curve

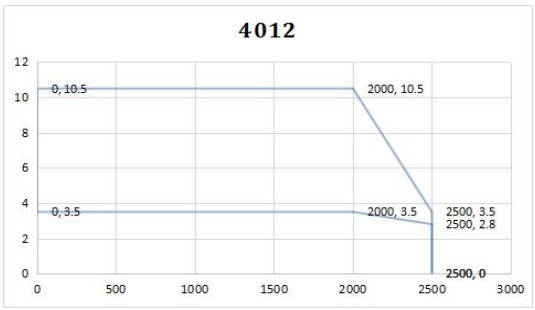


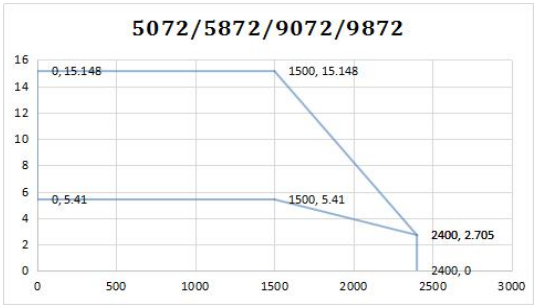


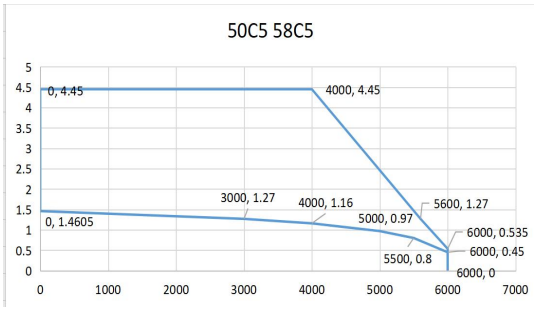


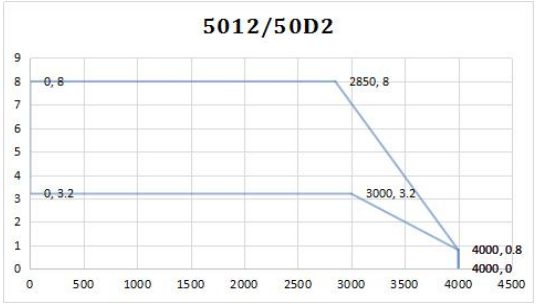


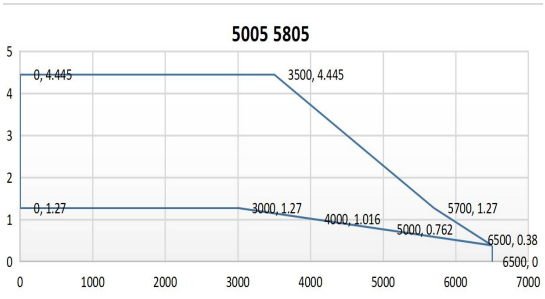


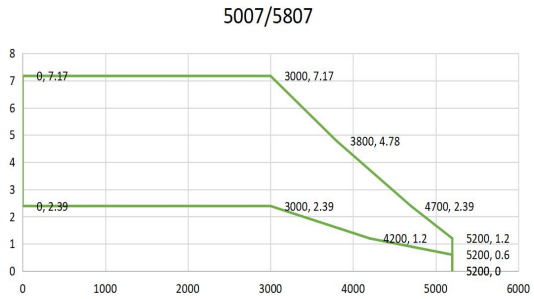











5007/5807
0, 7.17
3000, 7.17
3800, 4.78
0, 2.39
3000, 2.39
4700, 2.39
4200, 1.2
5200, 1.2
5200, 0.6
5200, 0
0
1000
2000
3000
4000
5000
6000


50D7
0, 7.17
3000, 7.17
4000, 4.78
0, 2.39
3000, 2.39
4700, 2.39
4200, 1.2
5200, 1.2
5200, 0.6
5200, 0
0
1000
2000
3000
4000
5000
6000

XINJE

We chat ID

WUXI XINJE ELECTRIC CO., LTD.

No.816, Jianzhu West Road, Binhu District, Wuxi City, Jiangsu Province, China 214072
Tel: (510) 85134136
Fax: (510) 85111290
Email: Fiona.xinje@vip.163.com
www.xinje.com