XINJE

DS5P series servo driver

User manual

WUXI XINJE ELECTRIC CO., LTD.

Data No.SC5 12 20230923EN 1.2.2

Basic explanation

- Thank you for purchasing Xinje DS5P series servo driver products.
- This manual mainly introduces the product information of DS5P 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

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Safety Precautions

Be sure to review this section carefully before use this product. In precondition of security, wire the product correctly.

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 P-2 □P□ - PTA

Display	Product name
DS5	Servo driver

Display	Product series
P	Profinet

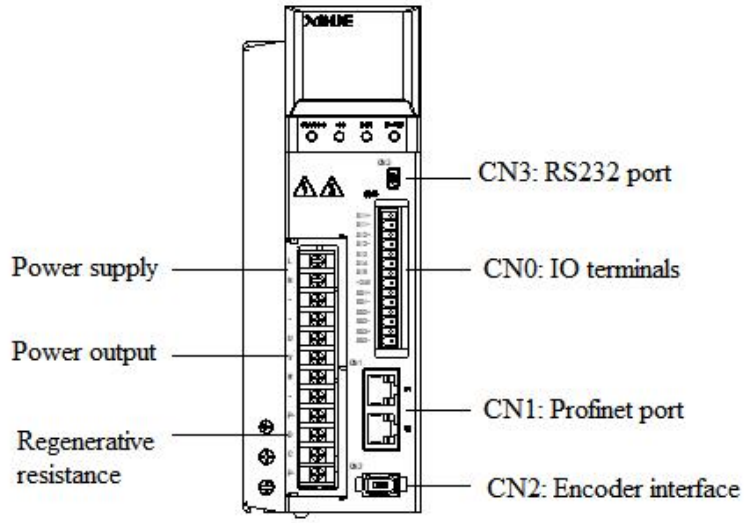
Display	Rated input voltage
2	AC220V
4	AC380V

Display	Encoder type
T	Communication

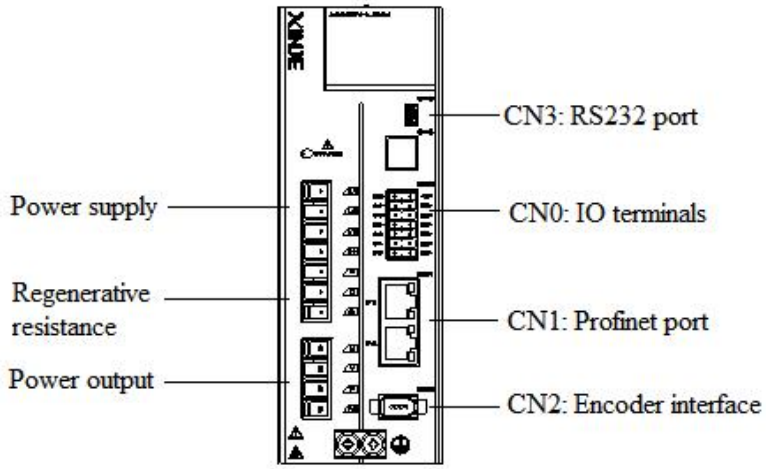
Display	Rated output power	Display	Rated output power
0P1	100W	2P3	2.3kW
0P2	200W	2P6	2.6kW
0P4	400W	3P0	3kW
0P7	750W	5P5	5.5kW
1P0	1.0kW	7P5	7.5kW
1P5	1.5kW		

1.1.2 Description of each part

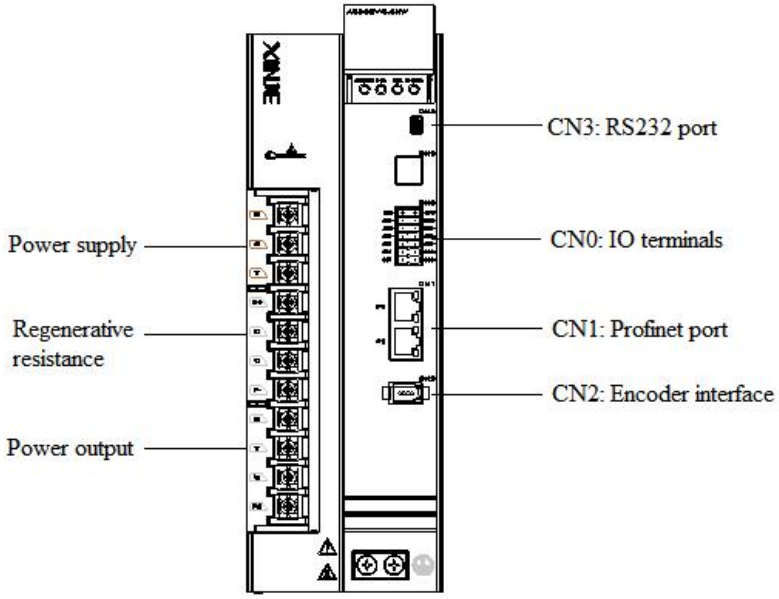
■ 750W and below



■ 1kW~3kW



■ 5.5/7.5KW



1.1.3 Performance specification

Servo unit		DS5P series servo driver
Applicable encoder		Standard: 17-bit/23-bit communication encoder
Input power supply		DS5P-2□P□-PTA: single phase/three phase AC200~240V, 50/60Hz (single phase power supply please connect to L1/L3)
		DS5P-4□P□-PTA: three phase AC380~4400V, 50/60Hz
Servo unit		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
Structure		Pedestal installation

1.2 Servo motor selection

1.2.1 Model name

■ MS5 motor

MS5S – 80 ST E – C S 02430 B Z - 2 0P7 – S01

Name	Inertia
MS5S	Low inertia
MS5G	Middle inertia
MS5H	High inertia

Name	Base No.
60	60 flange
80	80 flange

Name	Product name
ST	Sine drive motor

Name	Product name
Empty	No oil seal
E	With oil seal

Name	Encoder type
C	Magnetic encoder
T	Photoelectric encoder

Name	Encoder accuracy
S	Single circle 17-bit
M	Multi-circle 17-bit
U	Single circle 23-bit
L	Multi-circle 23-bit

Name	Rated torque (N·m)	Rated speed (rpm)
00630	0.637	3000
01330	1.3	3000
02430	2.39	3000

Name	Shaft
A	No key
B	With key

Name	Power-off brake
Empty	without
Z	with

Name	Voltage level
2	220V
4	380V

Name	Rated power (KW)
0P2	0.2
0P4	0.4
0P7	0.75

Name	Design number
S01	standard
S02	Small Aviation Plug Type

Note: At present, only the combination of CS, CM, TL is selected for the type of encoder.

■ MS6 motor

MS6S - 60 C S 30 B Z 1 - 2 0P4

Series	Inertia
MS6S	Low inertia
MS6H	High inertia

Display	Base No.
40	40 flange
60	60 flange
80	80 flange
100	100 flange

Name	Encoder type
C	Magnetic
T	Photoelectric

Name	Encoder bit
S	Single turn 17bit
M	Multi turn 17bit
U	Single turn 23bit
L	Multi turn 23bit

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

Name	Rated power
0P1	100W
0P2	200W
0P4	400W
0P7	750W
1P0	1.0KW
1P5	1.5KW

Name	Voltage level
2	220V
4	380V

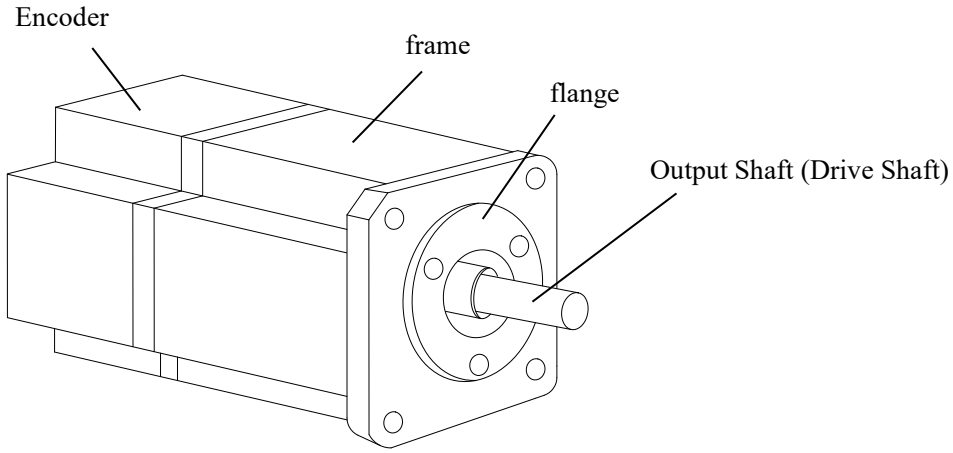
Name	Motor connector
1	AMP plug
2	Aviation plug
3	Connector (for IP67)

Name	Brake
/	No brake
Z	With brake

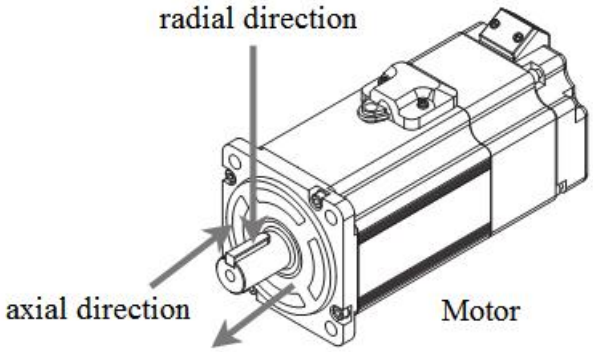
Name	Motor shaft
A	With Key, no oil seal
B	With key and oil seal
C	No key and oil seal
D	No key, with oil seal
E	Special shaft

Note: At present, only the combination of CS, CM, TL is selected for the type of encoder.
Standard type 1: 80 flange and below amp plug.
Standard type 2: 80 flange and below small aviation plug.

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 – SP T – M - 02

Name	Cable type
CP	Normal
CPT	High flexibility

Name	Plug type
SP	Amp plug-S01 motor
SW	Waterproof aviation plug-S02 motor
SL	Normal aviation plug
SC	10-core small aviation plug
SE	B3 forward outlet plug
SF	B3 reverse outlet plug
ZDL	Direct plug-in aviation plug

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

Name	Plug type
M	No battery box
B	With battery box
BM	With battery box

Name	Plug type
T	Thread buckle type
Empty	Buckle type

■ Power cable

CM - P 07 A - M - 03

Name	Cable type
CM	Normal
CMT	High flexibility
CMB	Normal with brake
CMBT	High flexibility with brake

Name	Plug type
P	4-core amp plug
W	6-core waterproof aviation plug
L	4-core small aviation plug
XL	4-core medium aviation plug
V	4-core waterproof aviation plug
D	O shape terminal
E	B3 forward outlet plug
F	B3 reverse outlet plug

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

Name	Cable type
M	White amp
Empty	Black amp

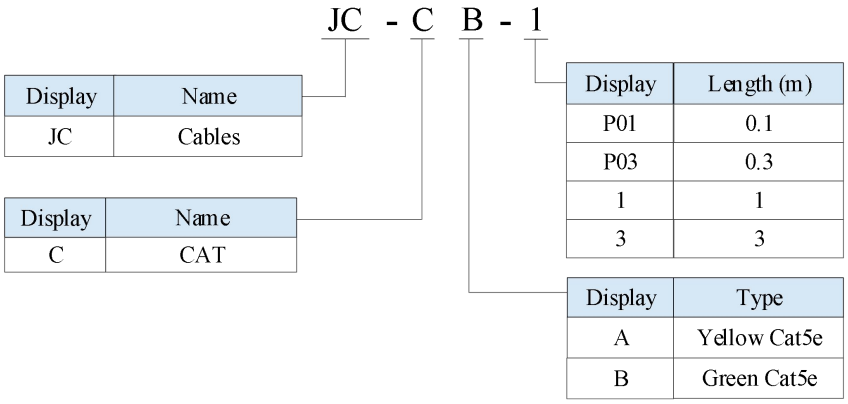
Name	Terminal
A	Needle cold pressed terminal
T	Thread protection type
Empty	U shape terminal

Name	Diameter (mm²)	Name	Diameter (mm²)
03	0.3	25	2.5
05	0.5	60	6
07	0.75	100	10
15	1.5		

■ 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, 12m, 16m and 20m.

■ Profinet communication cable



Display	Name
JC	Cables

Display	Name
C	CAT

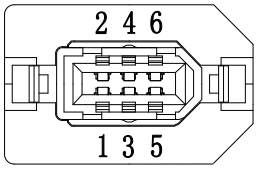
Display	Length (m)
P01	0.1
P03	0.3
1	1
3	3

Display	Type
A	Yellow Cat5e
B	Green Cat5e

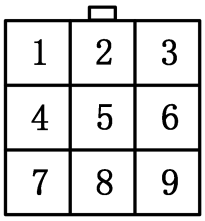
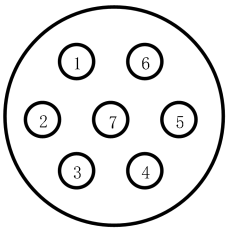
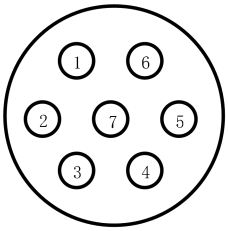
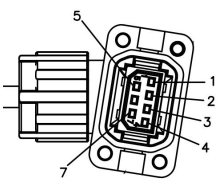
1.3.2 Description of each part

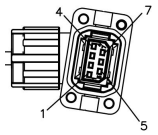
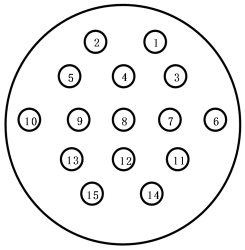
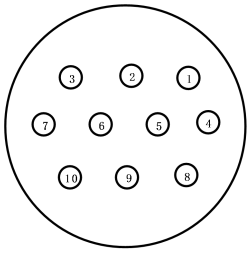
■ Encoder cable

(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

Suitable motor	Connector pins	Pin definition	
		No.	Definition
MS6-40, 60, 80 flange B1/B4 motor MS5-40, 60, 80 flange S01 motor		1	Battery +
		2	Battery -
		3	Shielded cable
		4	485-A
		5	485-B
		6	/
		7	5V
		8	GND
		9	/
MS5-40, 60, 80 flange S02 motor		No.	Definition
		1	Shielded cable
		2	Battery +
		3	Battery -
		4	485-A
		5	485-B
		6	5V
		7	GND
MS6-60, 80 flange B2 motor		No.	Definition
		1	GND
		2	Battery +
		3	Battery -
		4	485-A
		5	485-B
		6	5V
		7	Shielded cable
MS6-40, 60, 80 flange B3 motor	 Front outlet	No.	Definition
		1	5V
		2	GND
		3	Battery +
		4	Battery -
		5	485-A

	 Back outlet	6	485-B
		7	Shielded cable
MS6-180 flange B2 motor MS5-110, 180 flange S01motor MS-110, 130 flange absolute type motor		No.	Definition
		1	Shielded cable
		2	/
		3	485-A
		4	485-B
		5	/
		6	GND
		7	Battery -
		8	5V
		9	Battery +
MS6-100, 130 flange motor MS5-130 flange motor		No.	Definition
		1	/
		2	5V
		3	GND
		4	485-A
		5	485-B
		6	Battery +
		7	Battery -
		8	/
		9	/
		10	Shielded cable

Battery box description:

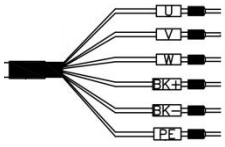
(1) The encoder including the cable definition of battery +, battery- is for the absolute motor, and the non-absolute motor cable has no such pin.

(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 chapter 5.6.2 change battery.

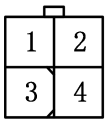
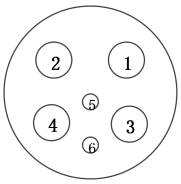
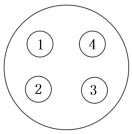
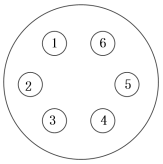
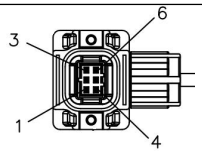
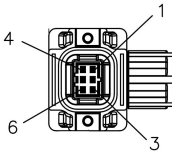
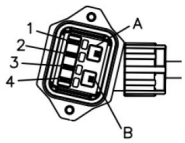
■ Power cable

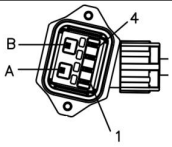
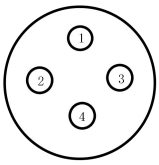
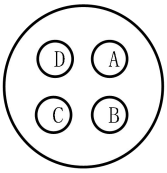
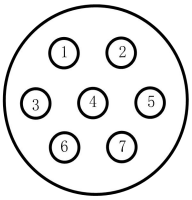
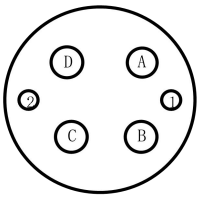
(1) Pin definition of power cable on servo driver side

Suitable model	Connector pins	Pin definition	
		Color	Definition
all MS5 series motor MS6 series B1,B2 motors		Brown	U
		Black	V
		Blue	W
		Yellow green	PE
all MS5 series MS6 series B1, B2 ,B4 motors		Color	Definition
		Brown	U
		Black	V
		Blue	W
		Yellow green	PE

		Color	Definition
MS6 series B3 motors MS6G series motors		Red	U
		White	V
		Black	W
		Yellow green	PE
		Blue	BK+
		Brown	BK-

(2) Power cable connection on motor side

Suitable model	Connector pins	Pin definition	
		No.	Definition
MS6-40, 60, 80 flange B1, B4 motor MS5-40, 60, 80 flange S01 motor		1	U
		2	W
		3	V
		4	PE
MS6-40, 60, 80 flange B1,B4 brake motor MS5-40, 60, 80 flange S01 brake motor		No.	Definition
		1	BK+
		2	BK-
MS5-40, 60, 80 flange S02 motors		No.	Definition
		1	PE
		2	U
		3	V
		4	W
		5	BK+
		6	BK-
MS6-40, 60, 80 flange B2 motor		No.	Definition
		1	U
		2	W
		3	V
		4	PE
MS6-40, 60, and 80 flange B2 brake motors		No.	Definition
		1	U
		2	W
		3	V
		4	PE
		5	BK+
		6	BK-
MS6-40 flange B3 motors	 Front outlet  Back outlet	No.	Definition
		1	W
		2	V
		3	U
		4	PE
		5	BK+
		6	BK-
MS6-60, 80 flange B3 motor	 Front outlet	No.	Definition
		1	U
		2	V
		3	W
		4	PE
		A	BK+
		B	BK-

Suitable model	Connector pins	Pin definition	
		No.	Definition
	 Back outlet		
MS6-100, 130,180 flange non medium inertia non brake motors MS5-110, 130, 180 flange non brake motors MS-110, 130 flange non brake absolute type motors		No.	Definition
		1	PE
		2	U
		3	V
		4	W
MS6G-110, 130 flange medium inertia non brake motors		No.	Definition
		1	PE
		2	U
		3	V
		4	W
MS6-100,130 flange non medium inertia with brake motor MS5G-130 flange medium inertia with brake motor		1	PE
		2	U
		3	V
		4	W
		5	BK+
		6	BK-
		7	/
MS6G-110, 130 flange medium inertia brake motor MS6, MS5-180 flange brake motor		No.	Definition
		1	U
		2	V
		3	W
		4	PE
		A	BK+
		B	BK-

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 regenerative resistance

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 servo motor driven by regenerative (generator) mode 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
DS5P-□□P□-PTA	(1) Use the built-in regenerative resistor, short P+ and D terminals, P+ and C disconnect. (2) 3kW and below use external regenerative resistor, connect the regenerative resistor to P+ and C terminals, remove P+ and D short wiring, P0-25= power value, P0-26= resistance value. 5.5kW~7.5kW use an external regenerative resistor to connect the regenerative resistor to the P+ and PB terminals, 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 braking resistor	Rmin (Not less than this value)	External regenerative resistance (Recommended resistance value)	External regenerative resistance (Recommended power values)
DS5P-20P1-PTA	/	50Ω	50Ω-100Ω	Above 200W
DS5P-20P2-PTA	/			
DS5P-20P4-PTA	/	40Ω	40Ω-100Ω	Above 500W
DS5P-20P7-PTA	/	40Ω	40Ω-100Ω	Above 600W
DS5P-21P0-PTA	80W45Ω	35Ω	35Ω-75Ω	Above 800W
DS5P-21P5-PTA	80W50Ω	30Ω	30Ω-50Ω	Above 1000W
DS5P-22P3-PTA	80W50Ω			
DS5P-22P6-PTA	80W50Ω	25Ω	25Ω-50Ω	
DS5P-41P0-PTA	80W100Ω	120Ω	120Ω-150Ω	Above 800W
DS5P-41P5-PTA	80W100Ω	75Ω	75Ω-120Ω	Above 1000W
DS5P-42P3-PTA	80W60Ω	55Ω	55Ω-75Ω	Above 1000W
DS5P-43P0-PTA	80W60Ω	50Ω	50Ω-75Ω	Above 1200W
DS5P-45P5-PTA	/	25Ω	25Ω-65Ω	Above 2000W
DS5P-47P5-PTA	/	22Ω	22Ω-50Ω	Above 2500W

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't 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.

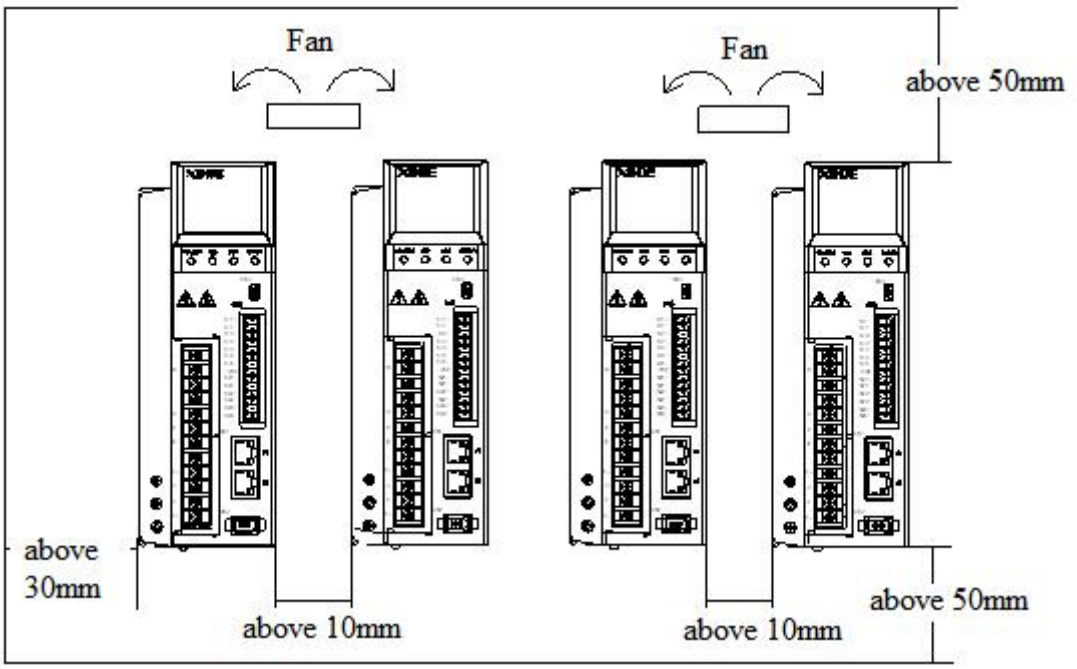
2.1.2 Environment condition

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)

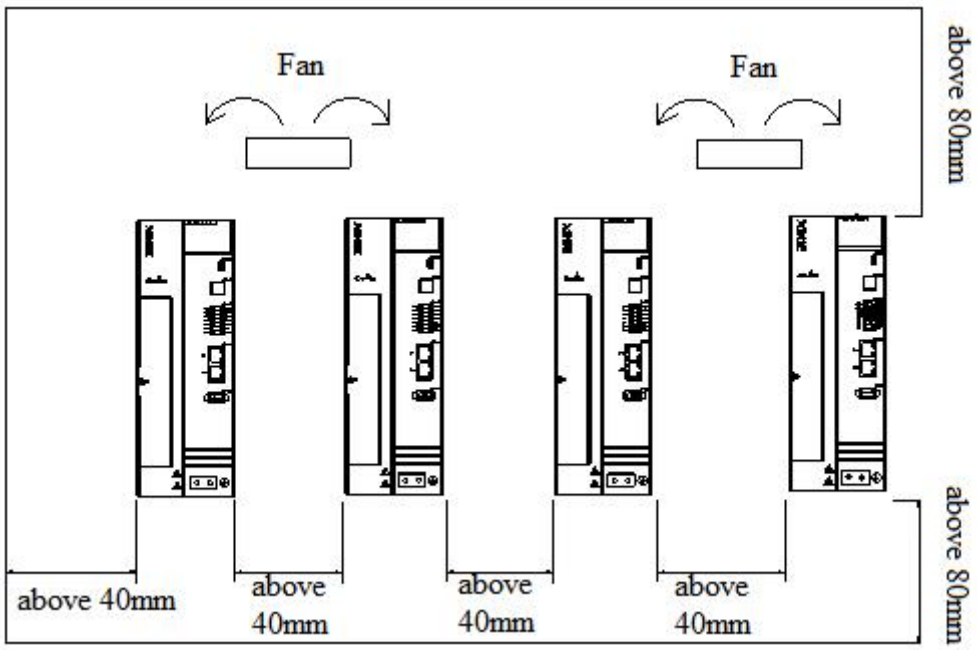
2.1.3 Installation standard

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").

■ 3kW and below driver installation standard



■ 5.5/7.5kW driver installation standard



■ **Servo Drive Orientation**

When installing, make the front of the servo drive (the actual mounting surface of the operator) face the operator and make it perpendicular to the wall. For drivers with regenerative resistors at the bottom, pay attention to the heat dissipation of the mounting surface to avoid overheating of the drive and causing fire.

■ **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**

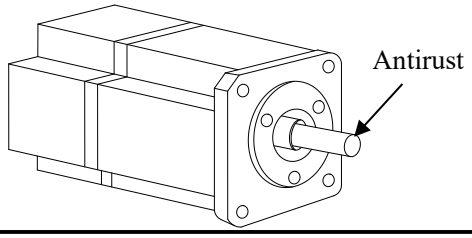
- Servo driver working ambient Temperature: -10~40 ℃
- Humidity: 90%RH or less
- Vibration: 4.9m/s^2
- Condensation and Freezing: None
- Ambient Temperature for Long-term Reliability: 50°C maximum

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.

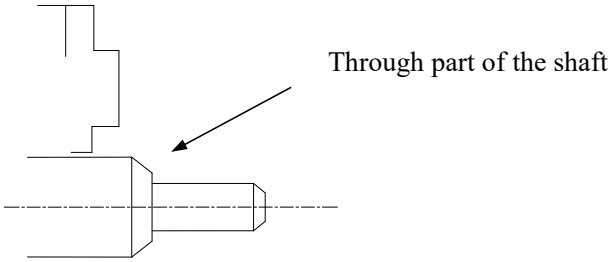
CAUTION

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

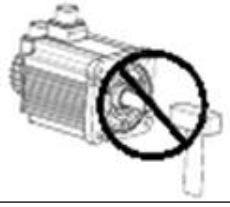
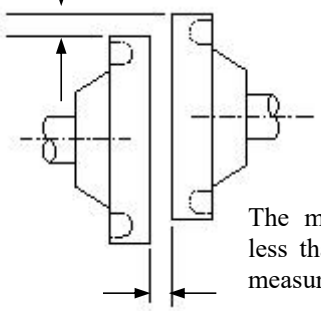
When used in places with water droplets or oil droplets, the protection effect can be achieved through the treatment of motors. However, in order to seal the through part of the shaft, please specify the motor with oil seal. Connectors should be installed downward.



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 flange motor) IP66 (MS6-40/60/80 flange motor) IP67 (MS6-B3, 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.

Item	Description
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 general 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:

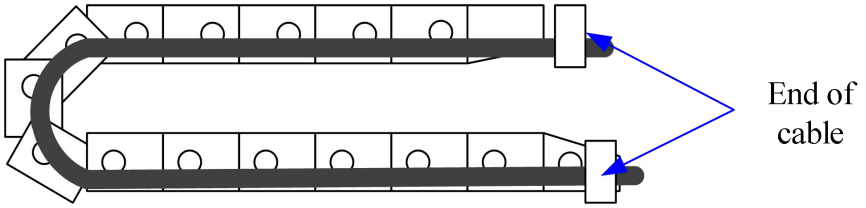
- For pulse command signal cable, please ensure wiring less than 3m.
- The encoder cable shall be within 20 meters. It is recommended to select special cable if it is more than 20 meters. The wire diameter of encoder cable depends on the length of encoder cable used on site. The longer the cable is, 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 is not 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 to (2.3.2 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't 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.

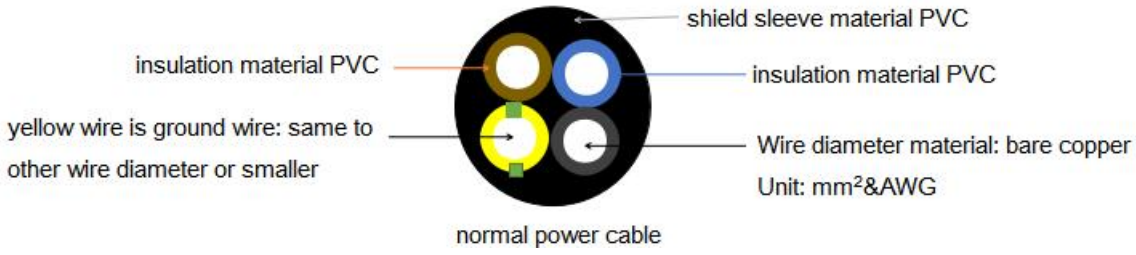
(4) Low / high temperature

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

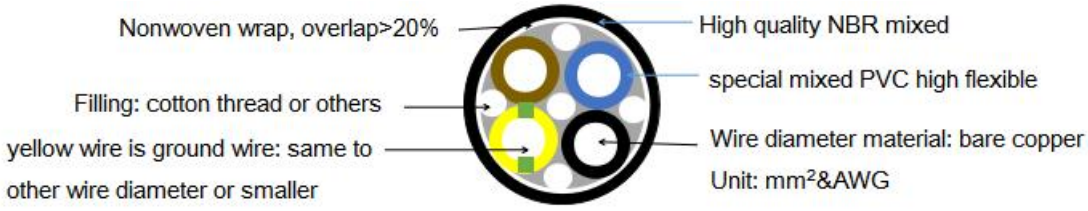
2.3.2 Xinje cable specification

1. Material composition of Xinje cable

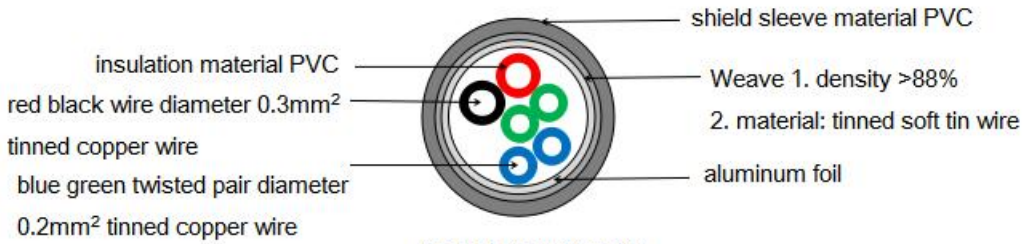
Cross section of cable (encoder, power cable), corresponding introduction of wire skin material, wire diameter, wire core material shielding material, etc.



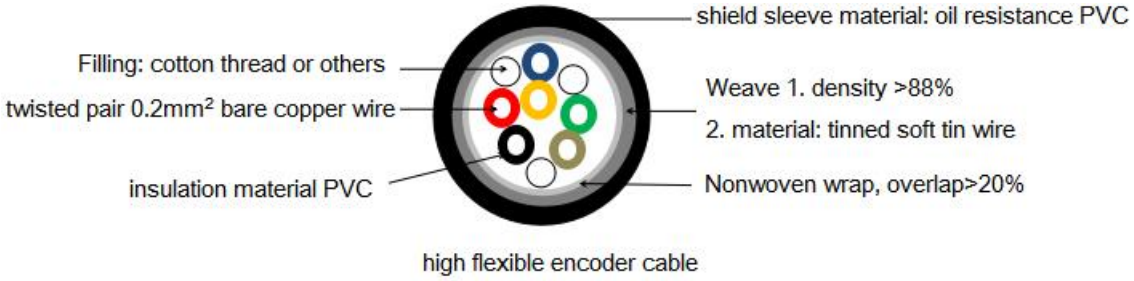
normal power cable



high flexible power cable



normal encoder cable



2. Cable diameter specification

Length	Flange	Encoder cable diameter			Power cable diameter		
		Type	Overall cable diameter(mm)	Individual cables Diameter (mm^2)	Type	Overall cable diameter(mm)	Individual cables Diameter (mm^2)
20m and below	80 flange and below	Ordinary without battery box /With battery box	5.8/6.4	3P*0.2mm²	Normal/ high flexible	7.2/7.0	4*0.75mm²
	110, 130 flange		6.2/6.2		Normal/ high flexible	9.4/9.6	4*1mm²
	180 flange 2.9kW\3kW	High flexible	6.2		Normal/ high flexible	11.4/11.9	4*2mm²
	Above 180 flange 3kW				Normal/ high flexible	14.5/15.6	4*6mm²
25m, 30m	180 flange and below	Normal/ high flexible	7.8/6.8	2P*0.2mm²+1P*0.34mm²	/	/	/

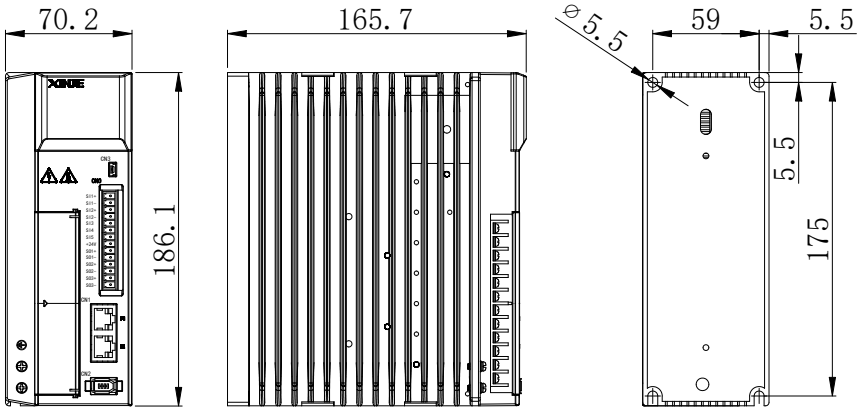
3. Cable performance specification

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

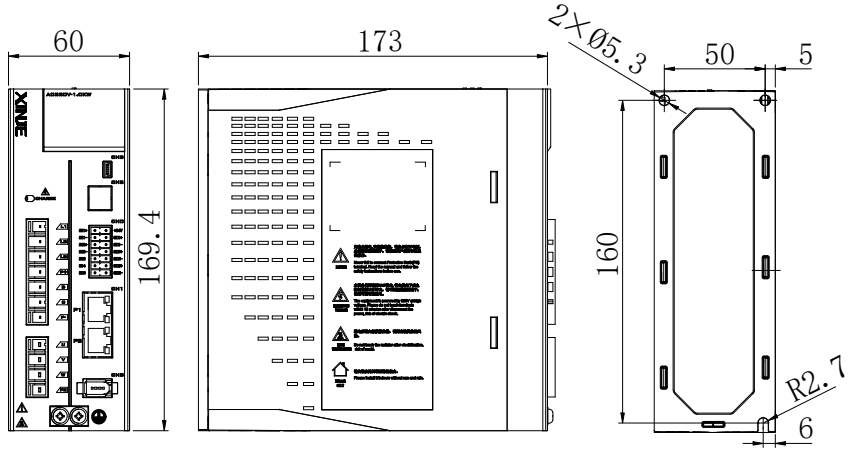
Note: D represents the finished product cable diameter.

2.4 Servo driver dimension

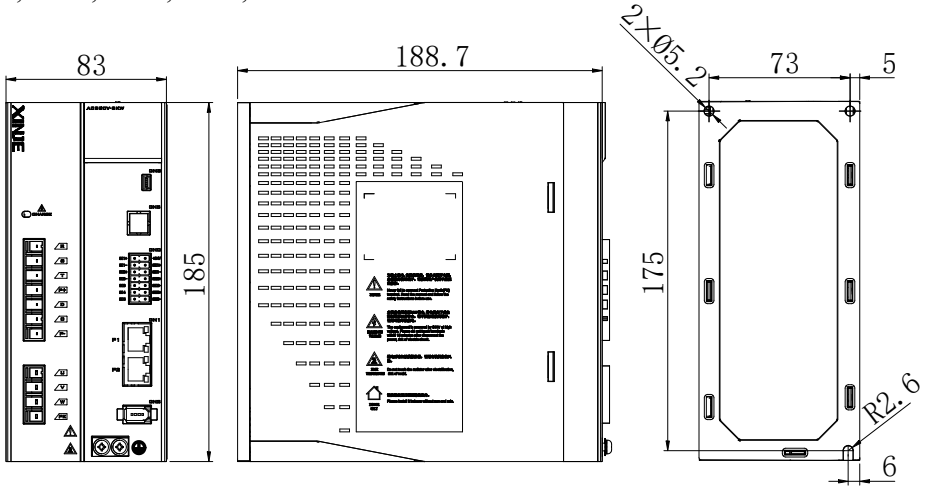
■ DS5P-20P1, 20P2, 20P4, 20P7-PTA Unit: mm



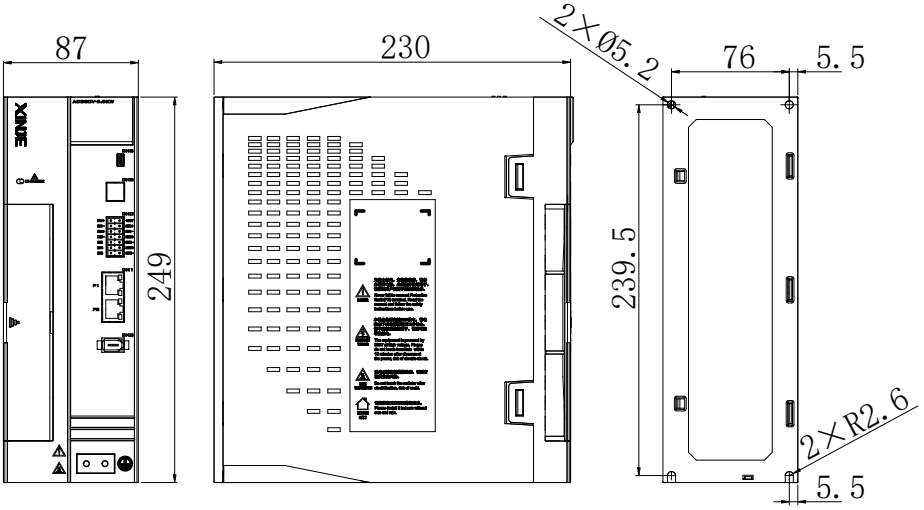
■ DS5P-21P0, 41P0, 41P5-PTA Unit: mm



■ DS5P-21P5, 22P3, 22P6, 42P3, 43P0-PTA Unit: mm



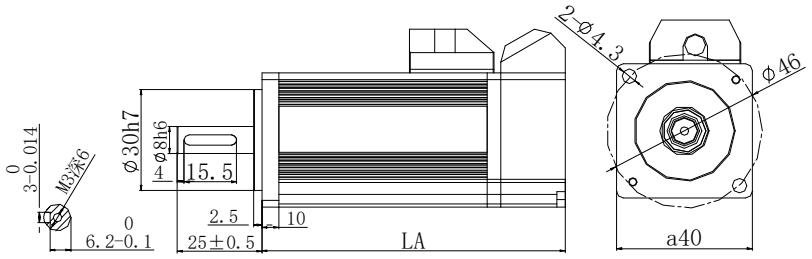
■ DS5P-45P5-PTA, DS5P-47P5-PTA Unit: mm



2.5 Servo motor dimension

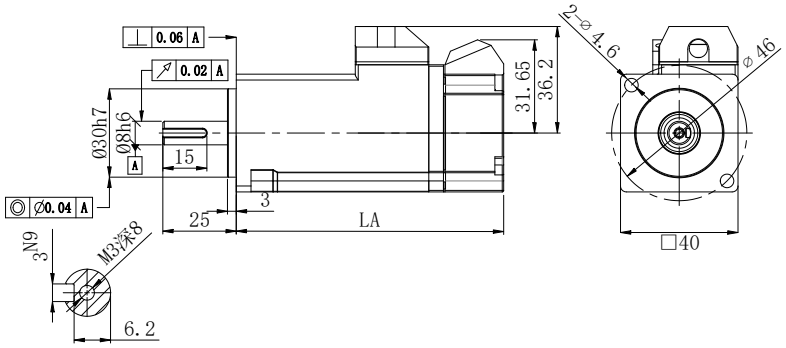
◆ 40 series motor installation dimensions Unit: mm

MS5 motor

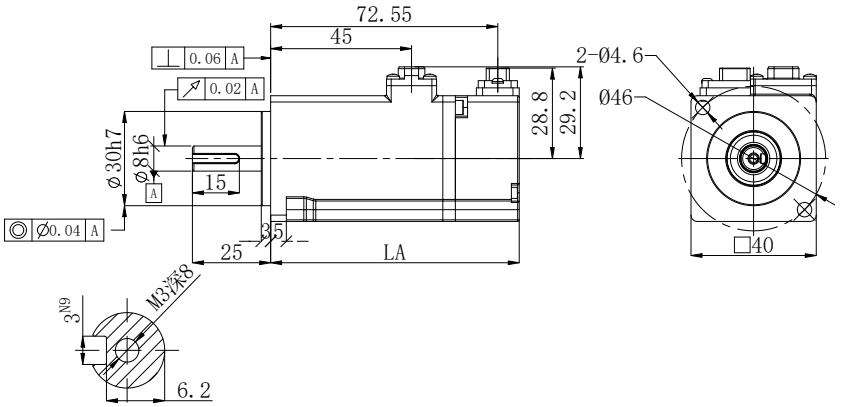


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-40STE-C□0030□□-20P1-S01/S02	89.5	119	Low inertia

◆ MS6 motor



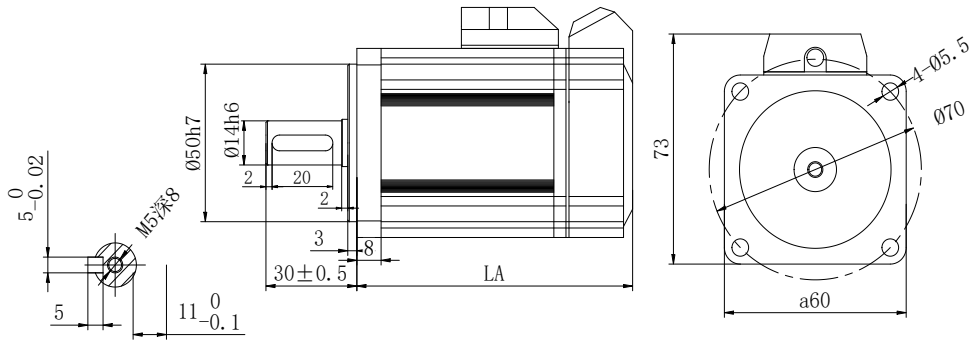
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-40C□30B□1-20P1	91	122.9	High inertia



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

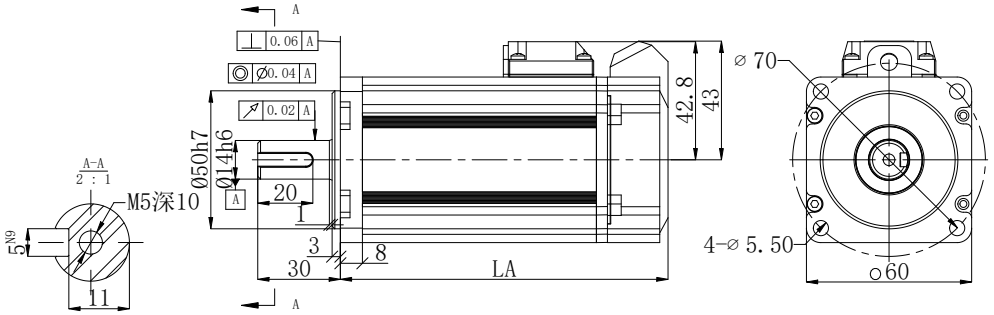
◆ 60 series motor installation dimensions Unit: mm

MS5 motor

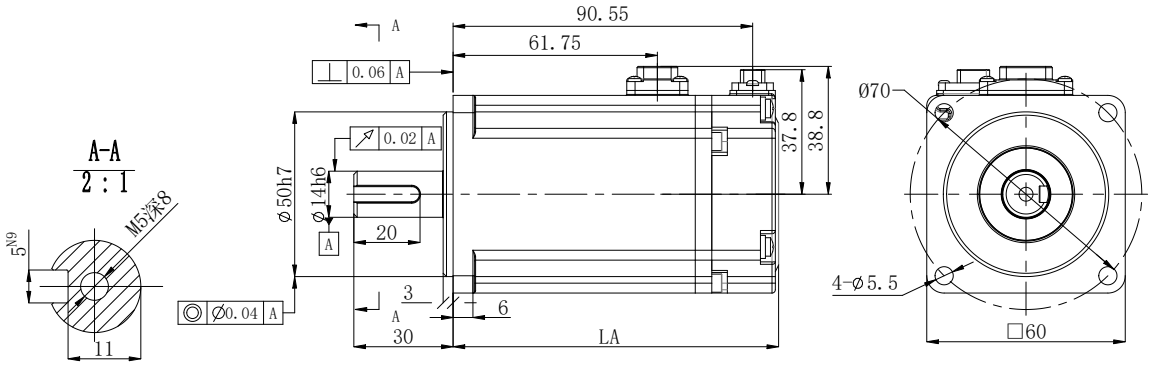


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-60STE-C□00630B□-20P2-S01/S02	79	114	Low inertia
MS5S-60STE-C□01330B□-20P4-S01/S02	99	134	
MS5H-60STE-C□00630B□-20P2-S01/S02	91	126	High inertia
MS5H-60STE-C□01330B□-20P4-S01/S02	111	146	
MS-60STE-T01330-20P4-D01	145	189	-

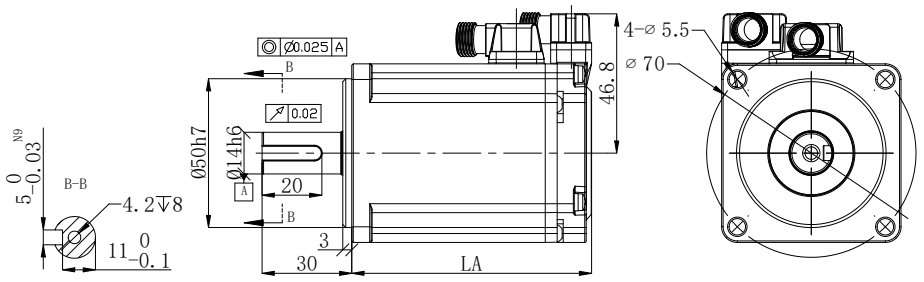
◆ MS6 motor



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



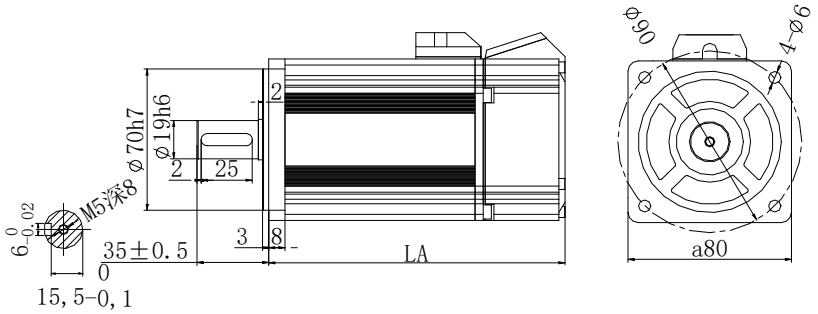
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-60C□30B□3-20P2	76.4	99.15	High inertia
MS6S-60C□30B□3-20P4	98.4	121.15	Low inertia
MS6H-60C□30B□3-20P4	98.4	121.15	High inertia



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

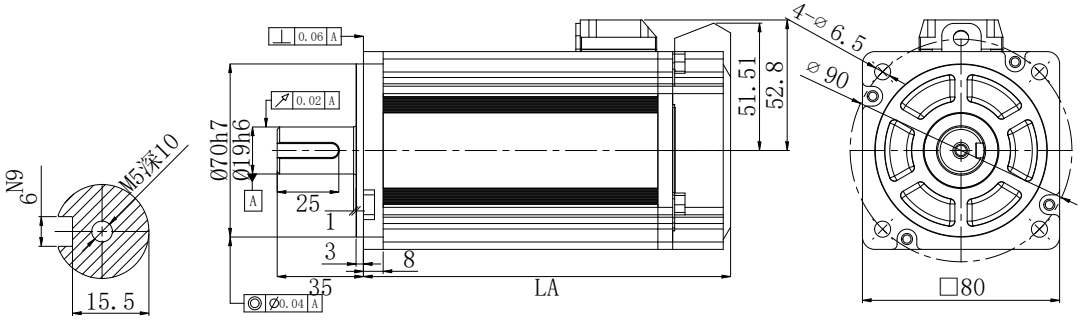
◆ 80 series motor installation dimensions Unit: mm

◆ MS5 motor

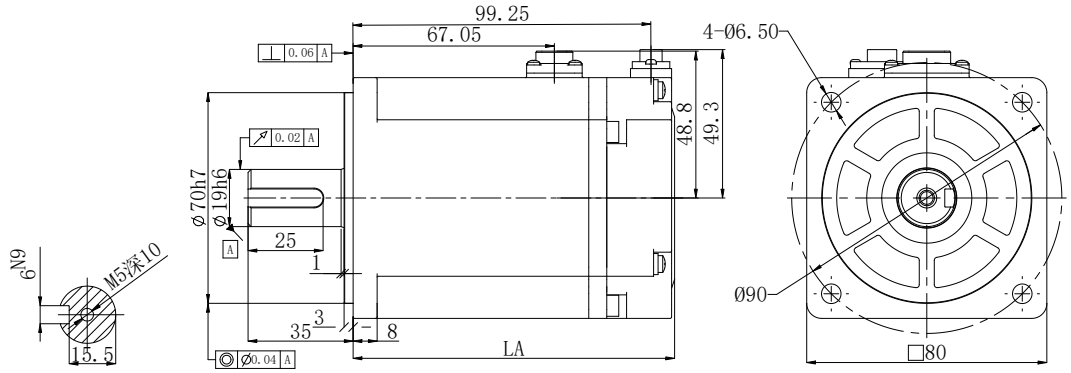


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-80STE-C□02430B□-20P7-S01/S02	107	144	Low inertia
MS5S-80STE-C□03230B□-21P0-S01/S02	128	165	
MS5H-80STE-C□02430B□-20P7-S01/S02	119	156	High inertia
MS5H-80STE-C□03230B□-21P0-S01/S02	140	177	
MS-80ST-T02430B□-20P7	151	199	-
MS-80ST-T03520B□-20P7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

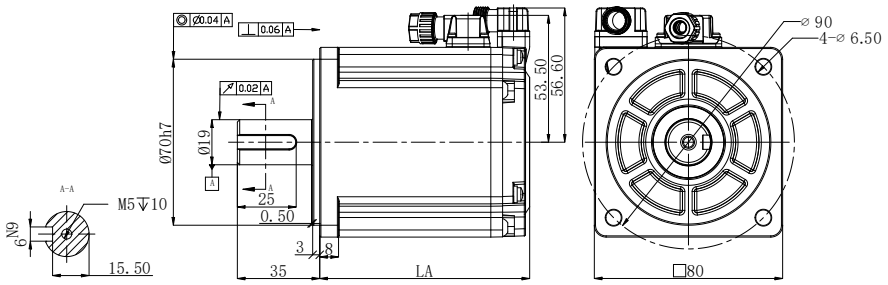
◆ MS6 motor



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

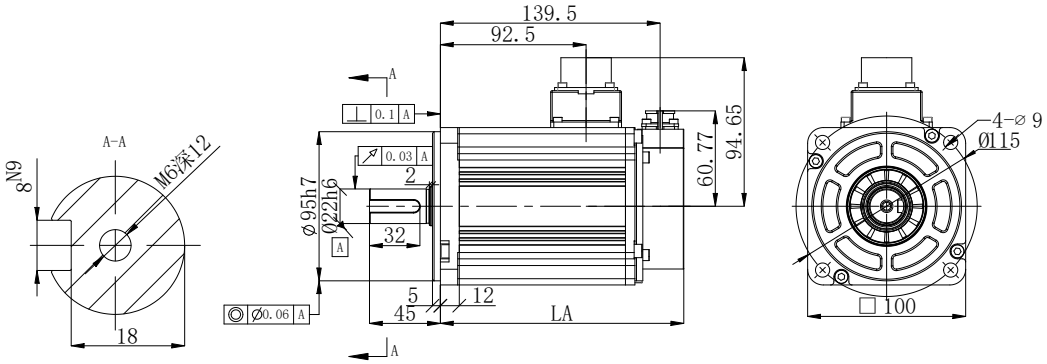


Motor model	LA±1		Inertia level
	Normal	With brake	
MS6S-80C□30B□3-20P7	107.1	132.1	Low inertia
MS6H-80C□30B□3-20P7	107.1	132.1	High inertia
MS6S-80C□30B□3-21P0	117.6	142.6	Low inertia
MS6H-80C□30B□3-21P0	134	159	High inertia



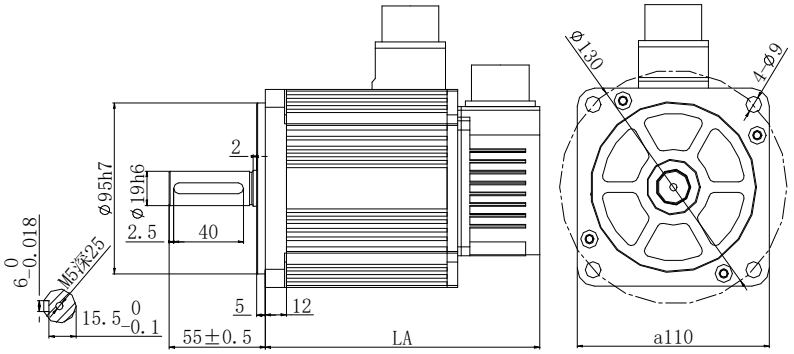
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-60CM30B□4-20P7	89.2	121.1	High inertia

■ 100 series motor installation dimensions Unit: mm

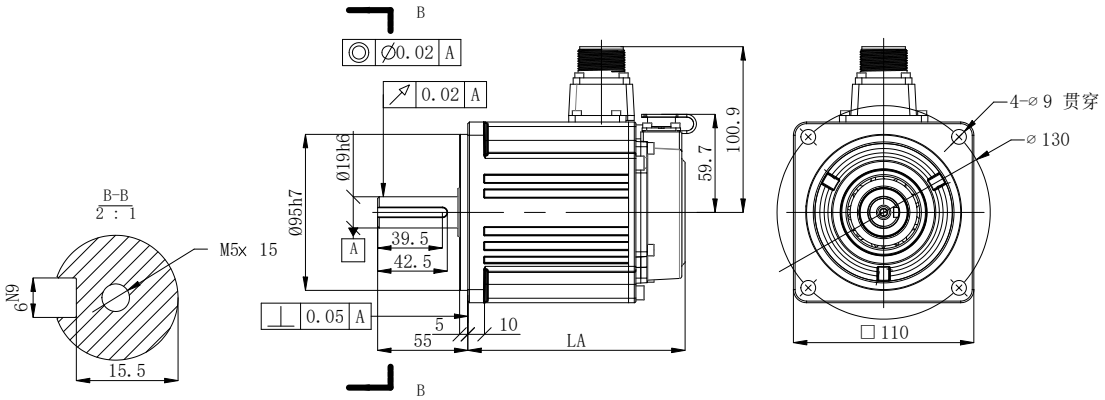


Motor model	LA±1		Inertia level
	Normal	With brake	
MS6S-100C□30B2-21P5	154.5	183	Low inertia
MS6S-100CS/CM30B□2-21P0	138.5	164	
MS6S-100TL30B□2-21P0	144.2	169.7	

■ 110 series motor installation dimensions Unit: mm



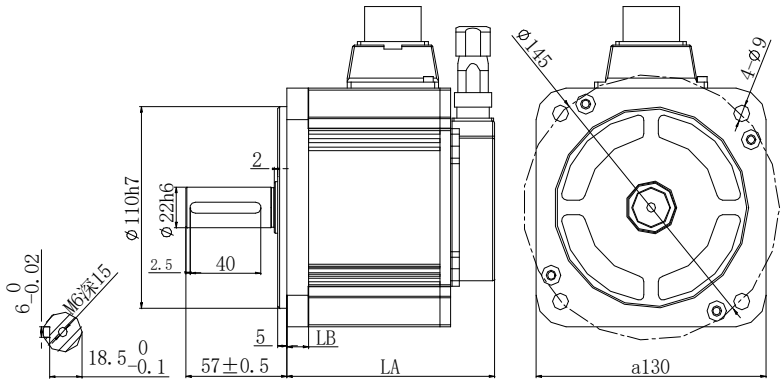
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-110ST-C□03230B□-21P0-S01	157	205	Low inertia
MS5S-110ST-TL03230B□-21P0-S01	157	205	
MS5S-110ST-C□04830B□-21P5-S01	166	214	
MS5S-110ST-TL04830B□-21P5-S01	166	214	
MS5S-110ST-C□06030B□-21P8-S01	181	229	
MS-110ST-TL06030B□-21P8-S01	181	229	-
MS-110ST-T04030B-21P2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



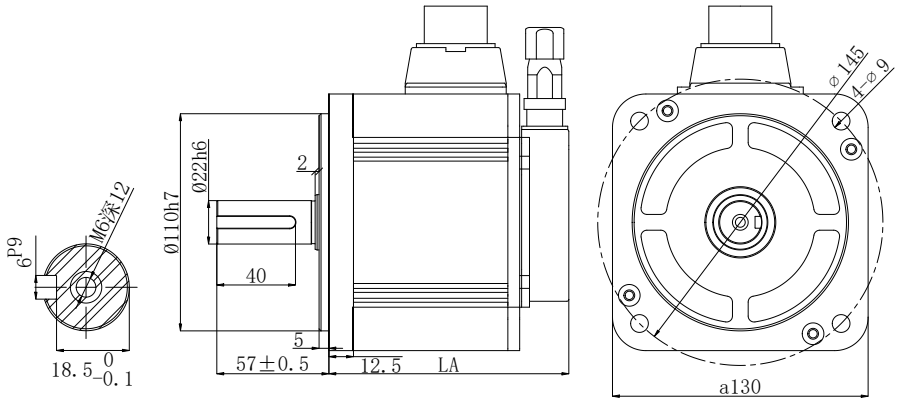
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6G-110CS□30B□2-21P5	132.5	-	Medium inertia
MS6G-110TL30B2-□1P5	149	-	

■ 130 series motor installation dimensions Unit: mm

◆ MS5 motor

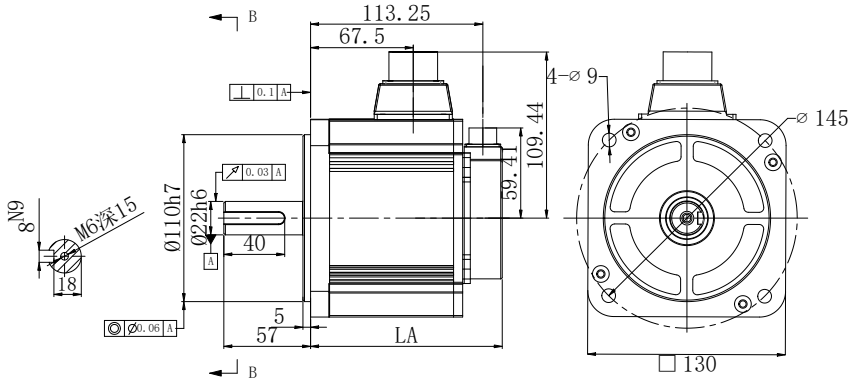


Motor model	LA±1		LB	Inertia level
	Normal	With brake		
MS5G-130STE-C□05415B□-20P8-S01	117.5	147.5	12.5	Medium inertia
MS5G-130STE-TL05415B□-20P8-S01	134.5	164.5		
MS5G-130STE-C□07220B□-21P5-S01	133.5	163.5		
MS5G-130STE-C□07220B□-41P5-S01	133.5	163.5		
MS5G-130STE-TL07220B□-21P5-S01	149.5	179.5		
MS5G-130STE-TL07220B□-41P5-S01	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	211.5		
MS5G-130STE-C□14615B□-42P3-S01	180.5	211.5		
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-T10015B□-21P5	205	264	14	-
MS-130STE-T07730B□-22P4	205	264		
MS-130ST-TL10025B□-22P6	209	290		
MS-130ST-TL10030□□-43P0	225	284	15	-

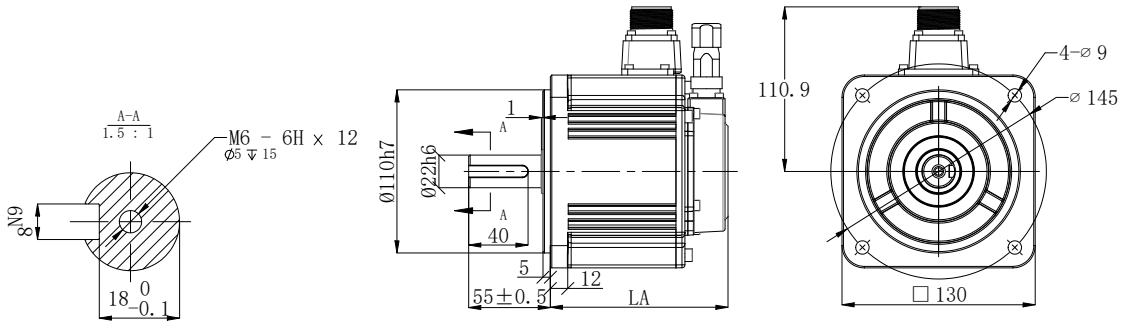


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-130STE-C□06025B□-21P5-S01	123.5	153.5	Medium inertia
MS5G-130STE-C□10015B□-21P5-S01	146.5	176.5	

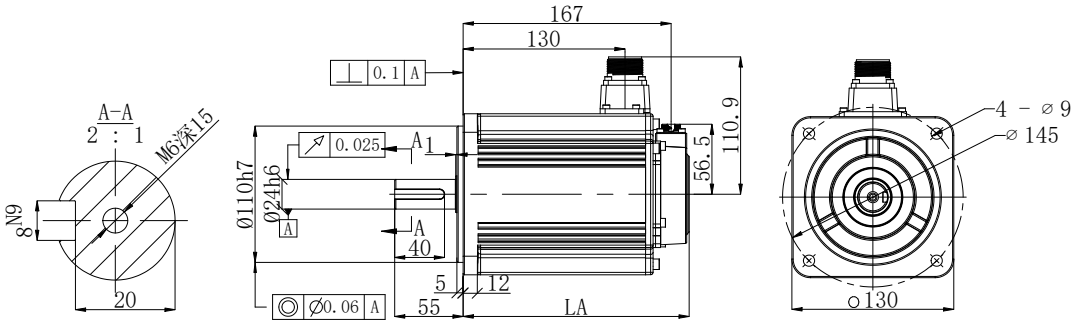
◆ MS6 motor



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	



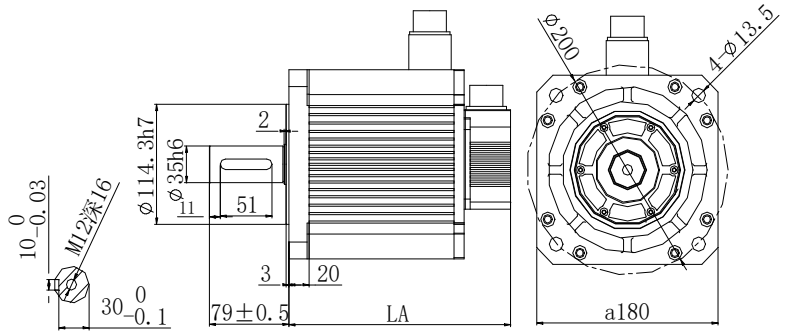
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6G-130C□25B□2-□1P0	119.5	148.5	Medium inertia
MS6G-130TL25B□2-□1P0	136	165	
MS6G-130C□20B□2-□1P5	133.5	162.5	
MS6G-130TL20B□2-□1P5	150	179	
MS6G-130C□15B□2-□1P5	151.5	180.5	
MS6G-130TL15B□2-□1P5	168	197	
MS6G-130C□15E□2-□2P3	181.5	210.5	
MS6G-130TL15E□2-□2P3	198	227	



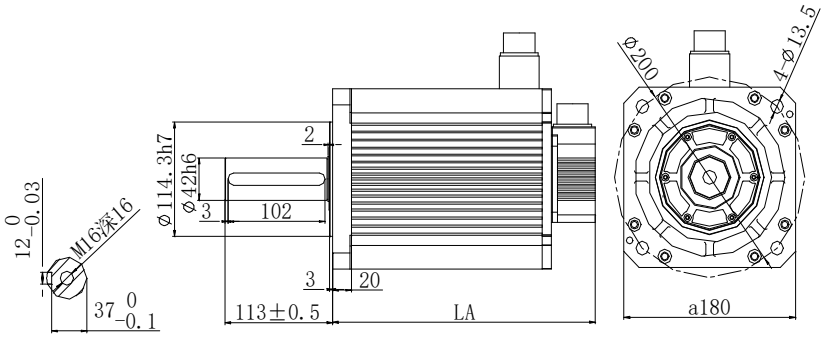
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6G-130C□15B□2-□2P3	181.5	210.5	Medium inertia
MS6G-130TL15B□2-□2P3	198	227	

■ 180 series motor installation dimensions Unit: mm

◆ MS5 motor

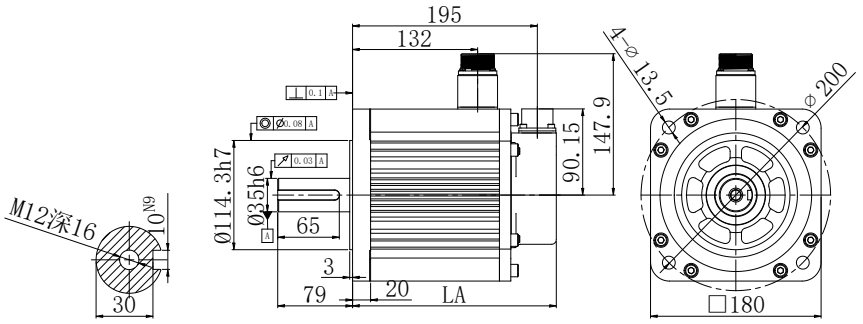


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-180ST-TL19015□□-42P9-S01	221	303	Medium inertia
MS5G-180ST-TL28015□□-44P4-S01	247	329	

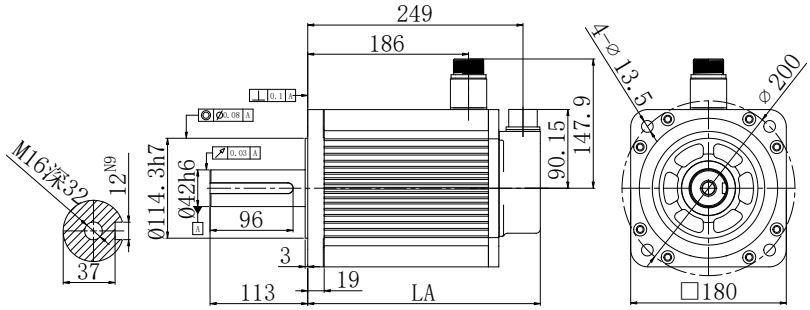


Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-180ST-TL35015□□-45P5-S01	277	359	Medium inertia
MS5G-180ST-TL48015□□-47P5-S01	308	390	

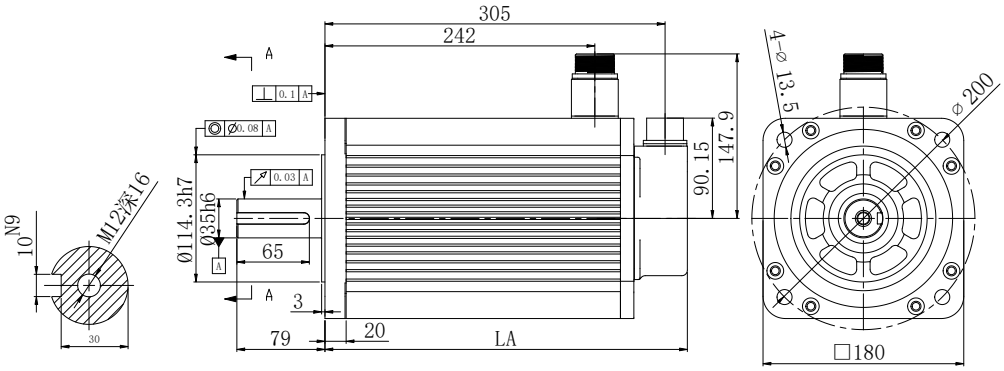
◆ MS6 motor



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	

3 Servo system wiring

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

Servo driver model	Power cable-diameter mm²	UVW power cable-diameter mm²	Encoder cable-diameter mm²	Ground cable ⏚-mm²
DS5P-20P1, 20P2, 20P4, 20P7-PTA	0.75	0.75	0.2	0.75
DS5P-21P0, 21P5, 22P3, 22P6, 41P0, 41P5, 42P3, 43P0-PTA	2.0	2.0	0.2	2.0
DS5P-45P5, 47P5-PTA	6.0	6.0	0.2	6.0

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.

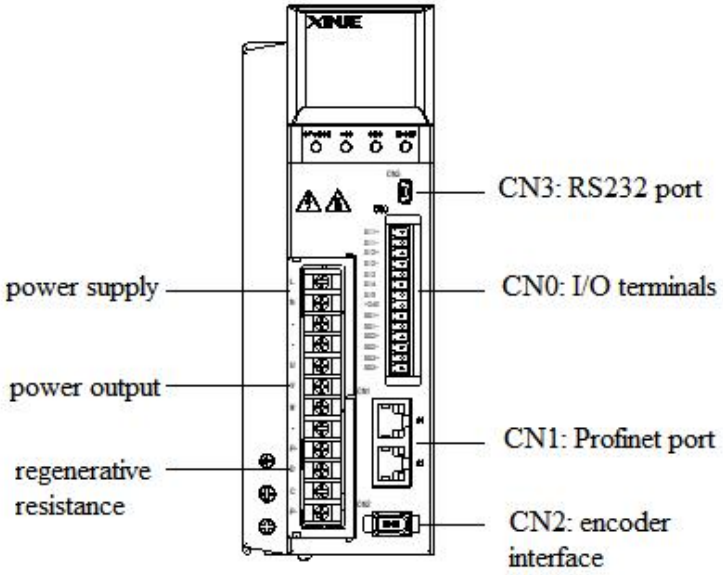
(4) Even if the power supply is off, there may still be a high voltage in the servo unit. Please don't touch the power terminal temporarily (10 minutes).

(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

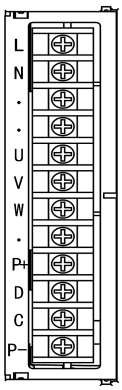
3.1.1 Servo driver terminal arrangement

The following uses 750W or below drives as an example:



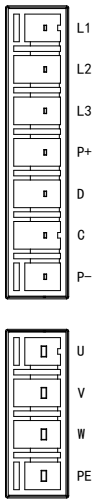
3.1.2 Main circuit terminal

■ DS5P-20P1-PTA, DS5P-20P2-PTA, DS5P-20P4-PTA, DS5P-20P7-PTA



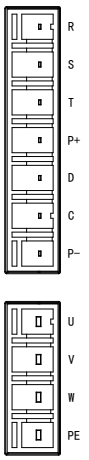
Terminal	Function	Explanation
L, N	Power supply input of main circuit	Single phase AC 200~240V, 50/60Hz
●	Vacant terminal	-
U, V, W	Motor terminals	Connect the motor **Note: the ground wire is on the terminal, please check it before power on!**
P+, D, C	Internal regenerative resistor	Short P+ and D,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

■ DS5P-21P0-PTA, DS5P-21P5-PTA, DS5P-22P3-PTA, DS5P-22P6-PTA



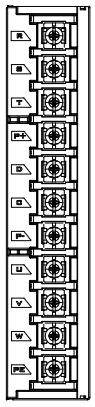
Terminal	Function	Explanation
L1, L2, L3	Power supply input of main circuit	Single/three phase AC200~240V, 50/60Hz (If single-phase power supply, please connect L1/L3, otherwise it will affect the memory of parameters when power off)
P+, D, C	Internal regenerative resistor	Short P+ and D, disconnect 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	The real-time voltage of the bus can be measured, please pay attention to the danger
U, V, W, PE	Motor terminals	Connect the motor

■ DS5P-41P0-PTA, DS5P-41P5-PTA , DS5P-42P3-PTA, DS5P-43P0-PTA



Terminal	Function	Explanation
R, S, T	Power supply input of main circuit	Three-phase AC380~440V, 50/60Hz
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	The real-time voltage of the bus can be measured, please pay attention to the danger
U, V, W, PE	Motor terminals	Connect the motor

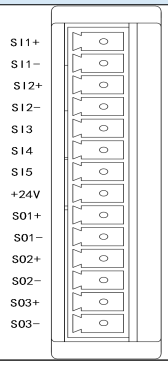
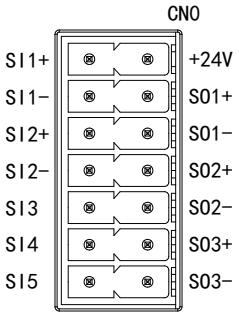
■ DS5P-45P5-PTA, DS5P-47P5-PTA



Terminal	Function	Explanation
R, S, T	Power supply input of main circuit	Three-phase AC380~440V, 50/60Hz
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	The real-time voltage of the bus can be measured, please pay attention to the danger
U, V, W, PE	Motor terminals	Connect the motor

3.1.3 CN0, CN2 terminal

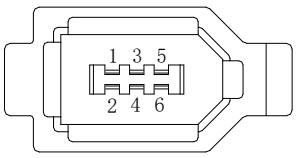
3.1.3.1 CN0 terminal (5 IN 3 OUT)

750W and below drivers	1kW and up drivers
	

Name	Explanation	Name	Explanation
SI1+	High speed SI+	+24V	Input common terminal
SI1-	High speed SI-	SO1+	Output terminal
SI2+	High speed SI+	SO1-	Output terminal
SI2-	High speed SI-	SO2+	Output terminal
SI3	Input terminal	SO2-	Output terminal
SI4	Input terminal	SO3+	Output terminal
SI5	Input terminal	SO3-	Output terminal

3.1.3.2 CN2 terminal

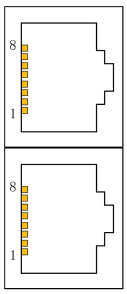
The terminals of the CN2 connector are arranged as follows (faced solder plates):



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

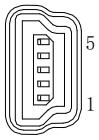
3.1.4 Communication port

■ CN1 (Profinet communication)



Pin	Name	Description
1	TX+	Data send +
2	TX-	Data send -
3	RX+	Data receive +
4	-	-
5	-	-
6	RX-	Datta receive -
7	-	-
8	-	-
Cover	PE	Shield

■ CN3 (RS232 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.

Modbus station no.

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

3.2 Classification and function of signal terminals

3.2.1 SI terminals

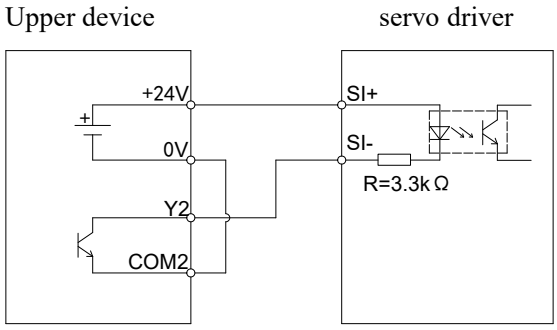
Please use a relay or an open collector transistor circuit to connect. When using relay connection, please select the relay for small current. If the relay is not small current, it will cause bad contact.

Type	Input terminal	Function
Digital input	SI1~SI3	Multifunctional input signal terminal

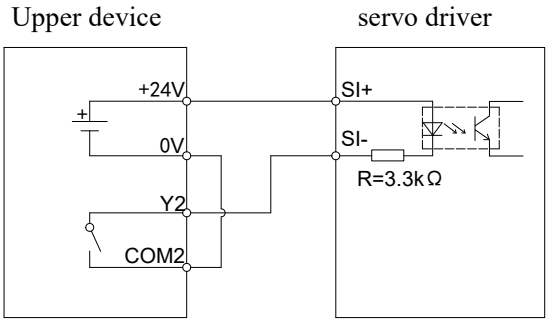
Defaulted assignment of input terminals

Terminal	SI1	SI2	SI3	SI4	SI5
Function	undistributed	undistributed	HOME signal	undistributed	undistributed

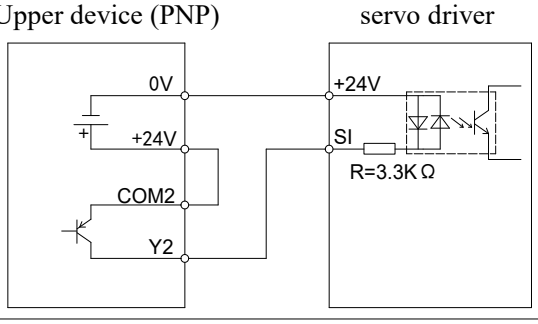
Optocoupler (24V power supply, SI1,SI2)



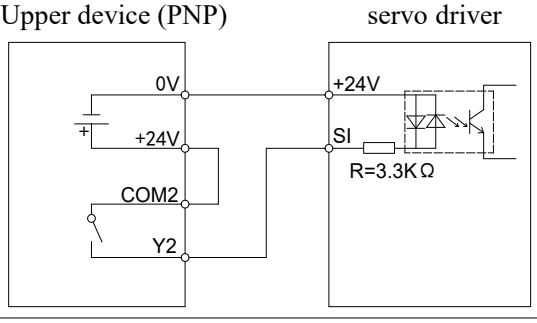
Relay type (24V power supply, SI1,SI2)

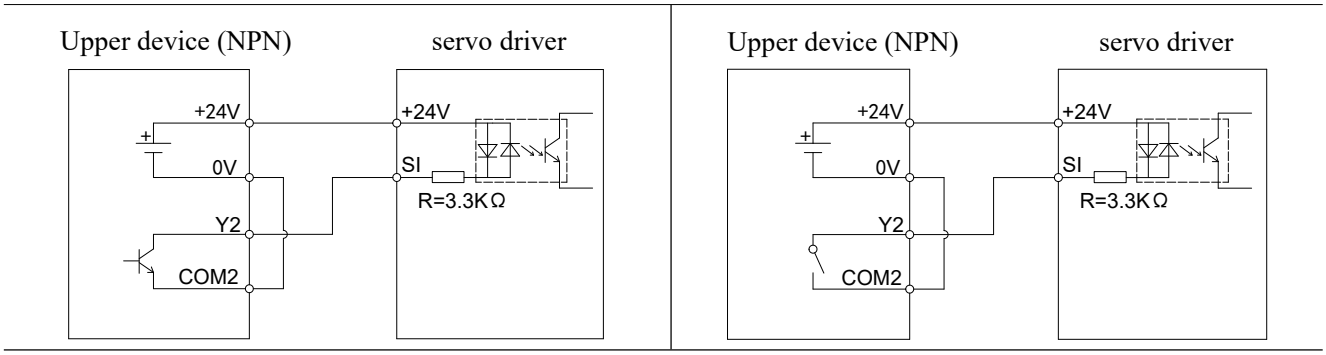


Optocoupler (24V power supply, SI3, SI4, SI5)



Relay type (24V power supply, SI3, SI4, SI5)





Note: SI1, SI2 with +, - identification, SI3, SI4, SI5 common end is "+24V" terminal.

(1) Among them, SI1/2 supports NPN and PNP connections. SI3/4/5 supports NPN or PNP connections (only one can be used at a time).

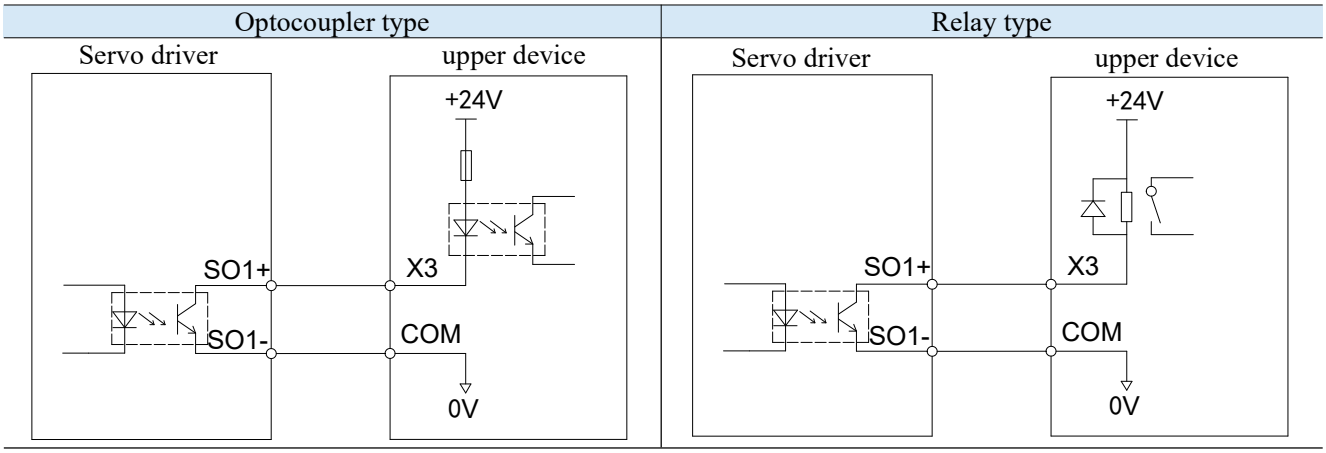
(2) The maximum allowable voltage and current capacity of the open collector output circuit are as follows:
Voltage: DC 30V (Max)
Current: DC 50mA (Max)

3.2.2 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



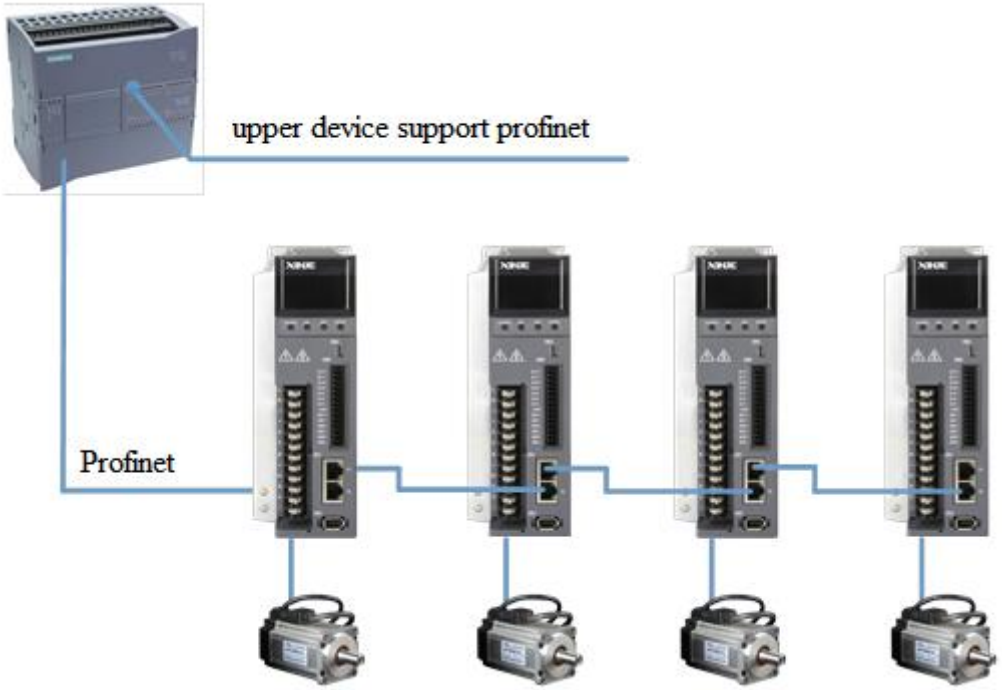
Note: SO1, SO2, SO3 are marked with +, -.

(1) SO1-, SO2-, SO3- can be connected together using the same COM, SO all support NPN and PNP connection.

(2) Maximum load current: All SO are 50mA output, support 24VDC, the maximum doesn't exceed 30VDC, so the brake unit needs to be switched through the intermediate relay.

3.2.3 Profinet communication

Profinet is a new Ethernet communication system, Profinet integrates the system based on Profibus, and can also integrate other fieldbus systems. As an open architecture, Profinet supports line, star, tree, ring and other network topologies, and can flexibly add or remove nodes as required. Its connection mode is shown in the following figure:

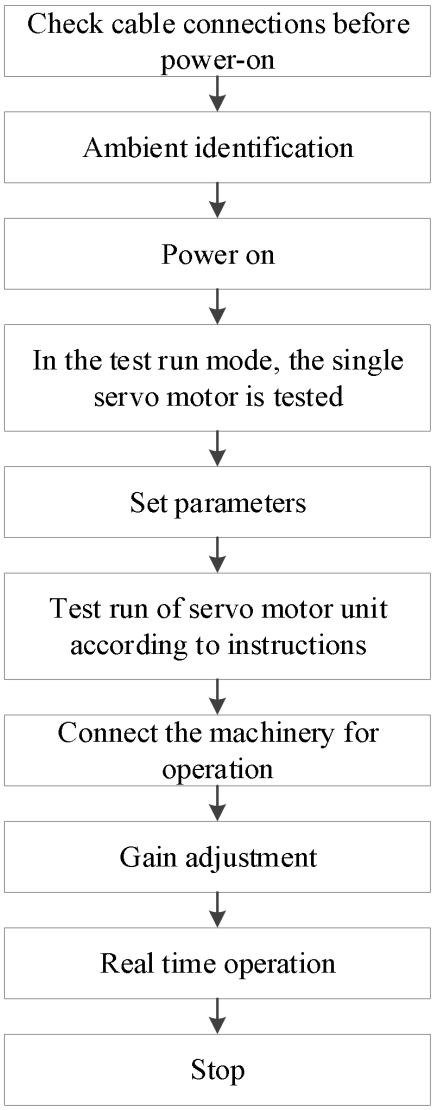


Note: The process of communication transmission will inevitably be affected by the surrounding electromagnetic environment, it is recommended that users use industrial grade Cat5e network cables, can also be purchased in our company.

4 Operate panel

4.1 New driver debugging process

The debugging sequence of the new driver is shown in the following figure:



4.1.1 Check cable connections and surroundings before power-on

1. Confirm whether the power cable, encoder cable and motor of the servo drive and servo motor are connected normally, and whether there is short circuit in the power supply. The part of the cable doesn't exert excessive external force, and the bending degree of itself is within the tolerable range.
2. Whether the motor is installed correctly.
3. Whether the motor and the mechanical part of the displacement phenomenon.
4. Foreign objects such as metal shavings that may short-circuit signal cables and power cables don't exist in the onsite environment.

4.1.2 Power on

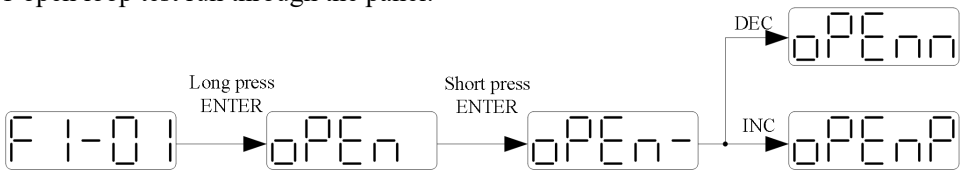
Confirm whether the servo supply voltage is within the specified voltage range: the specified voltage range of 220V is 200V~240V. 380V specified voltage ranges from 380V to 440V.

4.1.3 Empty shaft test run

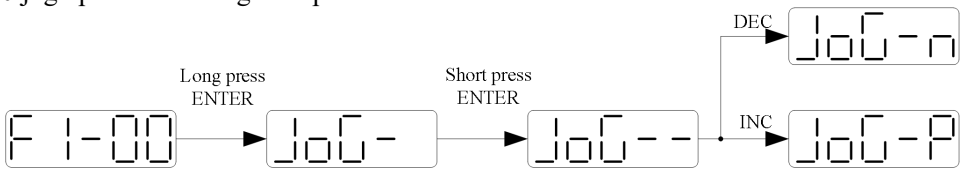
When the servo motor is separated from the machine, try to use the trial operation mode at low speed to confirm whether the servo motor is rotating correctly. The panel speed mode can be used to open and close the loop, or the servo PC software XinjeServo Tuner can be used to jog operation.

■ Panel speed jog operation

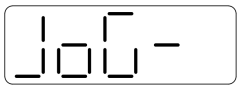
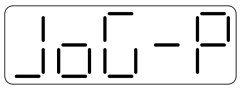
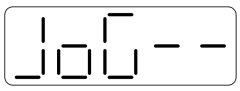
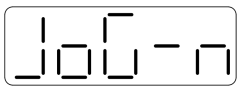
The following are valid only when the servo is not enabled (that is, the panel is bb).
F1-01 open loop test run through the panel:



F1-00 jog operation through the panel.



Press ENTER to enable the motor. In the enabled state, press INC to jog run forward, and DEC to jog run reverse. Press STATUS/ESC to stop enabling the function and exit jog operation.

State	Panel display	State	Panel display
Idle display		Forward run	
Enabled display		Reverse run	

Related parameters

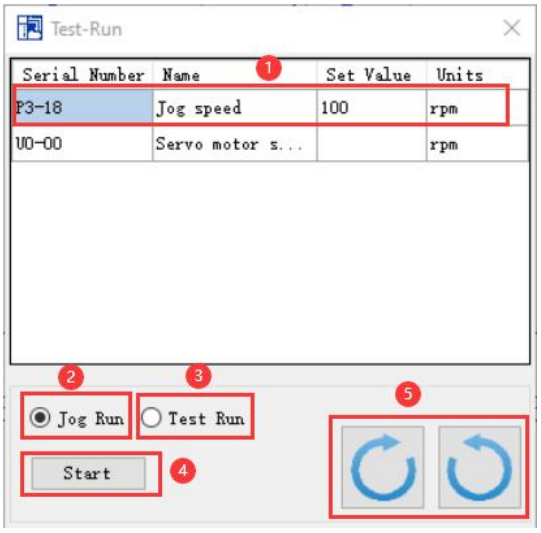
Parameter	Meaning	Default setting	Unit	Setting range	Change	Effective
P3-18	JOG speed	100	1rpm	0～1000	Servo OFF	At once

P3-18 is a 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 operation

Open the servo upper computer software XinjeServo Tuner, set the P3-18 jog speed, select the "test run"/"jog run "button, click"start", and realize the jog operation through the buttons on the interface.

Click "Test Run" on the menu bar, the following screen will appear:

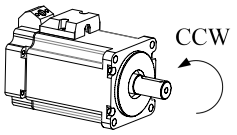
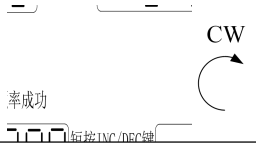
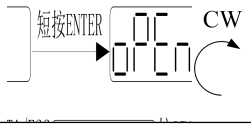
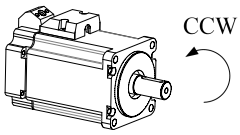


The screen is mainly divided into 5 setting modules:
① Jog speed P3-18: determine the running speed of the motor in the [point] mode.
② Jog mode: closed-loop jog operation.
③ Test run mode: open loop jog operation.
④ Start: Enable in jog mode.
⑤ Forward/reverse: make the motor run forward or reverse.

4.1.4 Motor rotation direction

Observe the servo motor running direction, if it is contrary to the actual need, then turn the servo OFF, then set the parameter P0-05 to 0 or 1, and then re-power on to make the change take effect.

The user can change the rotation direction of the servo motor by parameter P0-05. The "forward rotation" of the motor is "counterclockwise rotation" and "reverse" is "clockwise rotation". (All are viewed facing the motor shaft)

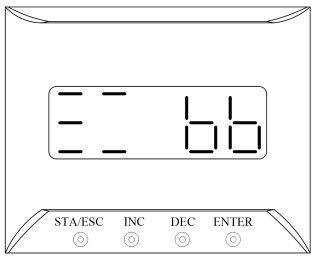
Mode	Forward running	Reverse running	P0-05 setting
Standard setting CCW is forward run			P0-05=0
Reverse mode CW is forward run			P0-05=1

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

4.2 Panel and status

4.2.1 Operating panel description



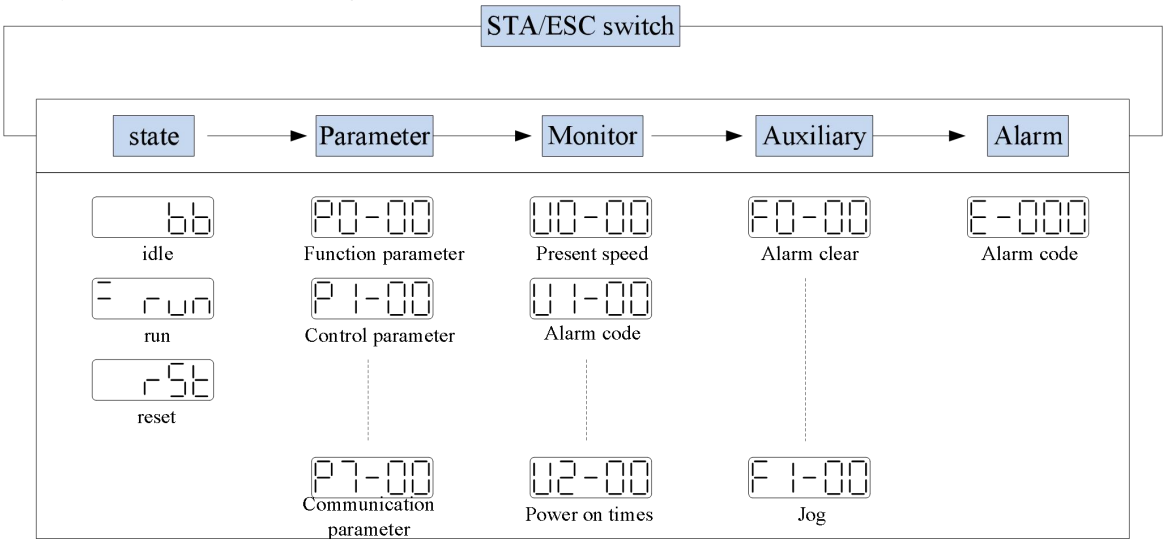
Button	Operation
STA/ESC	Short press: state switch, state return
INC	Short Press: The display data increases Long press: The display data increases continuously
DEC	Short Press: The display data decreases Long press: The display data decreases continuously
ENTER	Short press: shift. Long press: Set and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

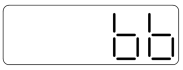
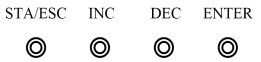
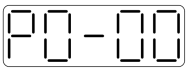
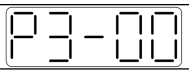
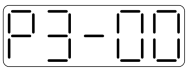
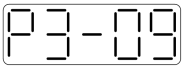
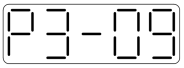
State: BB indicates that the servo system is idle. Run indicates that the servo system is running. RST indicates that the servo system needs to be re-energized.



- 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-xxx: The first two X denote the alarm category, and the last x denotes the small category under the category.

■ Parameter setting example

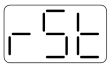
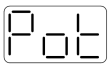
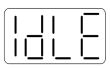
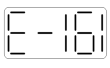
Taking modifying P3-09 as an example:

Step	Panel display	Used buttons	Operations
1			No operation
2			Press STA/ESC
3			Press INC for three times to show P3-00
4			Press ENTER, the last 0 will flash
5			Press INC for 9 times
6			Long press ENTER to show the value of P3-09
7			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

Panel simplified code display content

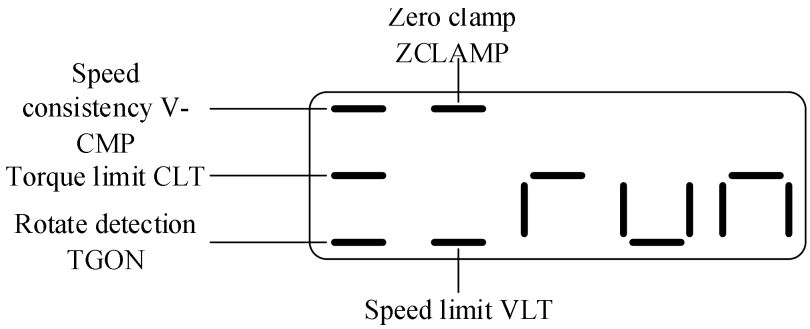
Code	Content
	Standby status Servo OFF status. (The motor is in a non-electrified state)
	In operation Servo enabling state. (The motor is on-line)
	Need reset status Servo needs to be re-energized
	Forbidden forward drive state P-OT ON status.
	Forbidden reversal drive state N-OT ON status.
	Control mode 2 is vacant.
	At this point, the panel is in an alarm state and needs to be cleared first. Please refer to Section 11.2 for specific alarm information.

4.2.4 Status display in each operating mode

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

Parameter	Signal name	Default value	Suitable mode	Meaning	Modify	Take effect
P8-25	Panel display setting	0	All	0: normal display, power on displays 'bb' or 'run' 1: display of U0-00 value, speed feedback, unit rpm 2: display of U0-07 value, torque feedback, unit %	Any time	Repower on

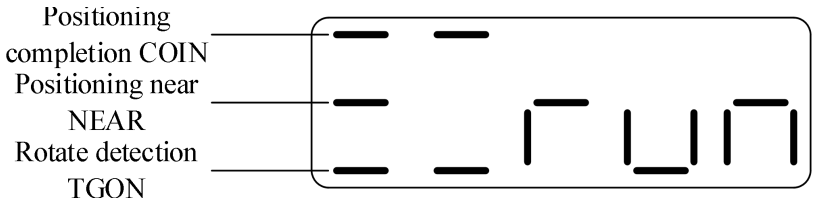
■ Speed torque control mode



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

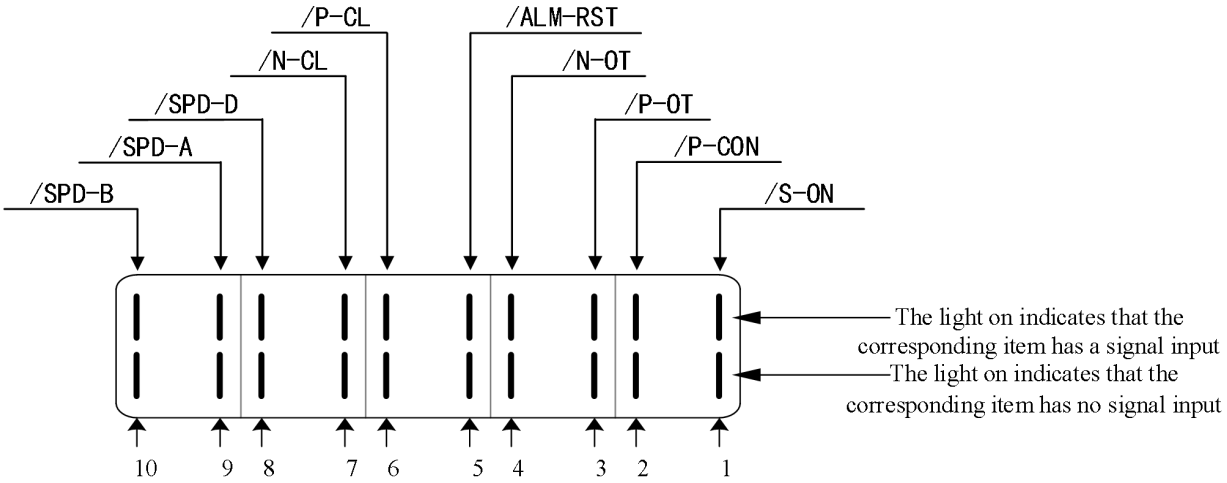


Digit display contects

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

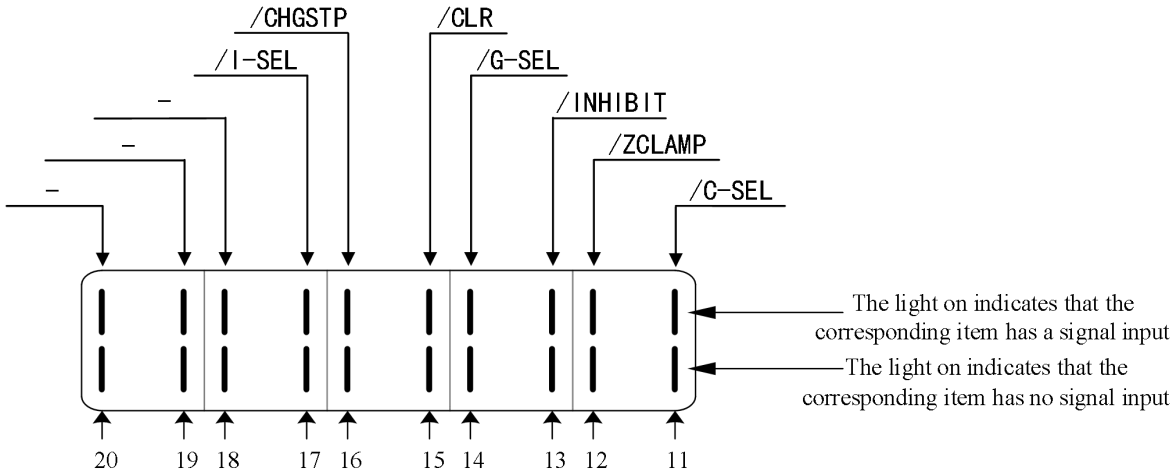
■ U0-21 input signal status



■ 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 is not 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



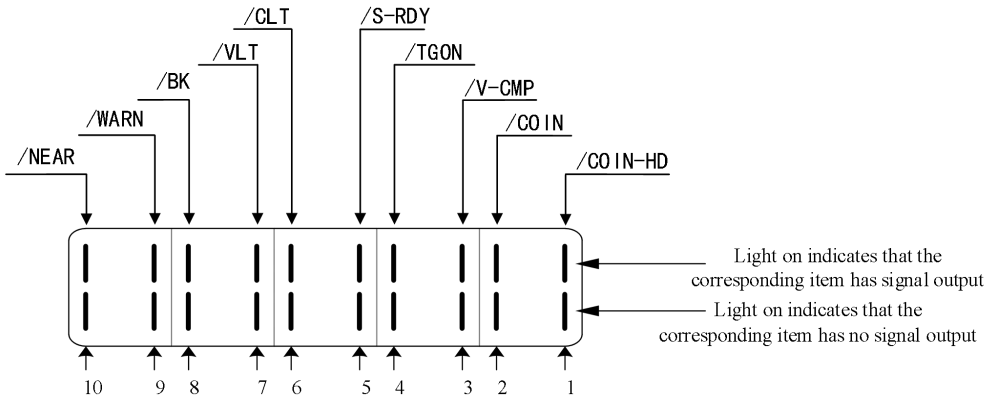
■ U0-22 input signal 2 distribution

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

	prohibition		
15	/CLR pulse clear	16	/CHGSTP change step
17	/I-SEL inertia switching	18	Reserved
19	Reserved	20	Reserved
Note: 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 is not input, 1 means that the position signal has input. Example: 0x0001 means / C-SEL has input, 0x0041 means / C-SEL and / G-SEL have input.			

Note: "-" is reserved for display purposes and doesn't represent any signal. This status bit remains at 0.

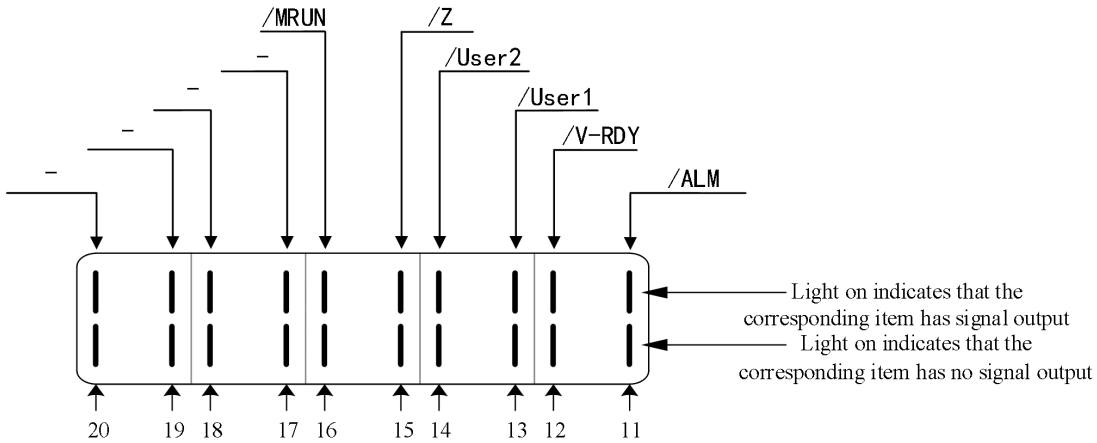
■ U0-23 output signal status



■ 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 is not 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: When reading the state through communication, the binary numbers correspond to /ALM position in turn from right to left. 0 means that the position signal has no input, and 1 means that the position signal has input. Example: 0x0001 indicates that /ALM has output, and 0x0041 indicates that /ALM and /custom output 2 have output.			

Note: "-" is reserved for display purposes and doesn't represent any signal. This status bit remains at 0.

■ U4-18 output 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 high-level, the 0th bit of U4-18 will not display 1. (Supported for firmware versions 3790 and above)			

■ 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 input 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 high-level, the 0th bit of U4-19 will not display 1. (Supported for firmware versions 3790 and above)			

4.2.6 Group F auxiliary function parameters

■ F0-XX

Function code	Description
F0-00	Alarm clear
F0-01	Restore Factory
F0-02	Clear the position offset

1. Clear alarm (parameter F0-00)

When a fault occurs, the alarm status of E-XXX will automatically pop up, displaying the alarm number. If there is no fault, the alarm status will not be visible.

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 power supply is turned off and the servo alarm is triggered, there is no need to clear the alarm.

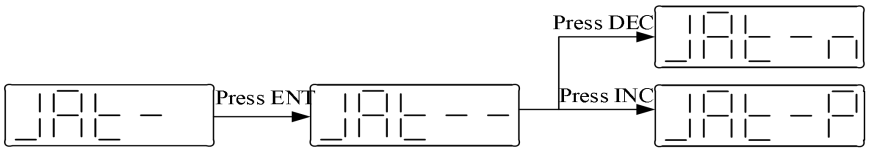
2. Restore parameters to factory values (parameter F0-01)

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

After setting F0-01=1 and pressing Enter to confirm, the parameter reset to factory has been completed and there is no need to power off again.

3. Identification of inertia through the panel (parameter F0-07)

Before inertia identification, please use the F1-00 jog function to confirm the servo rotation direction. At the beginning of inertia identification, the initial direction of servo operation is determined by INC or DEC!
If the servo shakes under the adaptive default parameters, please switch to the adaptive large inertia mode (P2-03.3=1) first to ensure that the servo runs smoothly before performing inertia identification!
When the servo is in bb state, enter parameter F0-07 to display:



Please refer to section 10.2.4 for detailed steps.

4. Panel external command self-tuning (parameter F0-08)

Please refer to section 10.4.5 for detailed steps.

5. Internal command self-tuning of the panel (parameter F0-09)

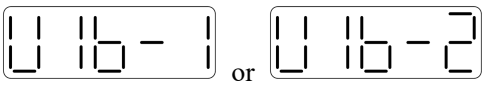
Please refer to section 10.4.4 for detailed steps.

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

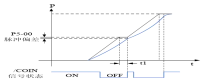
Mode	Display	Changed parameters
Mode 1	Vib-1	Only the parameters related to vibration suppression will be changed.
Mode 2	Vib-2	It will change the parameters of vibration suppression and the gain of speed loop.

The operation steps:

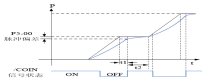
1. Enter F0-10 in auto-tuning mode, the panel shows vib-1 or enter F0-11, the panel shows vib-2.



2. 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.



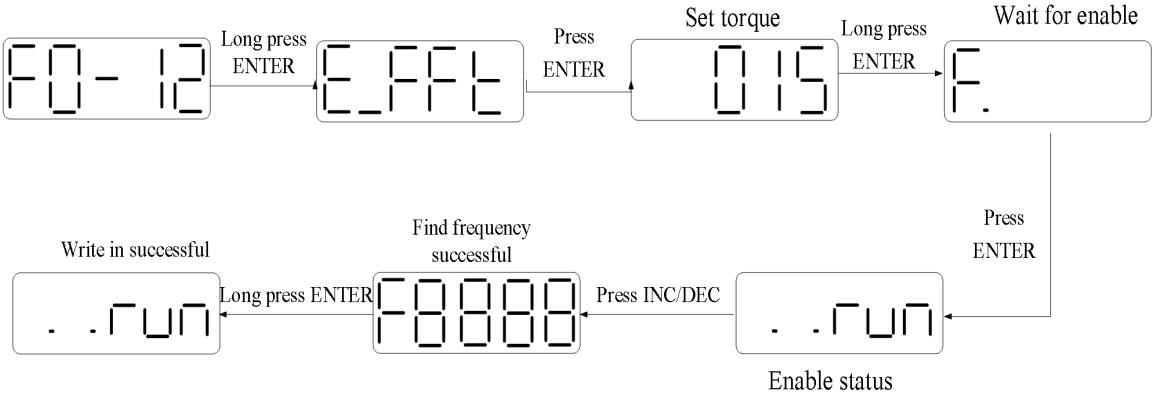
4. The upper device starts to send pulses, then it will show done and flicker.

5. Press STA/ESC to exit.

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 10.7.7 notch filter.

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

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.

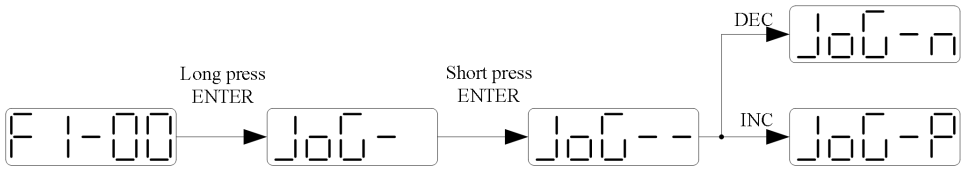


■ F1-XX

Function code	Description
F1-00	Jog run
F1-01	Test run
F1-02	Current Sampling Zero-correction
F1-05	Panel enable
F1-06	Absolute encoder position clear

1. Jog run (F1-00)

Before entering jog mode, please confirm that the motor shaft is not connected to the machinery and that the drive is in the idle state of BB!



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

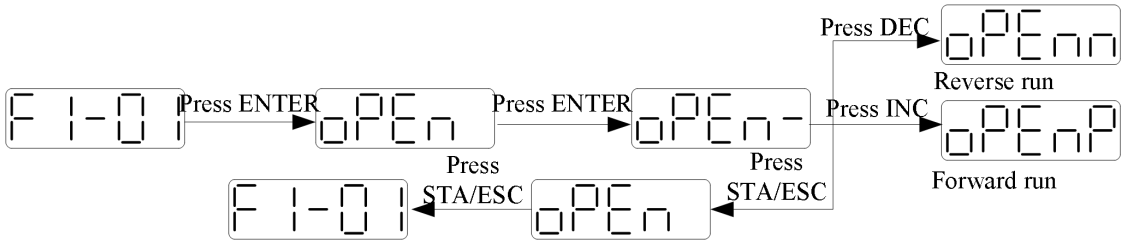
P3-18	JOG speed					
	Unit	Default value	Range	Suitable mode	Modify	Effective
	1rpm	100	0~1000	JOG run	Servo OFF	At once

2. Test run (F1-01)

Before entering the test run mode, please confirm that the motor shaft is not connected to the machine!

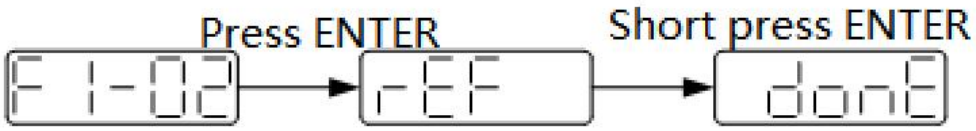
When the servo driver is connected to the non-original encoder or power cable, it should first enter the test run mode to verify that the encoder terminal or power terminal is connected correctly.

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 forward and reverse rotation. If the motor shaft shakes or driver alarms, please immediately disconnect the power supply, and re-check the wiring situation.



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

When the servo drive self updates or the motor runs unevenly after a long time, it is recommended that the user automatically adjust the current detection offset. When the drive is in the idle state of bb, the following operations should be carried out.



Press the START/ESC key to exit this function and power on again.

4. Panel enable (F1-05)

Parameter	Signal name	Setting	Meaning	Change	Effective
P0-03	Enable mode	0	Not enable	Servo OFF	At once
		1	I/O enable		
		2	Software enable (F1-05 or communication)		

		3 (default)	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: After re powering on, the forced enable will become invalid.
If the user wants to enable it as soon as it is powered on and still takes effect after a power outage, then P5-20 is set to n.0010. (When P0-03=1, it will take effect)

5. Absolute encoder clear number of turns (F1-06)

First, turn off the servo, and then clear the absolute value encoder turns. The operation is as follows:
Writing 1 to F1-06 through panel operation can clear the absolute encoder turns.
Write 1 to the hexadecimal address of 0x2106 through Modbus Rtu to clear the number of turns (servo bb status take effect, after clearing, write 0x2106 to 0).
Writing 3 to F1-06 through panel operation can perform zero calibration on the absolute value encoder.
To calibrate the zero point, write 3 to the hexadecimal address of 0x2106 through Modbus Rtu (servo bb status takes effect, after clearing please write 0x2106 to 0).

5 Operation of servo system

5.1 Control mode selection and switching

5.1.1 Control mode selection

Servo can choose 3 control modes to meet different control needs. (P0-00=0 takes effect)

User parameter		Control mode	Reference
P0-01 Submode 1	1	Torque control (internal setting)	5.4.1
	3	Speed control (internal setting)	5.4.2
	5	Position control (internal position instruction)	5.3.3

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 is not 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 section 3.2.2 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
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
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 is not 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**

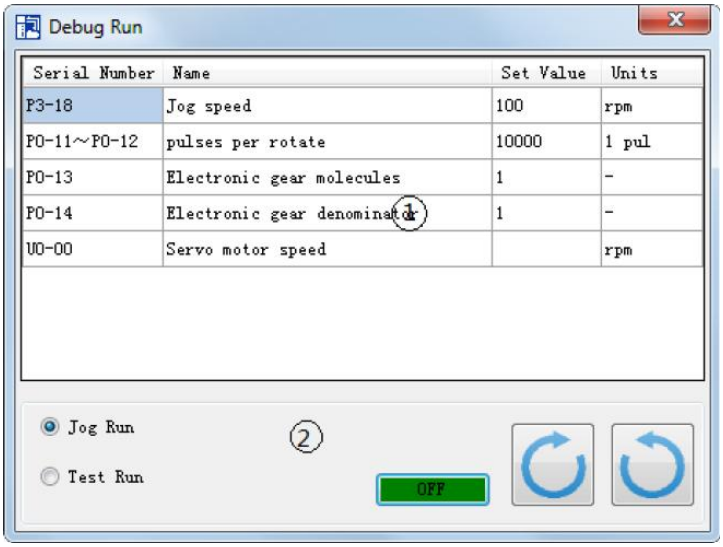
■ Related parameter

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 section 4.4.2 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	Modify	Effective
P0-03	Enable mode	0	Not enable	Servo bb	At once
		1	I/O enable /S-ON		
		2	Software enable (F1-05 or enabled by software)		
		3(default)	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.

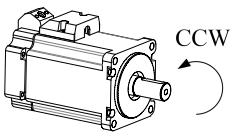
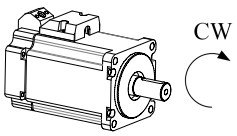
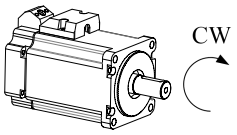
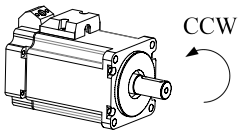
Prerequisite	Parameter setting status	signal/S-ON terminal input status	signal/S-ON terminal logic	Servo status
P0-03=1	P5-20=n.000□	SI□ terminal has no signal input	Invalid	The panel displays BB, and the servo is not enabled
	P5-20=n.001□	SI□ terminal has signal input		
	P5-20=n.000□	SI□ terminal has signal input	Valid	The panel shows run, servo enabled
	P5-20=n.001□	SI□ terminal has no signal 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	P0-05setting
Standard setting CCW is forward run			P0-05=0
Reverse mode CW is forward run			P0-05=1

5.2.4 Stop mode

Servo shutdown can be divided into inertia shutdown and deceleration shutdown according to the shutdown mode. The following explains the servo shutdown mode.

Shutdown mode	Inertia stop	Deceleration stop
Stopping principle	The servo driver is not enabled, the servo motor is not 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.
Stopping features	Advantages: smooth deceleration, small mechanical impact, small mechanical impact Disadvantage: slow deceleration process	Advantages: short deceleration time Disadvantages: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
P5-03	Rotation detection speed	50	rpm	0～10000	Anytime	At once
P0-27	Servo OFF stop mode	0	-	0/2	Servo bb	At once
P0-29	Alarm stop mode	2	-	0/2	Servo bb	At once

Parameter	Value	Meaning
P0-27/P0-29	0	Inertia stop and maintain the inertia operation state after stopping.
	2	Deceleration brake stop and maintain the inertia operation state after stopping.

Note:

1）Servo OFF stopping mode (P0-27)

① When P0-27=0, if the servo OFF occurs, the motor starts to stop relying on inertia without any alarm.

② When P0-27=2, if the servo OFF occurs, the motor starts to rely on inertia to stop until the speed is less than P5-03 before turning to free stop. At the same time, the servo will time the inertia stop stage. If the timing time has exceeded P0-30 and the motor speed has not dropped below P5-03 during the inertia stop process, an alarm E-262 will sound.

2）Servo alarm stopping method (P0-29)

① When P0-29=0, if the servo alarm occurs, the motor starts to rely on inertia stop.

② When P0-29=2, if the servo alarm occurs, the motor will generate a fixed braking torque, and the motor will start braking and stop until the speed is less than P5-03 (rotation detection speed) and then turn to free stopping. At the same time, the servo will time the braking stop stage.If the timing time is greater than P0-30 and the motor speed has not dropped below P5-03, the servo will directly stop freely. At this time, because the servo is in the alarm state, no matter P0-27=0 or 2, it will not alarm E-262.

3）The servo drive SO terminal is assigned with a holding brake function, and regardless of whether P0-27/P0-29=0 or 2, it stops in a deceleration mode.

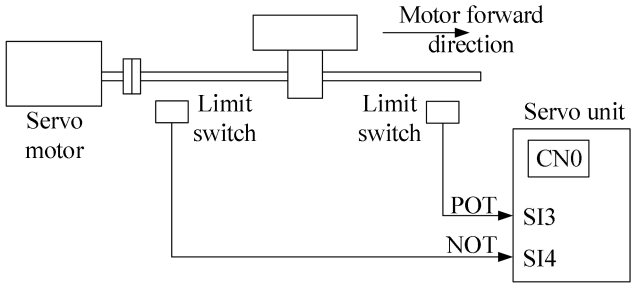
2.Stop mode in case of over travel

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.0000	-		Anytime	At once
P5-23	Reverse run prohibition /N-OT	n.0000	-		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't 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 receives an overtravel stop signal and begins to slow down and stop. At the same time, the stop timeout during the overtravel processing also takes effect.

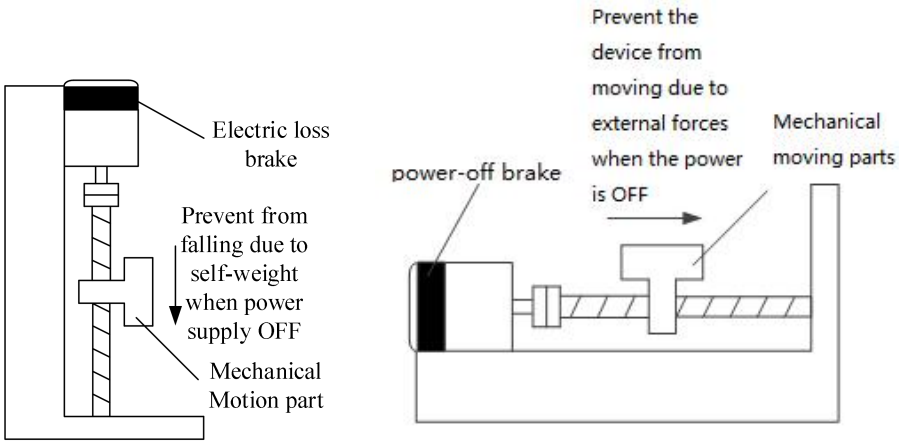
② During position control, when the motor is stopped by over travel signal, there may be position deviation pulse. To clear the position deviation pulse, the clear signal /CLR must be input. If the servo unit still receives pulses, they will accumulate until the servo unit gives an alarm.

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.

5.2.5 Power-off brake

When the servo motor controls the vertical load, the purpose of using a servo motor with a power-off brake is to prevent the movable part from moving under its own weight or external force when the power supply of the system is set to "OFF".



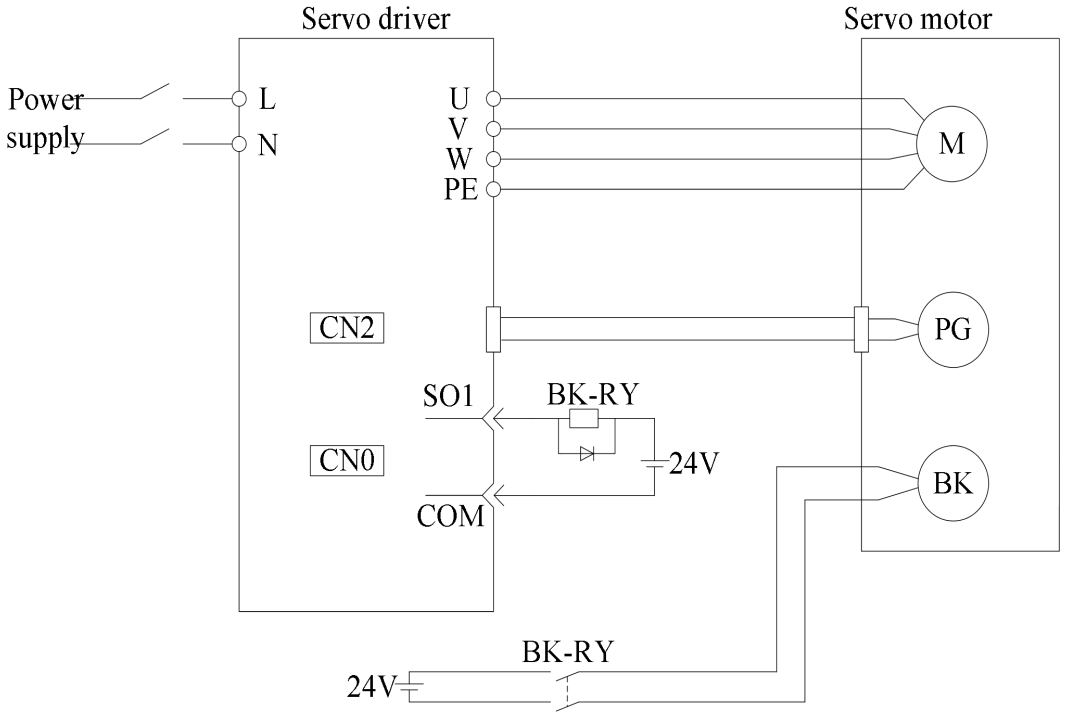
Note: The brake built in the servo motor is a fixed special brake without excitation. It can't be used for dynamic braking. Please use it only when the servo motor is in a stop state.

■ 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.

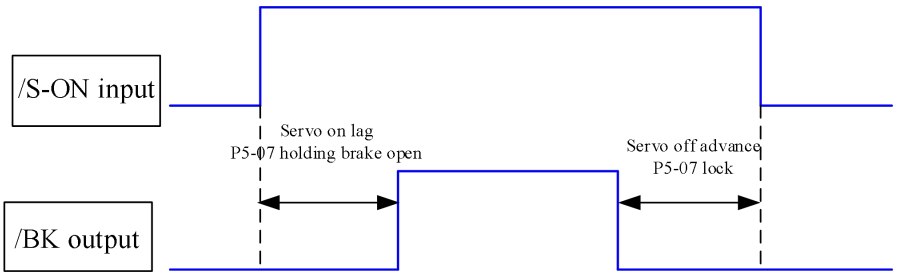
③ Please transfer the lock through the intermediate relay to prevent the terminal from being burned due to excessive current.

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.

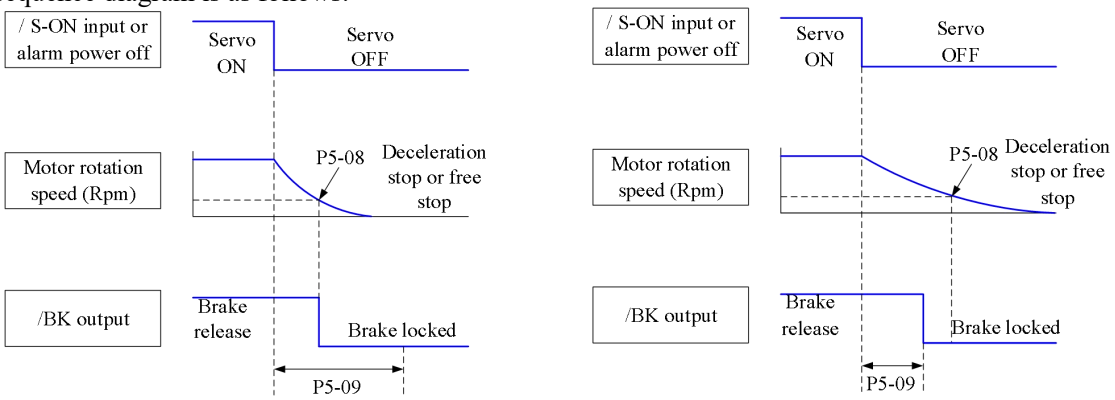


Note: the setting made here is the time when TGON of rotation detection is invalid when the motor is stopped.

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.

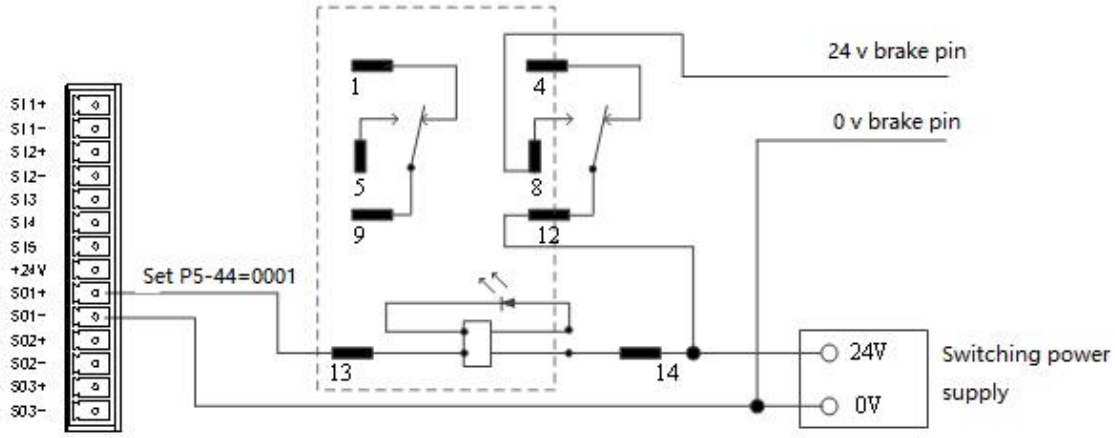
The sequence diagram is as follows:



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. Holding brake connection method

External intermediate relay brake connection, as shown in the figure below:



Note: T is recommended that the SO terminal and the intermediate relay not share the same switching power supply.

5.When there is a slight drop after the power failure, it can be solved by the following solutions:

① Appropriately reduce P5-07.
② Directly set P0-69.2 to 1.

5.3 Position control

5.3.1 General position control

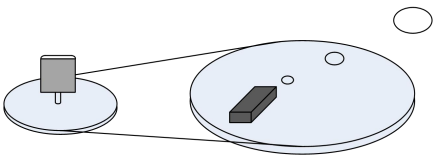
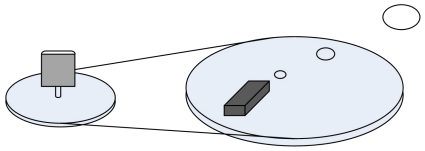
5.3.1.1 Electronic gear ratio

1.Overview

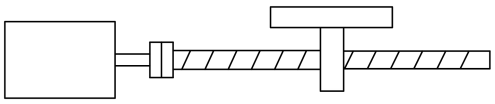
The so-called "electronic gear" function has two main applications:

(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 17-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 131072:10000	Set pulses per revolution to 5000 Electronic gear ratio set to 131072:5000
Two circle radius ratio: 2:1 Big circle run one rotation (need 20000 pulses), small circle run two rotations. Max speed 600rpm 	Two circle radius ratio: 2:1 Big circle run one rotation (need 10000 pulses), small circle run two rotations. Max speed 1200rpm 

(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: 131072(17-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 131072 pulses (P 0-11=0, P 0-12=0). If the workpiece is moved 6 mm in one turn, the number of pulses needed is 131072. If the workpiece is moved 10 mm, it will need 10/6*131072=218453.333 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 6 000. 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	Servo OFF	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~P0-14 is all about the parameters of electronic gear ratio, P0-11, P0-12 is group 1, P0-13, P0-14 is group 2, but the priority of P0-11 and P0-12 is higher than that of P0-13 and P0-14. Only when P0-11 and P0-12 are set to 0, the ratio of electronic gear P0-13 and P0-14 will take effect.

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	priority ↓
		$\frac{P0-13}{P0-14} = \frac{encoder\ resolution}{M} = \frac{encoder\ resolution}{N \times n} \times m$	

Note:

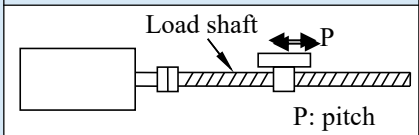
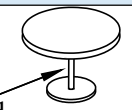
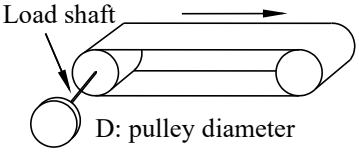
① In step 6, the effective priority of the number of pulses per revolution is higher than the electronic gear ratio, that is, when P0-11 ~ P0-12 are all 0, P0-13 ~ P0-14 will take effect. In special cases, if the number of pulses per revolution is calculated as a decimal, the electronic gear ratio should 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 DS5 series servo motor encoder is 131072 (17 bits) and 8388608 (23 bits).

④The 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 = $\frac{P}{command\ unit}$	 Load shaft 1 rotate = $\frac{360°}{command\ unit}$	 1rotate = $\frac{\pi D}{command\ unit}$
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 131072	Encoder resolution 131072	Encoder resolution 131072
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=131072 P0-14=6000 After reduction P0-13=8192 P0-14=375	P0-13=131072 P0-14=1200 After reduction P0-13=8192 P0-14=75	P0-13=131072 P0-14=7850 After reduction P0-13=65536 P0-14=3925 Conver to second gear ratio P0-92=5536 P0-93=6 P0-94=3925 P0-95=0

5.3.1.2 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	Modify	Effective
P5-00	Positioning completion width	11	Command unit	0～65535	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.0001	5|6	Positioning complete output	Anytime	At once
Refer to section 3.2.2 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.						

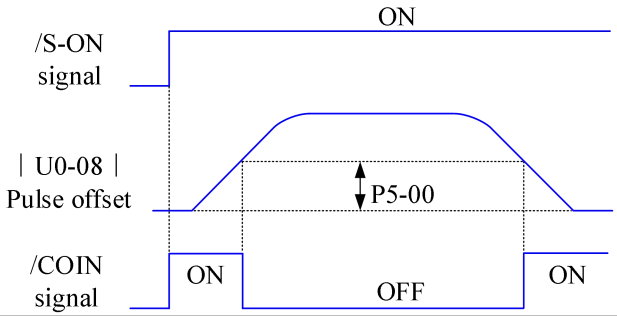
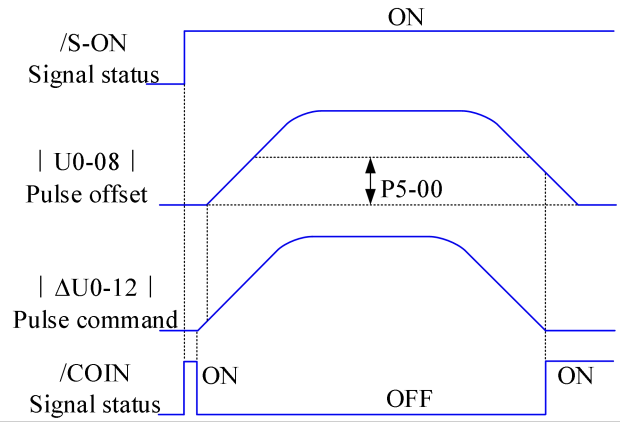
1.Conditions for positioning completion signal output

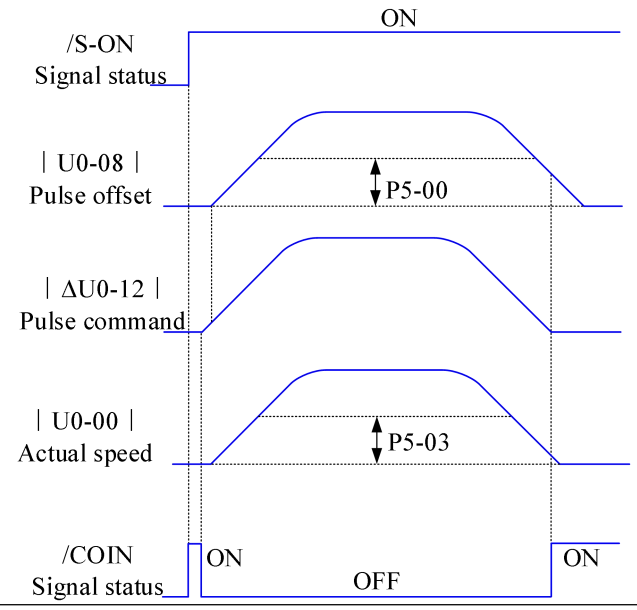
(1) /COIN-HD signal output conditions

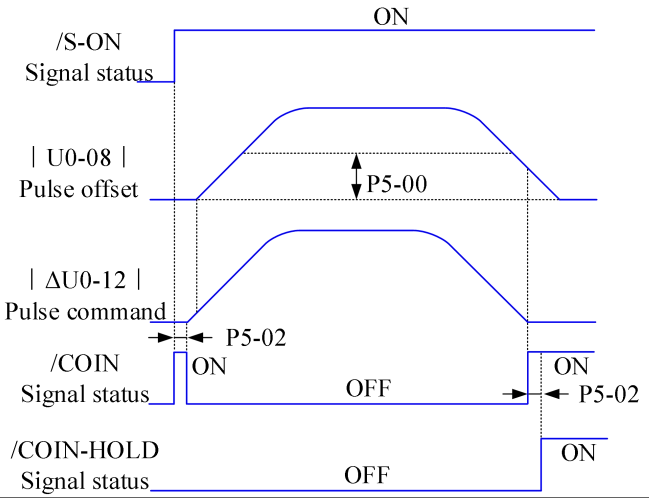
When the positioning completion detection mode P5-01 is set to 3, the positioning completion holding /COIN-HD signal can be output. When the /COIN signal holds P5-02 time, the COIN-HD signal can be output.

(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.	

P5-01 setting	Content	Diagram
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.

5.3.1.3 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.

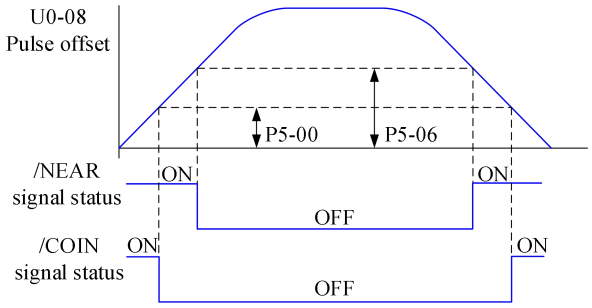
■ Related parameters

Parameter	Meaning	Default setting	Unit	Range	Modify	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	Positioning near	Anytime	At once
Refer to section 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
5000	25
3000	15
2000	10

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 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.

5.3.1.4 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 section 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.

5.3.1.5 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 section 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 deviatio.

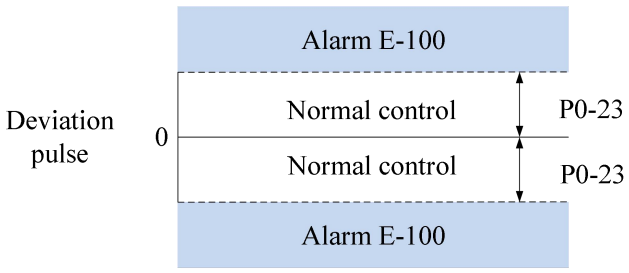
5.3.1.6 Position pulse deviation

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	Modify	Effective
P0-23	Pulse deviation limit value	2000	0.01turns	0～65535	Anytime	At once

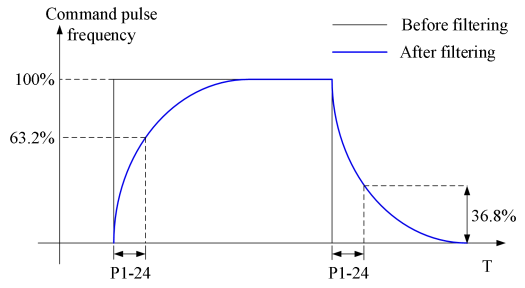
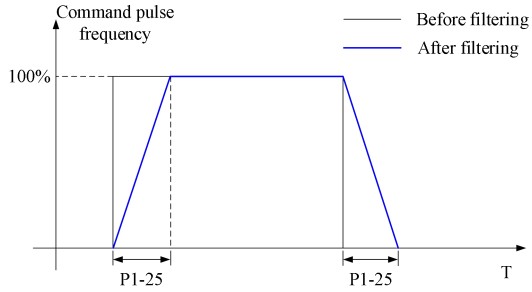
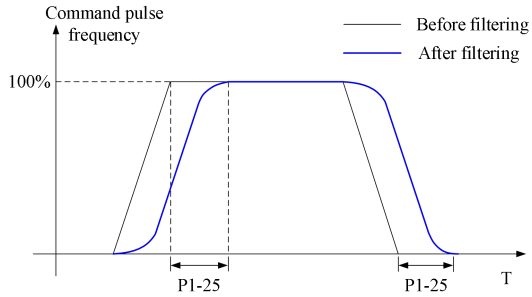
When the deviation pulse limit is 0, the deviation pulse will not be detected.



5.3.1.7 Position command filter

■ Related parameters

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

Position command acceleration and deceleration filter	Position command smoothing filter
	
	

5.3.1.8 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	Modify	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.(Need to P9-21 = 0)						

Signal setting

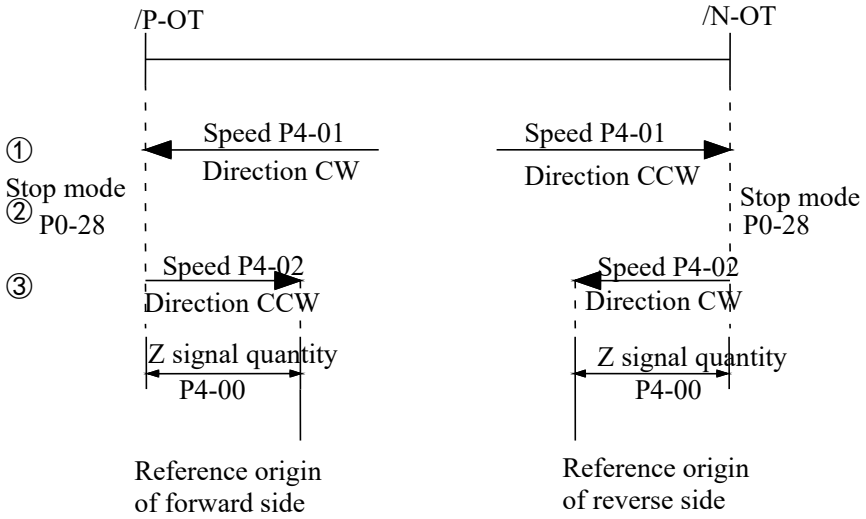
Parameter	Signal	Default setting	Meaning	Modify
P5-28	/SPD-A	n.0000	Mode 3: internal speed selecting signal Mode 5: find origin point at forward direction	Range: 0000-0014, distributes to input terminal through P5-28. When it set to 0001, it means input signal from SI1.
P5-29	/SPD-B	n.0000	Mode 3: internal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

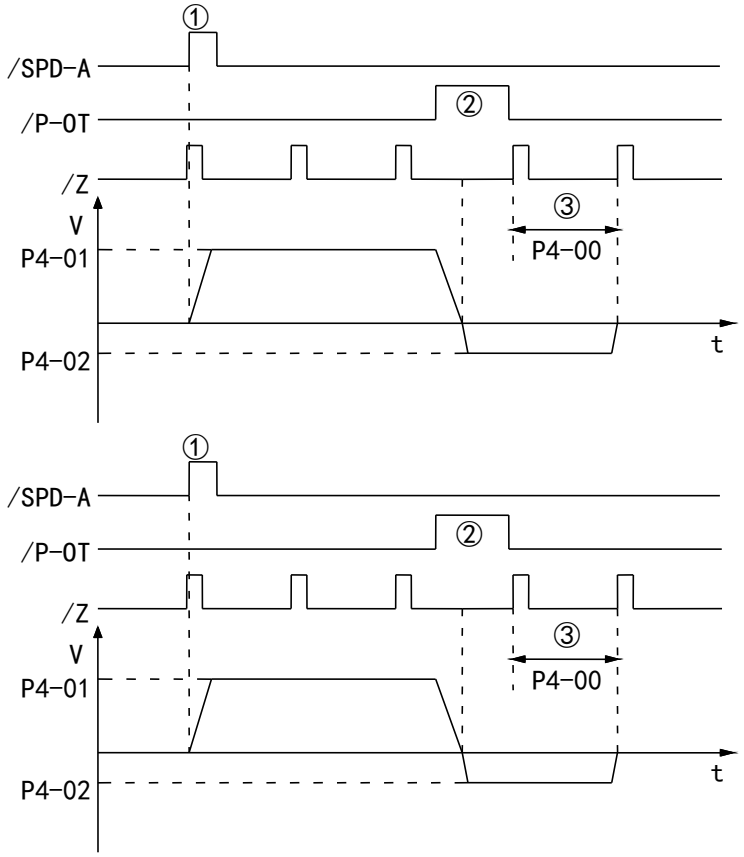
Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P4-00 n.xxx□	Z phase signal numbers	2	-	0～f	Servo OFF	At once
P4-01	The speed hitting the proximity switch	600	rpm	0～65535	Servo OFF	At once
P4-02	The speed leaving the	100	rpm	0～65535	Servo OFF	At once

	proximity switch					
Note: The origin searching function is only for single turn absolute motor (The origin searching function can also be supported for multi turn absolute motor P0-79 =1).						

Finding the reference origin schematic 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.

5.3.1.9 Homing function

1.Function overvie

Homing function refers to that when the servo enable is on in the position control mode, after the homing 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	Modify	Effective	Default setting
P9-11.0	Z phase number	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：trigger homing after enabling	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, 5 and 6 respectively.

Parameter	Name	Range	Unit	Meaning	Modify	Effective	Default setting
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

Parameter	Name	Range	Unit	Meaning	Modify	Effective	Default setting
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
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	Range	Meaning	Modify	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

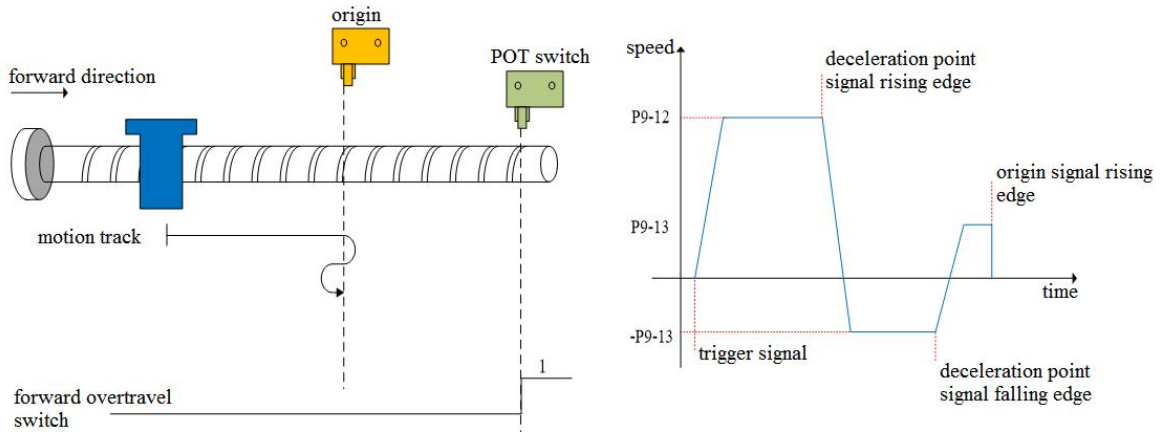
3.New homing mode selection

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

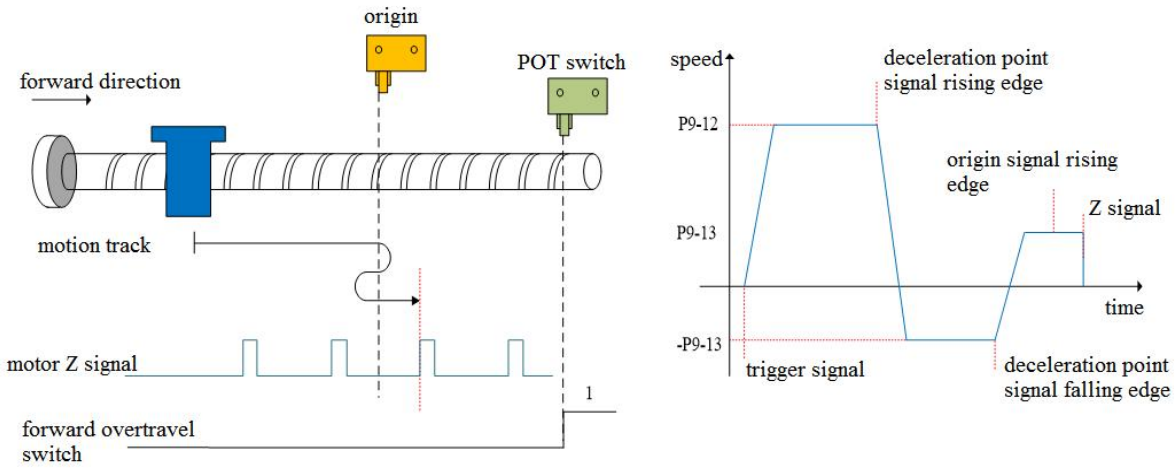
phases (P9-11.0) is 0 and the mechanical offset (P9-19, P9-20) is not 0, the servo doesn't find the Z phase, but executes the mechanical offset (P9-19, P9-20). If the number of Z phases is not 0 but the mechanical offset is 0, the servo will find the Z phase (P9-11.0) without performing the mechanical 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:
(1)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)
(a) 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) is not 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:
(a1) 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.



(a2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 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.

(a3) 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.



(a4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 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.

(b) 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) is not 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:

(b1) 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.

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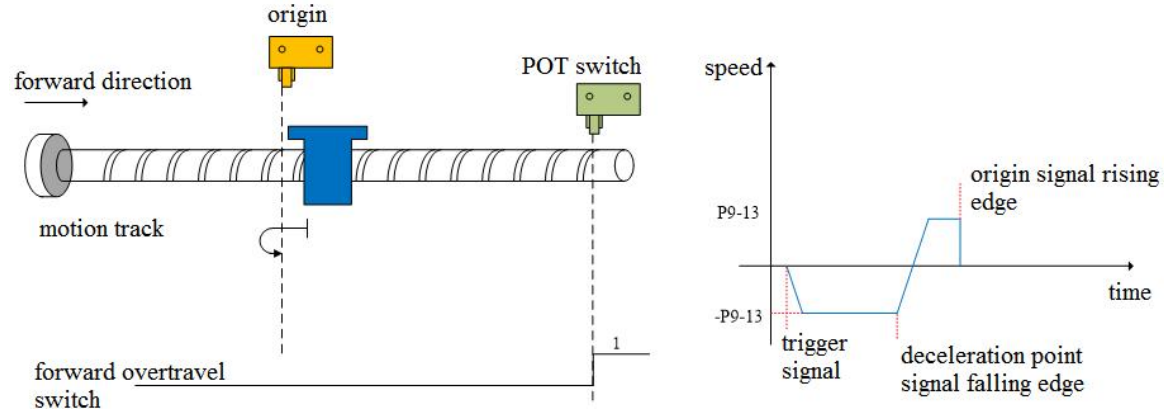
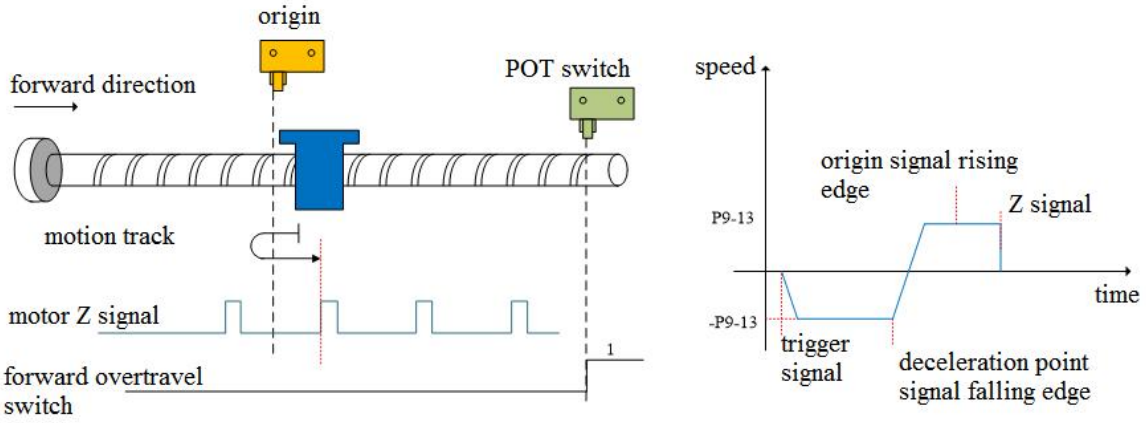


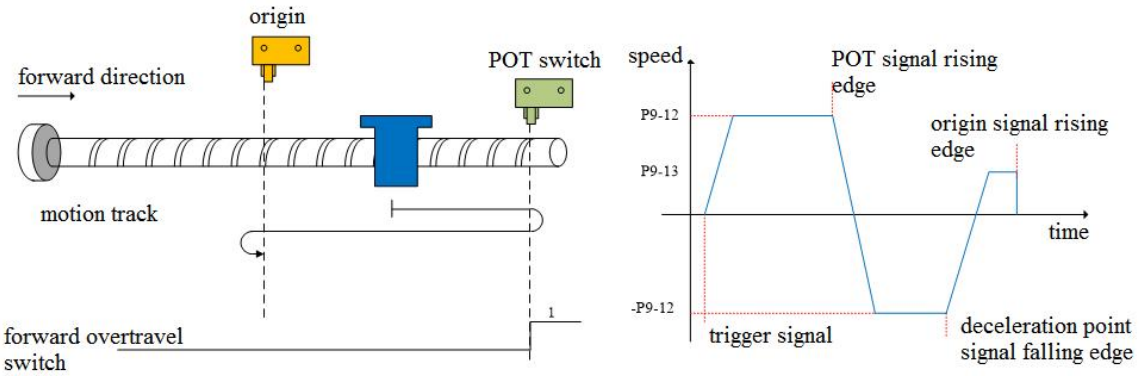
(b2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 0:
In the process of positive acceleration or positive constant speed operation, stop immediately after encountering the rising edge of the origin signal. After the motor is completely stopped, according to the set number 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.
(b3) 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.



(b4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 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.

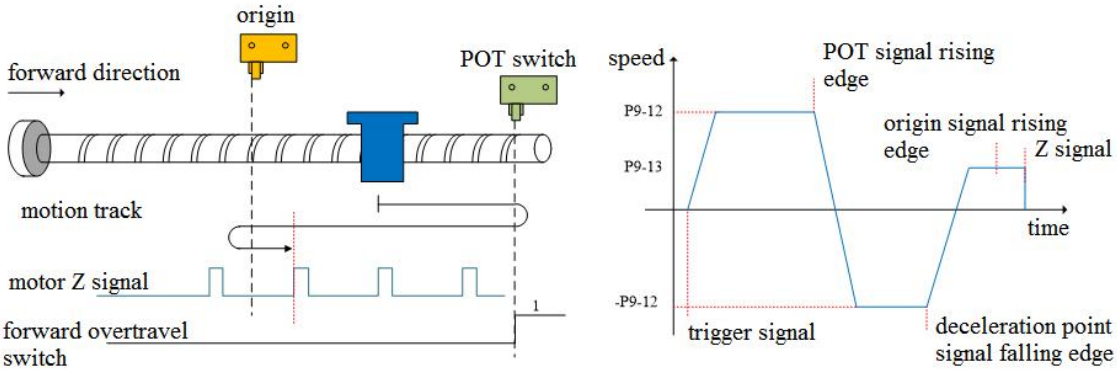
(c) When the motor starts to move, the signal of the origin switch (deceleration point) is invalid (P5-64 = 0-invalid, 1-valid), and the forward overtravel switch (P5-22) triggered in the process is valid.
Firstly, the servo motor forward searches for the deceleration point signal at high speed P9-12 (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:

(c1) 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.



(c2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 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.

(c3) 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.

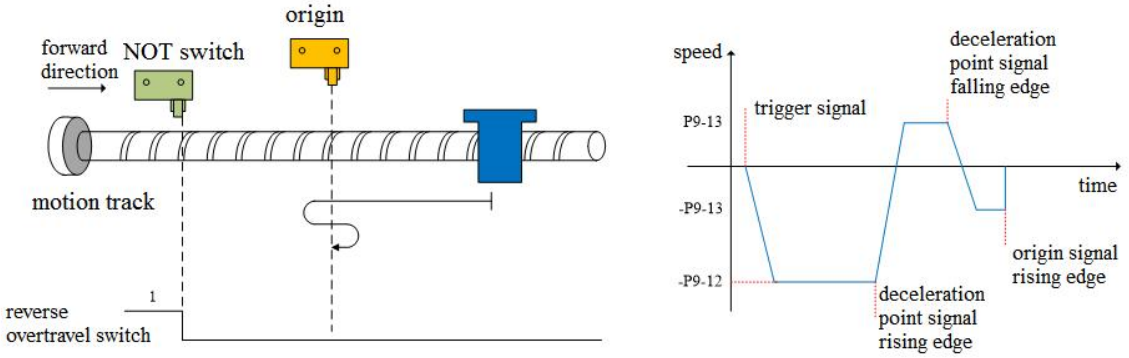


(c4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 0:
In the process of positive acceleration or positive constant speed operation, continue to run after encountering the rising edge of the deceleration point (origin) signal, and then find the first Z-phase signal to stop 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.

2. 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)

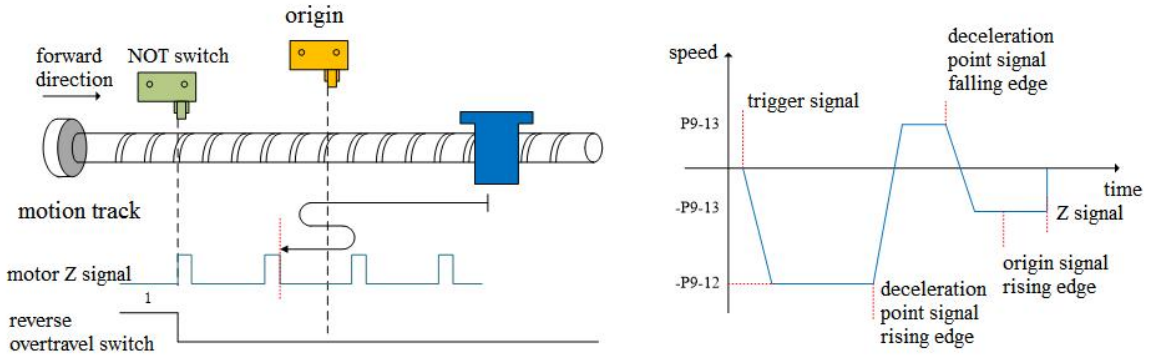
(a)When the motor starts to move, the signal of origin switch (deceleration point) is invalid, and the reverse overtravel switch (NOT)(P5-23) is not triggered in the whole process
Firstly, the servo motor searches for the deceleration point signal at high speed -P9-12 (homing high speed) in reverse until 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:

(a1) 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.

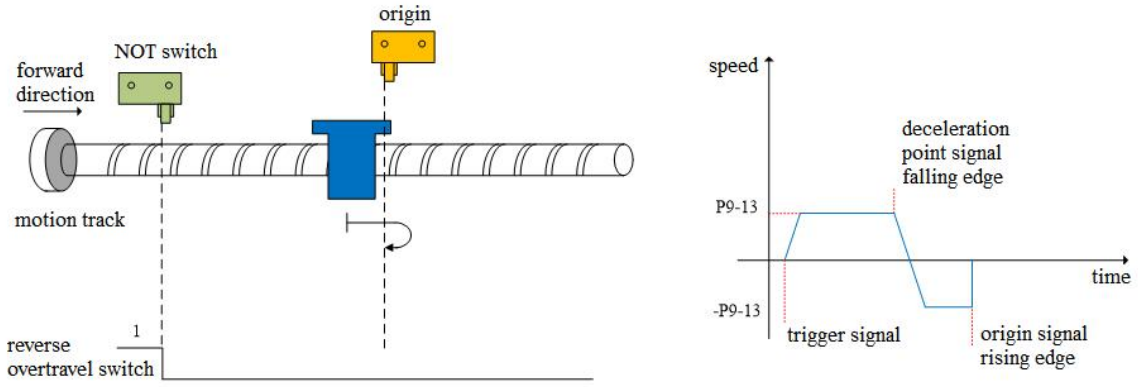


(a2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 0:
During the operation of continuing to search the rising edge of deceleration point (origin) signal at low speed -P9-13 (homing low speed), stop the machine immediately after encountering the rising edge of deceleration 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.

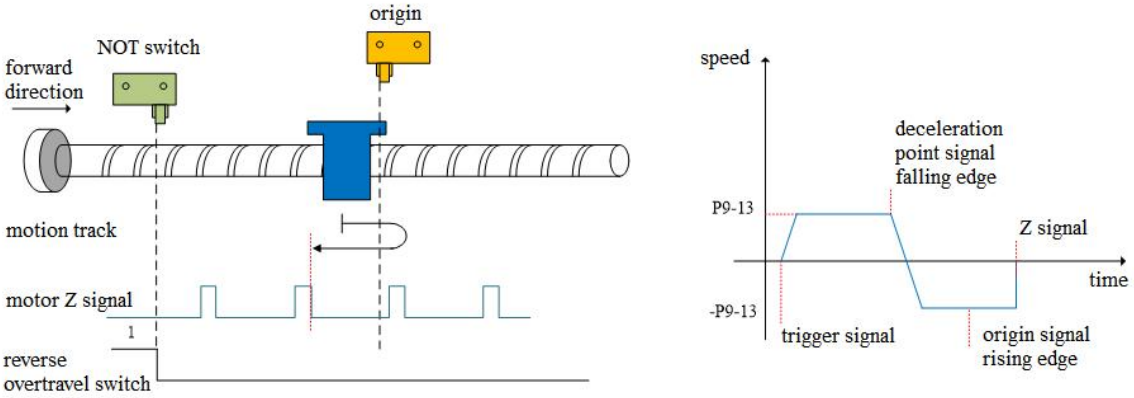
(a3) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
During the operation of continue to search the rising edge of deceleration point (origin) signal at low speed -P9-13 (homing low speed), continue to run after encountering the rising edge of deceleration point (origin) signal, and then find the first Z-phase signal and stop immediately.



(a4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 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.
(b)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 is not 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:
(b1) 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.



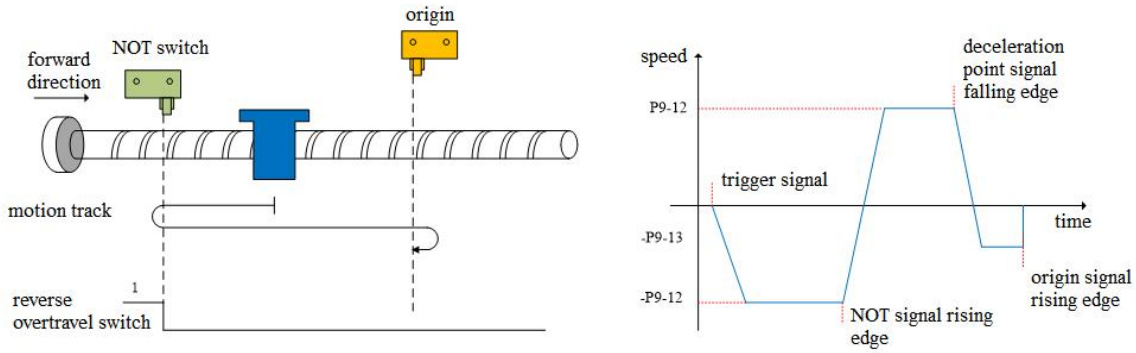
(b2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 0:
In the process of negative acceleration or negative constant speed operation, stop the machine immediately after encountering the rising edge of the origin signal. After the motor is completely stopped, the motor will walk 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.
(b3) 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.



(b4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 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.

(c)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:

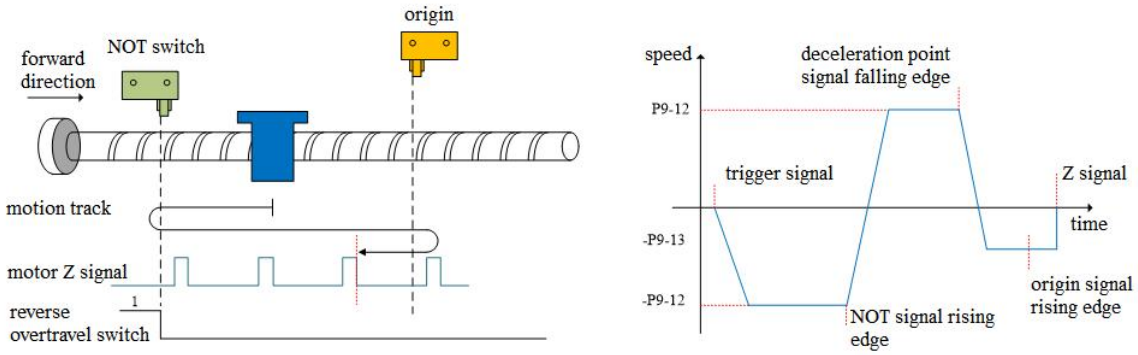
(c1) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
In the process of reverse acceleration or reverse constant speed operation, stop immediately when encountering the rising edge of the origin signal.



(c2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 0:

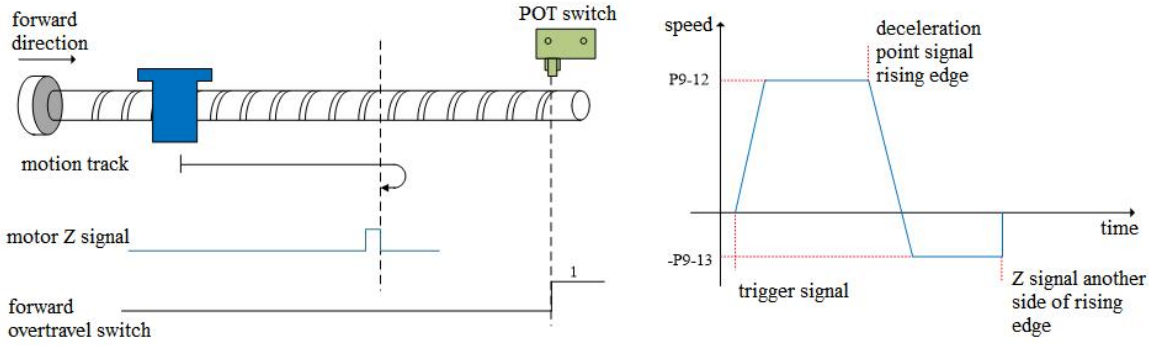
In the process of reverse acceleration or reverse constant speed operation, stop the machine immediately after encountering the rising edge of the deceleration point (origin) signal. After the motor is completely stopped, the motor will move a quantitative pulse (P9-19, P9-20) at the speed set by P9-12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

(c3) 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.



(c4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 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.

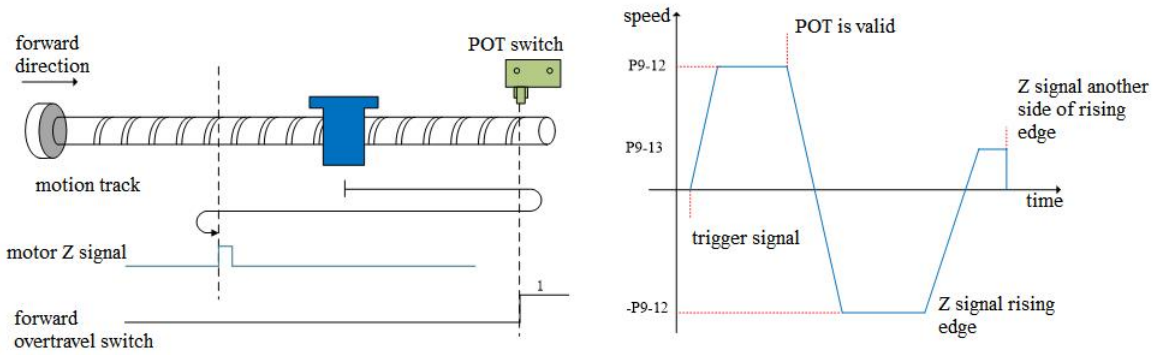
3.Homing mode 2——forward homing, deceleration point and origin are motor Z signal (P9-11.2=2)
In this mode, the number of Z phases of the motor is not found. To use this mode, you need to connect POT and NOT.
(a)When the motor starts to move, the Z signal is invalid or valid (P5-64 = 0-invalid, 1-valid), and the forward overtravel switch (POT) is not 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:
(a1) 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.



(a2) Mechanical offset (P9-19, P9-20) is not 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.

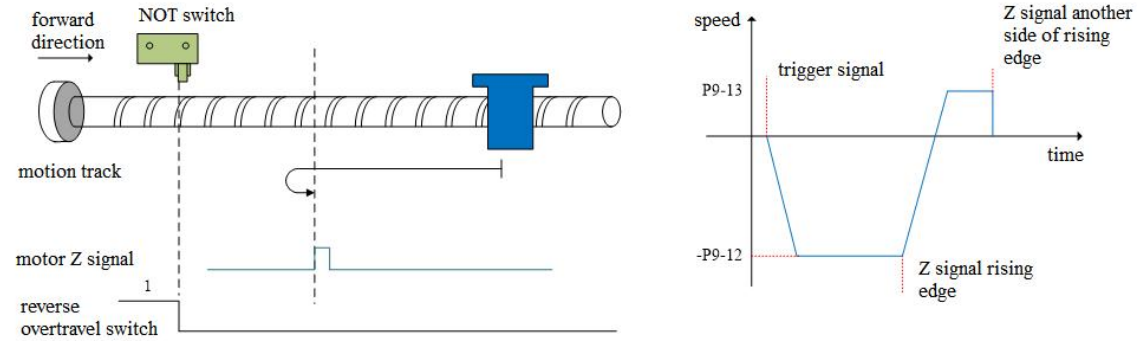
(b)When the motor starts to move, the Z signal is invalid or valid (P5-64 = 0-invalid, 1-valid), and the forward overtravel switch is triggered in the process (POT) (P5-22).
Firstly, the servo motor searches for the Z signal in forward direction with the high speed P9-12 (homing high-speed speed). After 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:
(b1) 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.



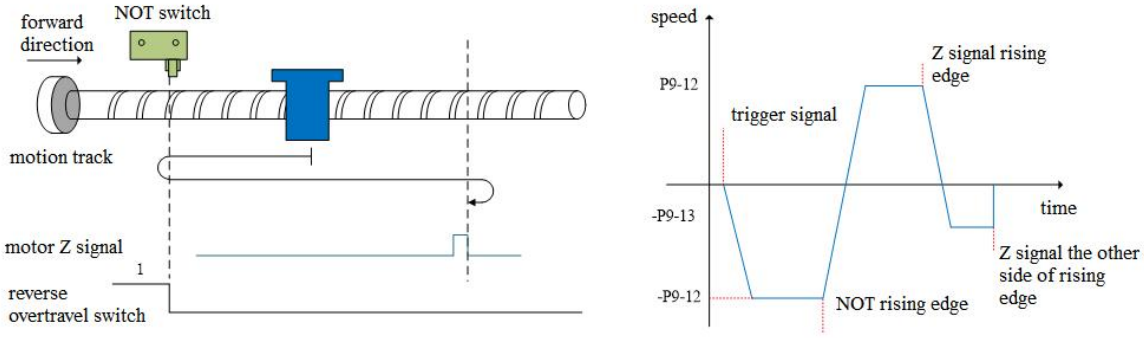
(b2) Mechanical offset (P9-19, P9-20) is not 0:
In the process of positive acceleration or positive constant speed operation, stop immediately when encountering the rising edge on the other side of the motor Z signal. After the motor is completely stopped, the motor will walk a quantitative pulse at 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.

4.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 is not found. To use this mode, you need to connect POT and NOT.
(a)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 not 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:
(a1) 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.



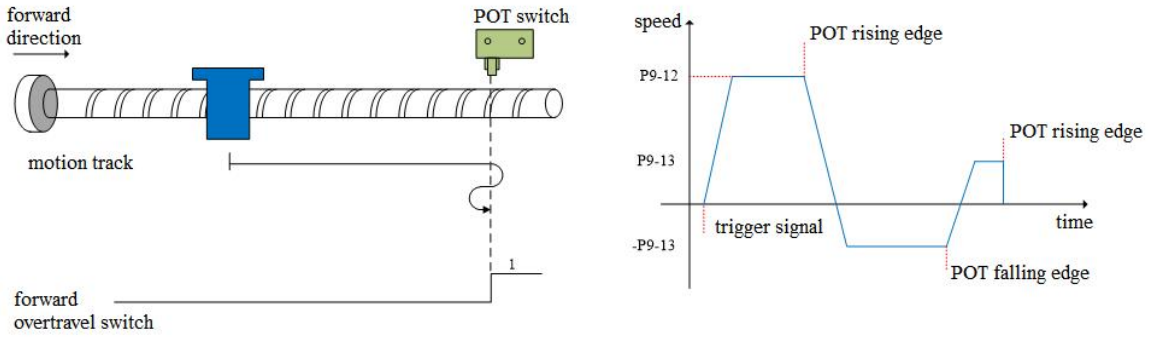
(a2) Mechanical offset (P9-19, P9-20) is not 0:
In the process of positive acceleration or positive constant speed operation, stop the machine immediately when encountering the rising edge on the other side of the motor Z signal. After the motor is completely stopped, the motor will walk a quantitative 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.
(b)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:

(b1) 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.



(b2) Mechanical offset (P9-19, P9-20) is not 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.

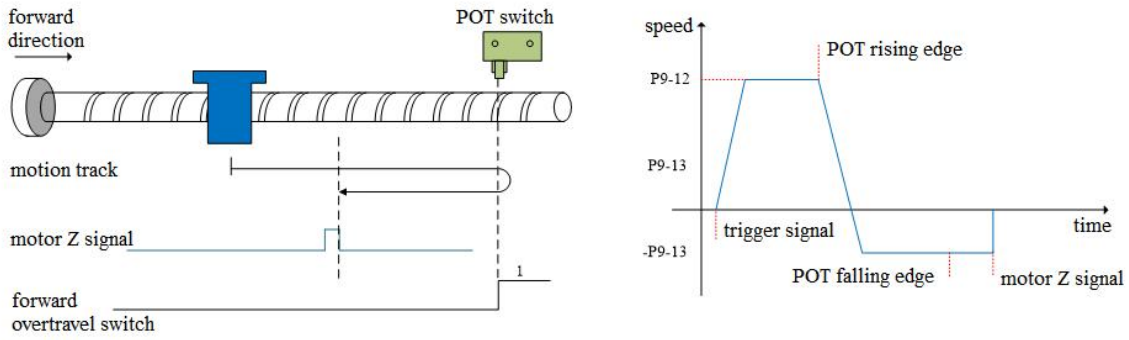
5.Homing mode 4——forward homing, deceleration point and origin are forward overtravel switch POT (P5-22) (P9-11.2=4)
(a)When the motor starts moving, the forward overtravel switch (POT) is invalid
Firstly, the servo motor searches the forward overtravel switch at high speed P9-12 (homing high speed). 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:
(a1) 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.



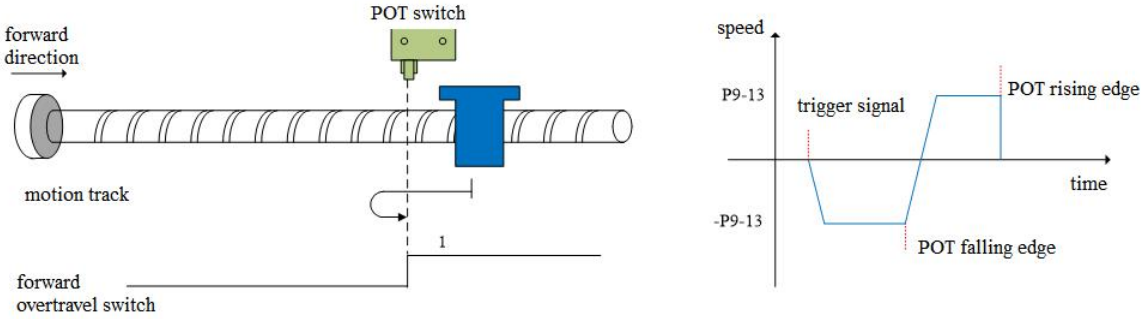
(a2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 0:

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.
(a3) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:

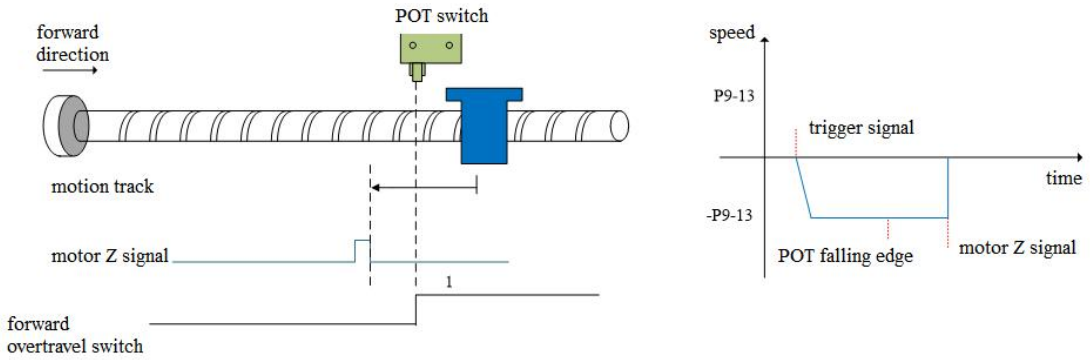
Continue to operate in reverse at the low speed set by -P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal.



(a4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 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.
(6)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:
(b1) 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.



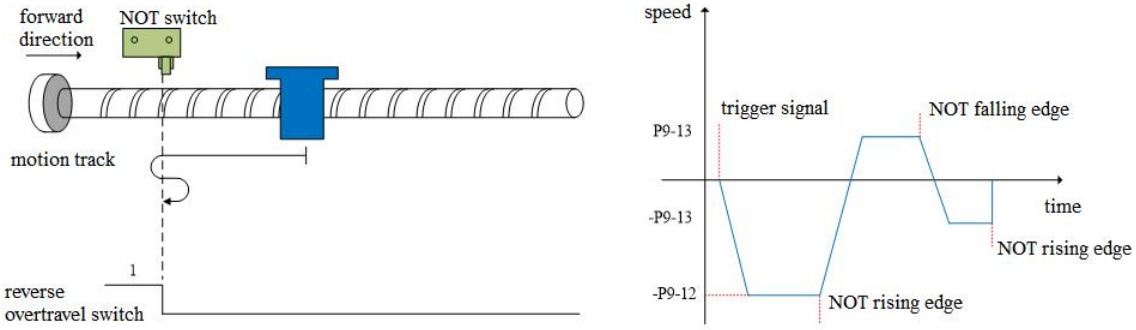
(b2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 0:
Decelerate in reverse direction (i.e. restore the positive direction), search the rising edge of POT at low speed and positive direction with P9-13 (homing low speed). In the process of positive acceleration or positive 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.
(b3) 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.



(b4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 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.

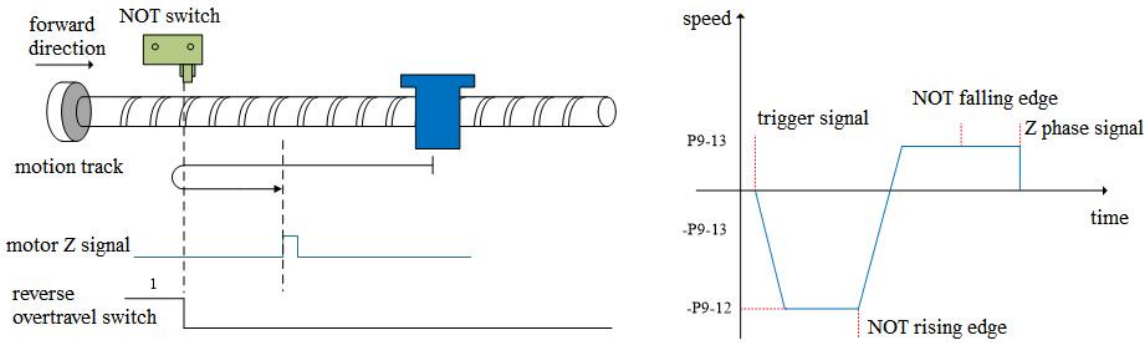
6. Homing mode 5——reverse homing, deceleration point and origin are reverse overtravel switch NOT (P5-23) (P9-11.2=5)
(a) When the motor starts moving, the reverse override switch (NOT) is invalid
Firstly, the servo motor searches for the reverse overtravel switch (NOT) at reverse high speed -P9-12 (homing 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:

(a1) 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.



(a2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 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.

(a3) 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.

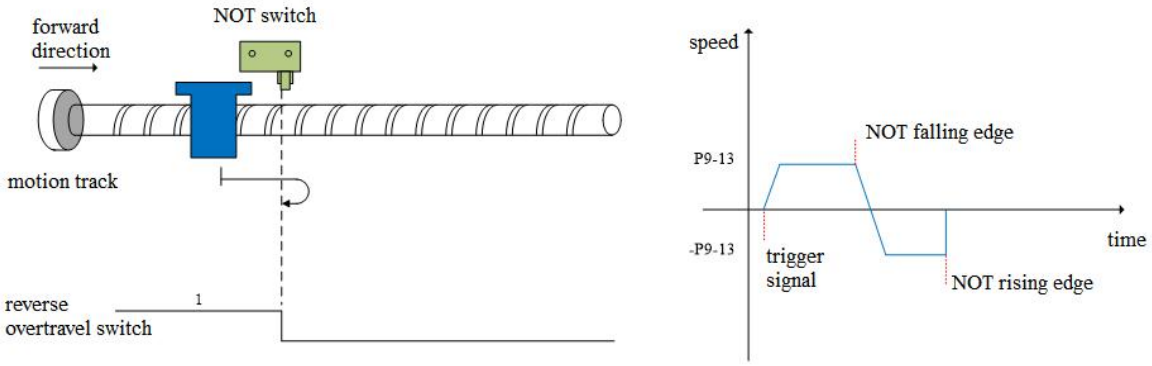


(a4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 0:
Continue to operate in the forward low-speed P9-13, and then stop immediately after encountering the rising edge of the first Z-phase signal. After the motor stops completely, the motor will move a quantitative pulse at 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.

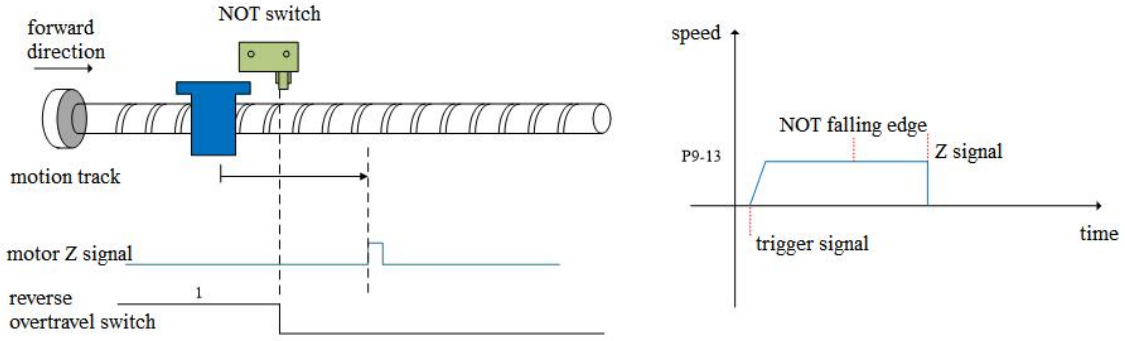
(b)When the motor starts to move, the reverse overtravel switch (NOT) (P5-23) is valid
The servo motor directly searches for the falling edge of the reverse overtravel switch signal (NOT) at the forward low speed P9-13 (homing low speed). After encountering the falling edge of NOT, the next homing action is divided into four cases:

(b1) 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.



(b2) Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 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.

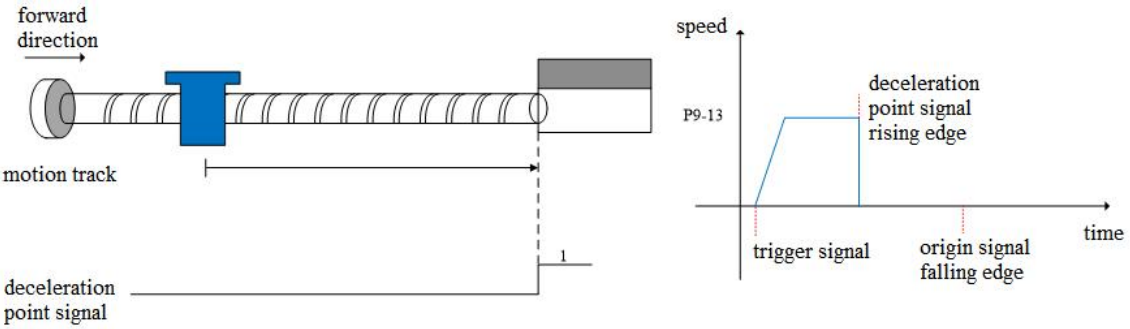
(b3) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
Continue to operate at the forward low speed P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal.



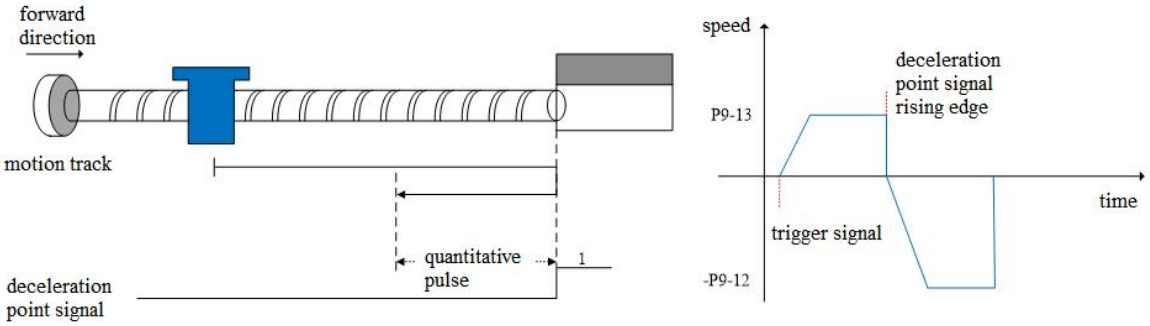
(b4) Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 0:
Continue to operate at the forward low speed P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal. After the motor stops completely, the motor will move a quantitative 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.

6.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

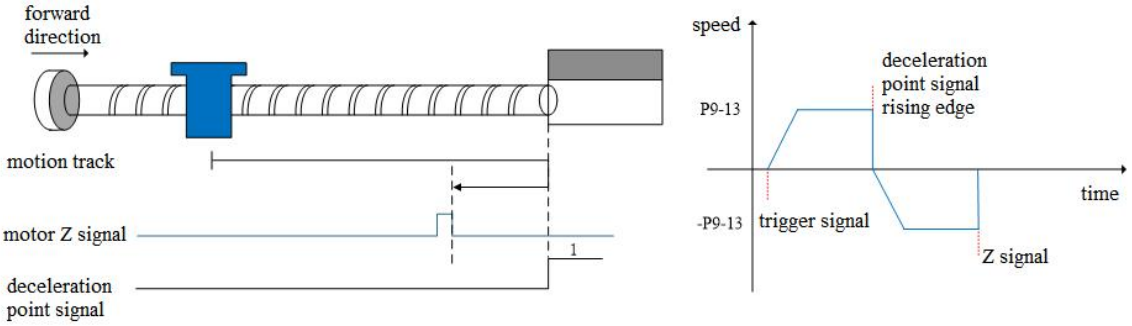
position, if the absolute value of torque reaches the upper torque limit of P9-17 (touch stop homing mode torque threshold), and the absolute value of speed is lower than the set value of P9-16 (touch stop homing mode speed threshold), this state remains P9-18 (touch stop homing mode time threshold) 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) is not 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.



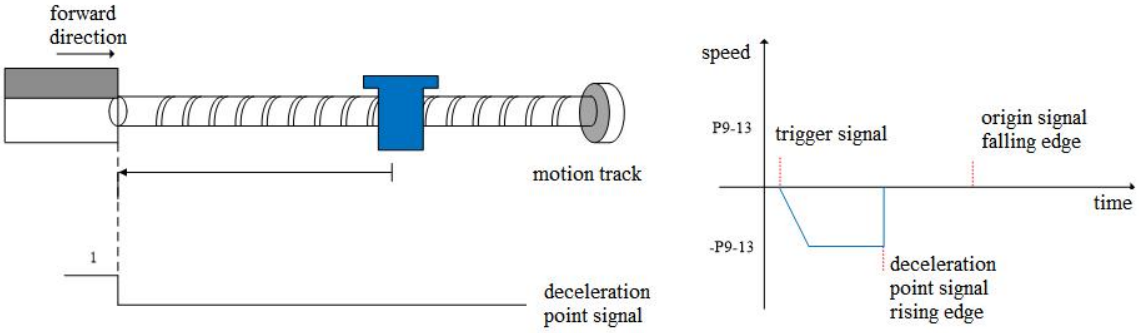
(c)Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is 0:
Operate in reverse at the low speed set by -P9-13 (homing low speed), and then stop immediately after encountering the rising edge of the first Z-phase signal.



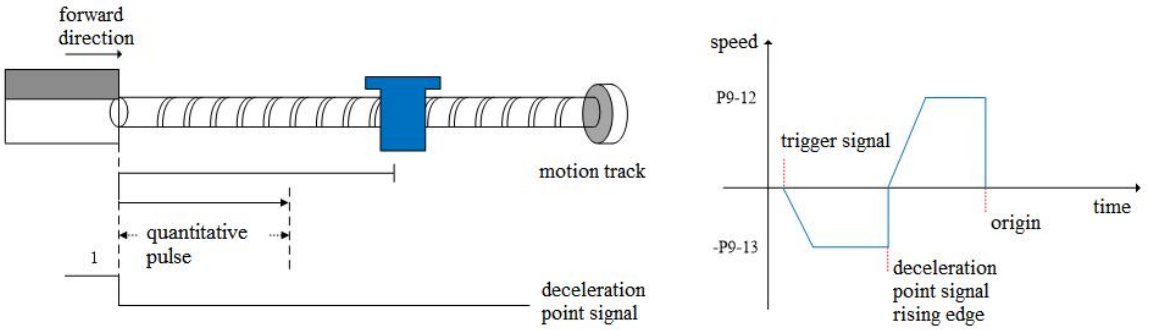
(d)4Z phase number (P9-11.0) is 1 and mechanical offset (P9-19, P9-20) is not 0:
Run in reverse at the low speed set by -P9-13 (homing low speed), then stop immediately after encountering the rising edge of the first Z-phase signal, and then walk a quantitative pulse (it can run in positive direction 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.

8. 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:

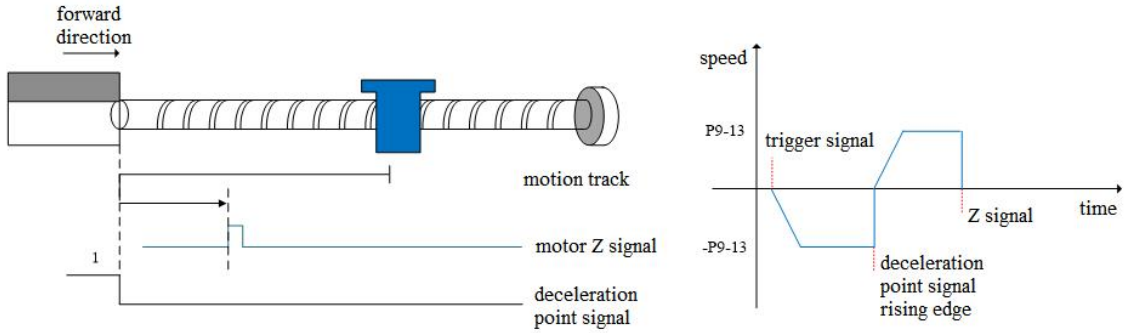
(a)Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is 0:
Shut down immediately.



(b)Z phase number (P9-11.0) is 0 and mechanical offset (P9-19, P9-20) is not 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) is not 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 is not triggered, 1.1 times of the set value of torque limit P9-17 (touch stop homing torque threshold) will not take effect.

5.3.2 Position control (external pulse command)

Parameter	Overview	Reference chapter
P0-01 control mode selection	Set to 5: external pulse mode	5.3.2.1 Internal position model
P4-03 Internal position given pattern P4-04 Number of effective segments P4-10~P4-254 Internal paragraphs 1 to 35 positional parameter Settings	The control mode of internal position mode is given: including step change mode, positioning mode, adjustment time The configuration of pulse displacement, speed, acceleration and deceleration time at each position	5.3.2.3 Position parameter settings for paragraphs 1 to 35
P5-35 Step change signal/GHGSTP P5-32 Pause the current segment signal/INHIBIT P5-31 Skip the current segment number/Z-CLAMP	Common terminal function allocation	5.3.2.4 Step change signal(/CHGSTP) 5.3.1.4 Command pulse prohibition(/INHIBIT) 5.3.2.5 Skip the current segment signal(/ZCLAMP)
P4-00 The number of Z-phase signals passed after leaving the limit switch P4-01 The speed of hitting the proximity switch P4-02 The speed of leaving the proximity switch P5-28 Find the reference origin on the forward rotation side in position mode/SPD-A P5-29 Find the reference origin on the forward rotation side in position mode/SPD-B	Internal position return to origin setting parameters	5.3.1.8 New back to origin function
F2-09 35 Arbitrary setting of segment positions	Number of communication settings segments	5.3.2.6 Communication setting segment number

5.3.2.1 External position mode

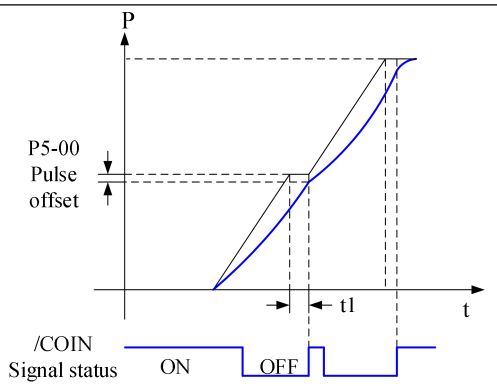
Parameter	Setting value	Meaning	Modify	Effective
P0-01	5	Control the position by external pulse	Servo OFF	At once

5.3.2.2 Internal position mode setting

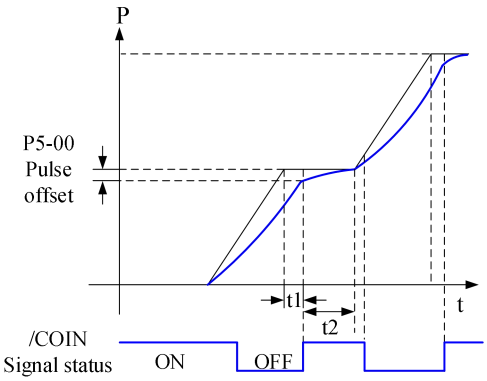
Paramete	Function	Unit	Default setting	Suitable mode	Modify	Effective
P4-03	Internal position mode setting	—	n.0000	5	Servo bb	At once
	Parameter setting	Meaning	Default setting	Setting range		
	n.□xxx	No meaning				
	n.x□xx	Waiting mode	0	0～1		
	n.xx□x	Change step mode	0	0～6		
	n.xxx□	Positioning mode	0	0～1		

1. **Waiting mode**

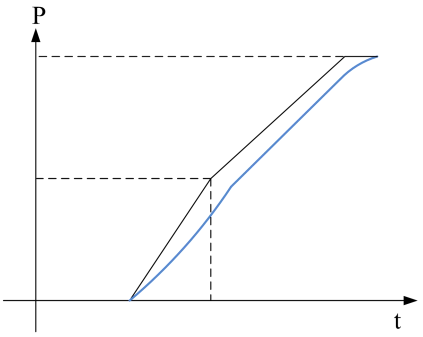
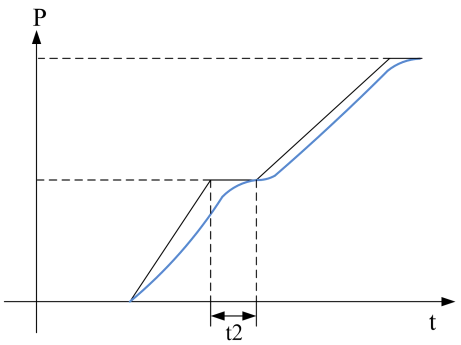
n.x□xx	Meaning
0	Wait for positioning completion
1	Not wait for positioning completion
Note: Waiting mode refers to whether the driver waits for the motor to be positioned after outputing a position instruction in internal position mode. It takes effect in all Step-Changing modes.	
Waiting mode=0, adjust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



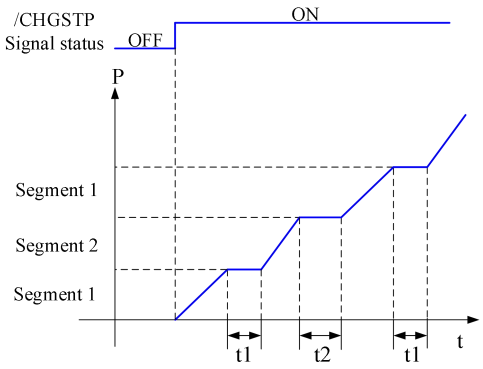
After the drive output 1-segment position command, it will wait for the completion of motor positioning, and then start the next position command at once. T1 is positioning time, which means the time from pulse output complete to the output of positioning completion signal.

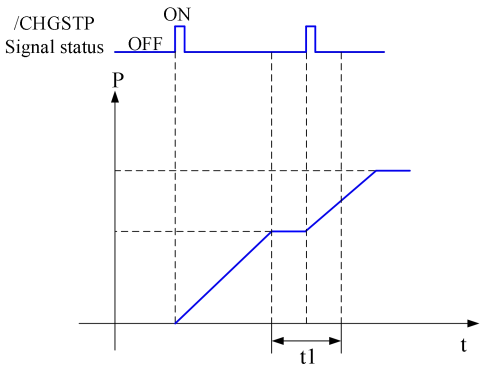
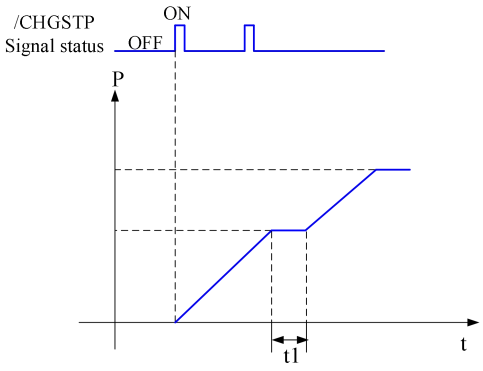


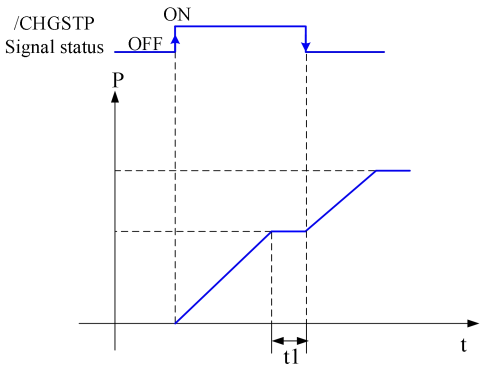
After the drive output 1-segment position command, it will wait for the completion of motor positioning, and pass the adjust time, then start the next position command. T1 is positioning time, t2 is adjust time. Refer to parameter P4-11.

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 P4-11.

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. 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 is not valid in this mode.
2: Start at the rising edge of the signal, sequential run all, not recycling		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.
3: set segment no. through communication	Servo is ON, set parameter P2-09=0, then set the running segment. The motor will run the setting segment. Refer to 5.3.2.6 Set segment through communication.	

<table>
<tr><th>n.xx□x</th><th colspan="2">Description</th></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 is not 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 segment through terminal, the range is segment 1~3</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>
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't only trigger the step change at the edge, but also keep on state. This mode supports continuous and repeated triggering of a certain segment. If the segment number selection terminal remains on, the motor stops after encountering the overtravel signal, it is necessary to change the segment number selection terminal to off, otherwise, the motor will execute the position segment after the overtravel signal is cancelled.</td></tr>
</table>

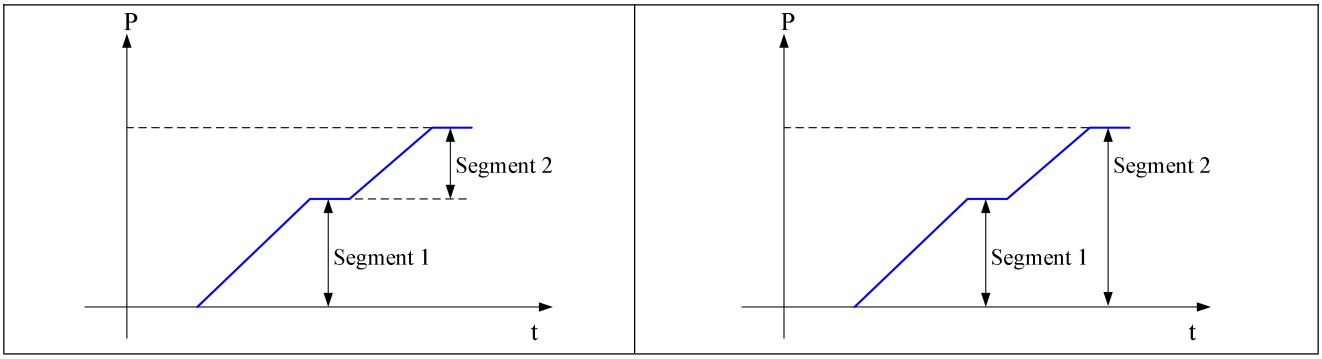
<table>
<tr><th>n.xx□x</th><th>Description</th></tr>
<tr><td>6
/PREFA(P5-57),
/PREFB(P5-58),
/PREFC(P5-59),
/PREFD(P5-60)Choose the segment through terminal, the range is segment 1~16.</td><td>
<table>
<tr><th>/PREFD</th><th>/PREFC</th><th>/PREFB</th><th>/PREFA</th><th>Segment no.</th></tr>
<tr><td>0</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 1 position)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>10 (segment 2 position)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>11 (segment 3 position)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>12 (segment 4 position)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>13 (segment 5 position)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>14 (segment 6 position)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>15 (segment 7 position)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>16 (segment 8 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 is not 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 16:

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)



5.3.2.3 Position segment 1 to 35 parameter settings

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P4-10+(n-1)*7	Pulse number (low bit)	0	1 pulse	-9999～9999	Servo bb	At once
P4-11+(n-1)*7	Pulse number (high bit)	0	10000 pulses	-32767～32767	Servo bb	At once
P4-12+(n-1)*7	Speed	0	0.1rpm	0～65535	Servo bb	At once
P4-13+(n-1)*7	Trapezoid acceleration time	0	ms	0～65535	Servo bb	At once
P4-14+(n-1)*7	Trapezoid deceleration time	0	ms	0～65535	Servo bb	At once
P4-15+(n-1)*7	Reserved	-				
P4-16+(n-1)*7	Adjust time	0	ms	0～65535	Servo bb	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 is not 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 is not 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.

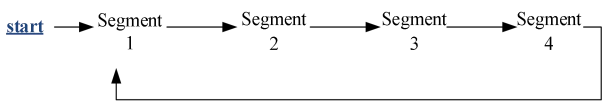
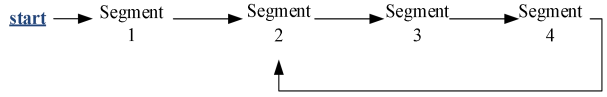
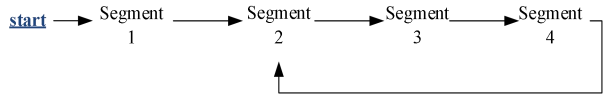
14.In the relative positioning mode, the infinite pulse position segment can be set in the 35 segment positions. The motor will run continuously in this segment, unless the trigger skips the current segment.

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
P4-04	Effective segment	0	-	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.

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

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.

5.3.2.4 Change step signal (/CHGSTP)

Parameter	Name	Setting	Meaning	Range
P5-35	Change step signal/CHGSTP	n.0000	Defaulted is not distribute to input terminal. Refer to 5.3.2.2.	Range:0000-0014. Distribute to input terminal through P5-35. When it set to 0001, it means input from SI1.

5.3.2.5 Skip present segment signal (/ZCLAMP)

Parameter	Signal name	Setting	Meaning	Range
P5-31	Skip the present segment /Z-CLAMP	n.0000	Defaulted is not distribute to input terminal.	Range: 0000-0015. 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

5.3.2.6 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.						

5.3.2.7 Motion start signal (/MRUN)

Parameter	Signal name	Default setting	Meaning	Modify
P5-50	Motion start /MRUN	n.0000	Terminal output is not 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.

5.4 Speed control

5.4.1 Speed mode general control

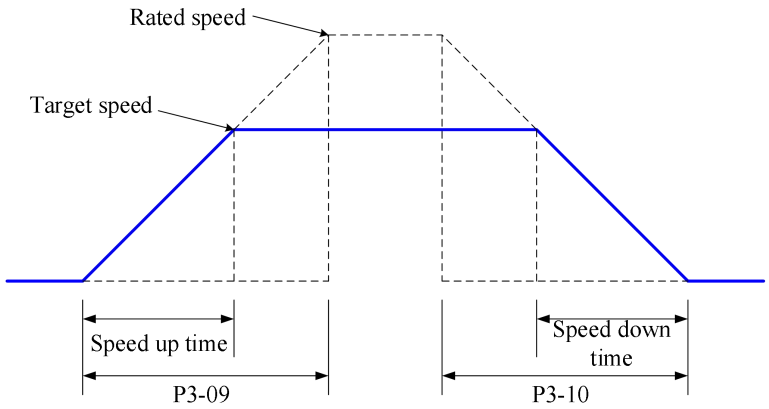
5.4.1.1 Soft start

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



5.4.1.2 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 is not 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 name	Setting	Meaning	Range
P5-31	Zero clamp /ZCLAMP	n.0000(default)	Defaulted isn't distribute to input terminal	Range: 0000-0014. /Z-CLAMP signal is distributed to input terminal by parameter P5-31.
		n.0002	Input signal from SI2 terminal	

3.Parameter setting

parameter	Meaning	Default setting	Unit	Range	Modify	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.

5.4.1.3 Speed reach signal (/V-RDY)

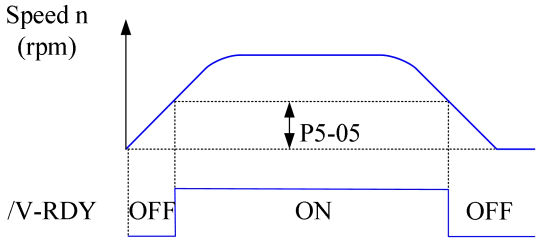
■ Related parameter

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

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P5-05	Reach speed	50	rpm	0～10000	Anytime	At once

1.Speed arrival signal output condition

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

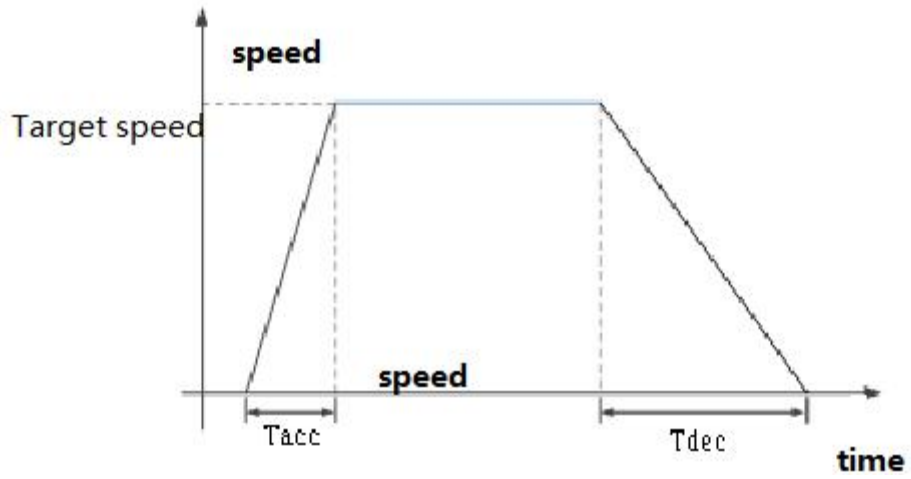


5.4.1.4 Speed command filter

■ Related parameter

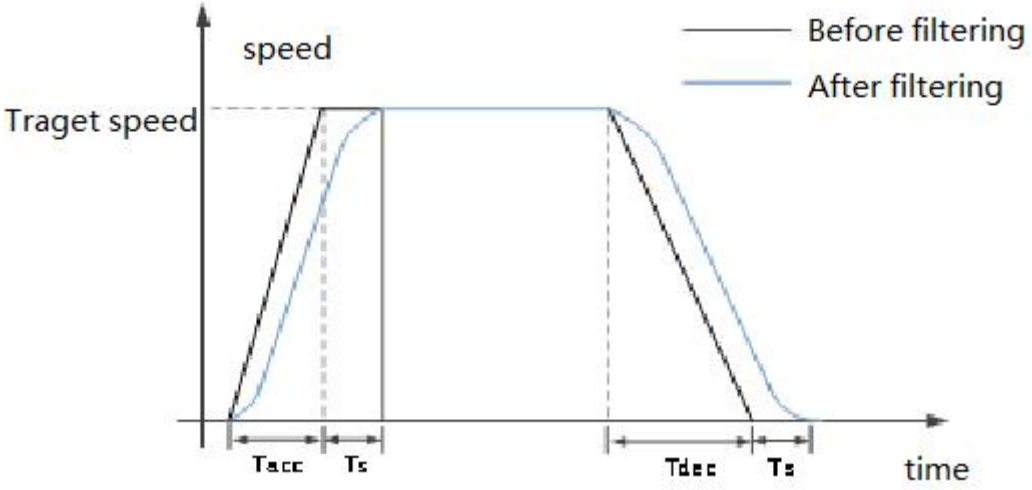
Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P1-23	Speed command filtering time constant	0	0.1ms	0～65535	Servo bb	At once
P3-09	Acceleration time	200	1ms	0～65535	Servo bb	At once
P3-10	Deceleration time	200	1ms	0～65535	Servo bb	At once
P3-11	Moving average filtering time constant	0	0.1ms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

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



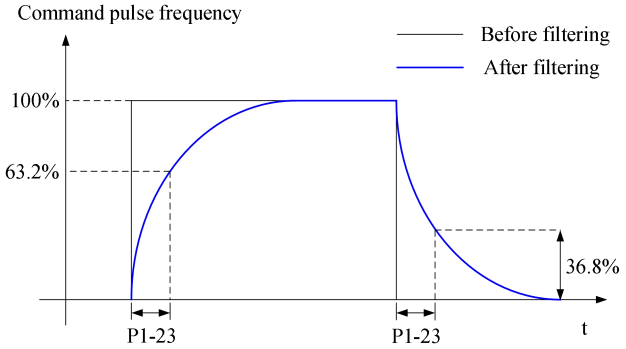
Among them, acceleration time Tacc =(Target speed/Rated speed) * P3-09 [ms],deceleration time Tdec = (Target speed/Rated speed) * P3-10 [ms].

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 and 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.

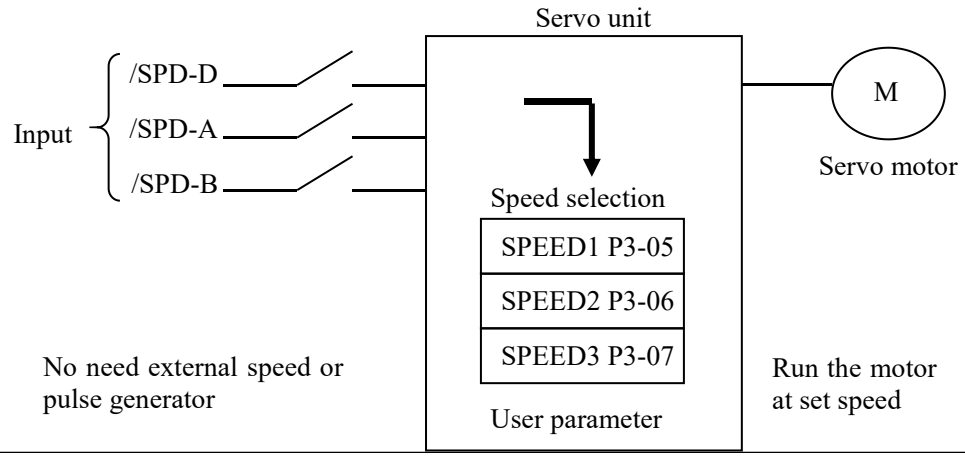
5.4.2 Speed control (internal speed)

Parameter	Overview	Chapter
P0-01 Control mode selectio	Set to 3: internal speed control mode	5.4.2.1
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	5.4.2.1
P5-28 Internal speed selection /SPD-A P5-29 Internal speed selection /SPD-B	The combination of terminals determines the speed of corresponding section	5.4.2.1
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	5.4.2.1
P3-09 Soft start acceleration time P3-10 Soft start deceleration time	Set acceleration and deceleration time in ms	5.4.1.1

5.4.2.1 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 name	Default setting	Range	Range	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

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

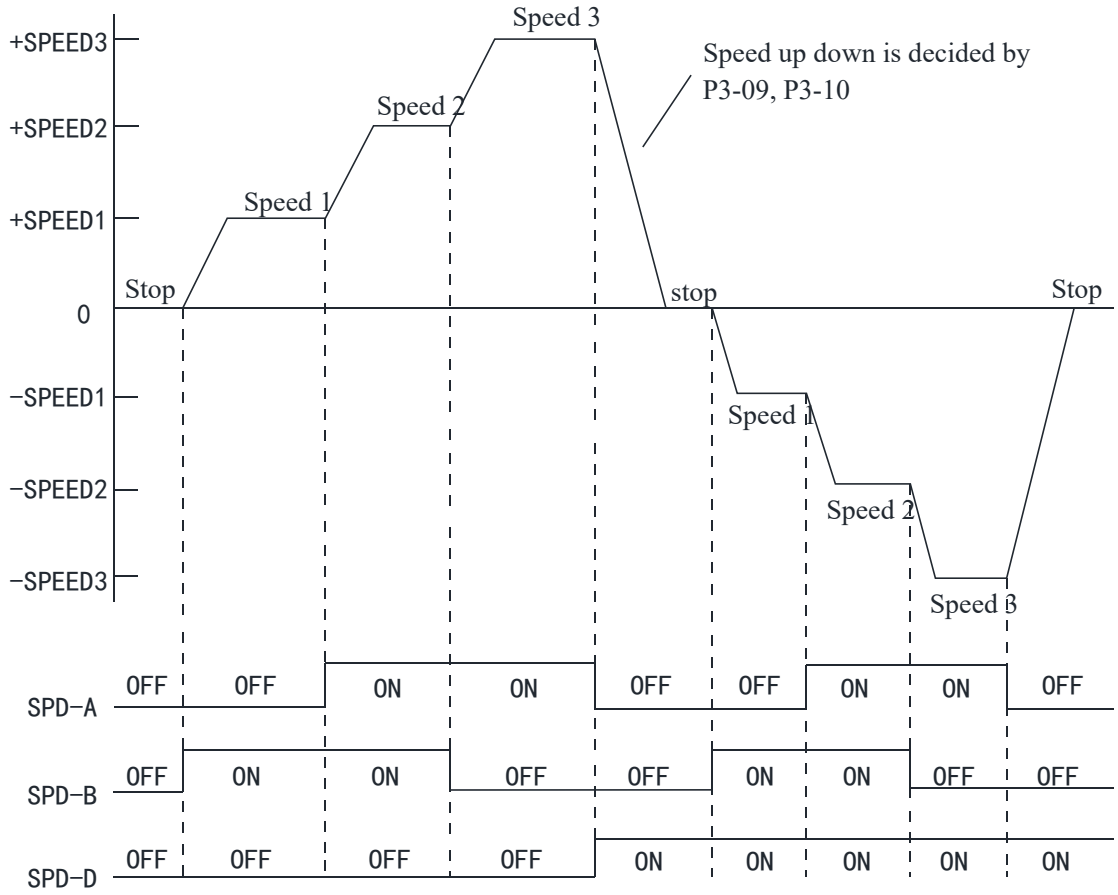
③ 0/1 of the above table represent the validity of the signal. The 0-bit terminal input is invalid. 1 is the terminal input valid.

2.Running example

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 Speed control (pulse frequency command)

Parameter	Overview	Reference chapter
P0-01 Control mode selection	Set to 1: Internal torque mode	5.5.1
P3-33 Internal torque command	The given value is the percentage of rated torque	5.5.1.1
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	5.4.2.1
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	

5.5.1 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.				

5.5.1.1 Internal torque command

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-33	Internal torque command	0	1% rated torque	-1000～+1000	Anytime	At once
The unit of this parameter is 1% of the rated torque. 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.						

5.5.1.2 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)						

5.5.1.3 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 is not met, the speed limit signal is invalid.

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-43	/VLT	n.0000	1	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.						

5.6 Absolute value system

5.6.1 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.
If you don't use encoder cable with battery unit, please set P0-79 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	

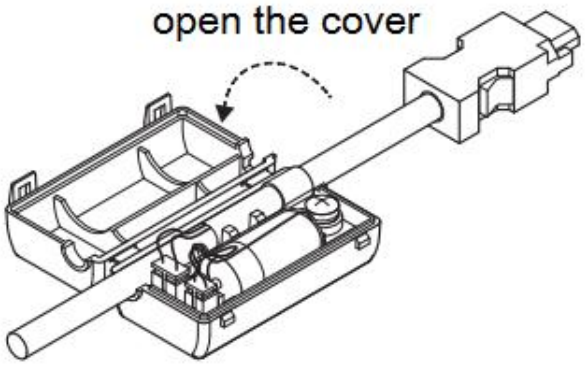
Note: After replacing the multi-turn motor, an E-222 alarm will occur, which will automatically clear the number of times the multi-turn overflow occurred. Otherwise, serious position deviation may occur, causing danger.

5.6.2 Replace the battery

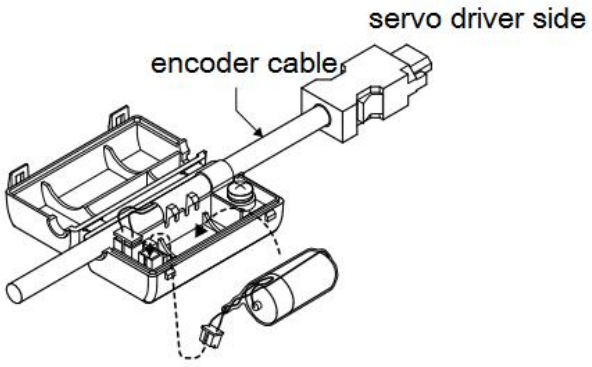
When replacing the battery, please replace the battery while keeping the driver and motor connected well and the control power is connected. If the battery is replaced when the control power between the driver and the motor is closed, the data stored in the encoder will be lost.

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

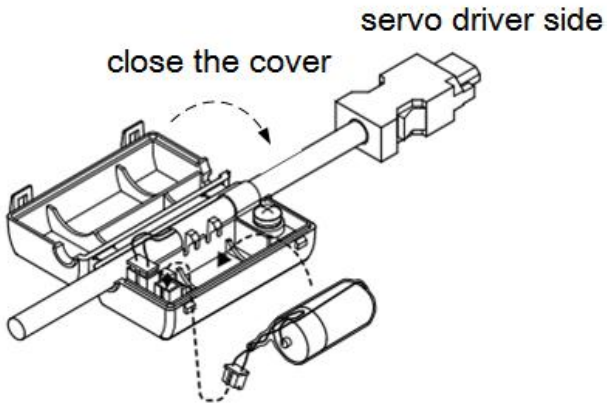
Battery replacement steps
When using encoder cable with battery unit.
(1)Only the control power of the servo unit is connected.
(2)Open the cover of the battery cell.



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



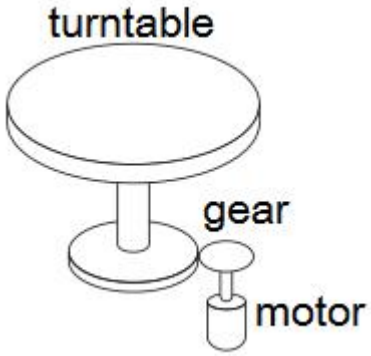
(4)Close the cover of the battery unit



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

5.6.3 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
CM/T	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

5.6.4 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 ModbusRTU protocol.

■ 17-bit absolute encoder, the pulses per turn is 131072.

■ 23-bit absolute encoder, the pulses per turn is 8388608.

Read U0-60 (0x103C) value.

(1) 0 is encoder zero position forward direction. Encoder current position is U0-57 * 1 + U0-58 * 2^{16}+ U0-59 * 2^{32} + U0-60 * 2^{48}.

(2) -1 is encoder zero position reverse direction. Encoder current position 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.

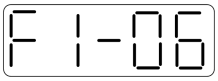
5.6.5 Clear multi-turn

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 current position feedback U0-57 ~ U0-59 of absolute value encoder will also change.

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.

5.6.6 Zero calibration of absolute encoder

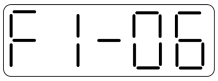
User parameter	Name
F1-06	1: absolute encoder position clearing 3:absolute encoder zero point calibration
U0-94	Relative encoder feedback value which can be cleared
U0-95	

U0-96	
U0-97	

1.Servo panel calibration

Enter the parameter F1-06 in servo bb status:

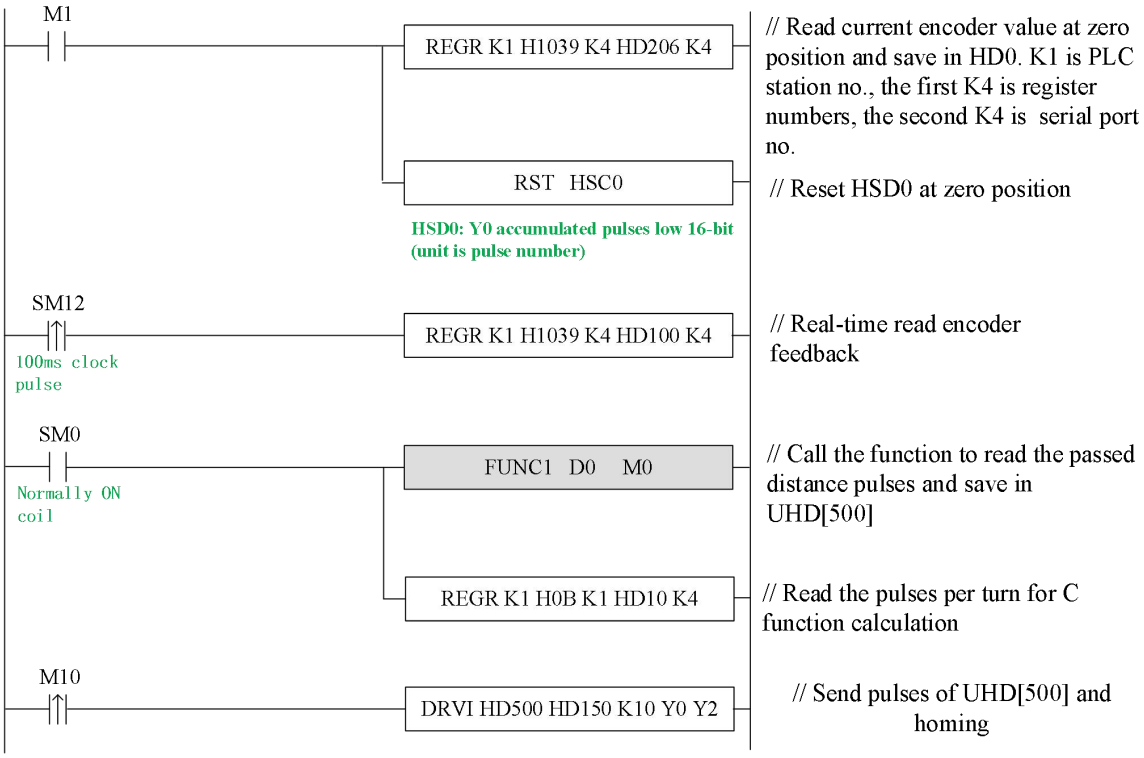
Press【INC】add to 3, keep press【ENT】to exit:

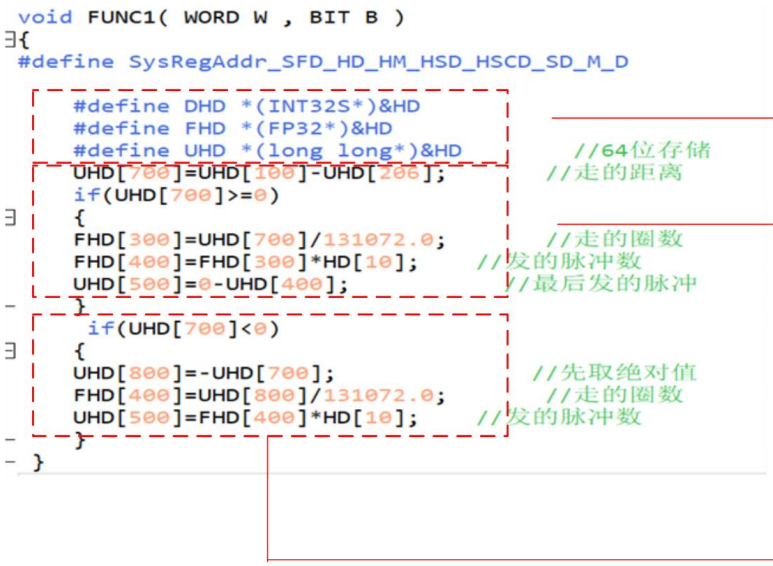


Calibrate the encoder current position to zero point thorugh F1-06. U0-94~97 will show the encoder position after calibration.

5.6.7 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 the register data word

①real-time read encoder feedback-initial value position=passed distance encoder feedback, saved in UHD[700].

②forward running, distance feedback>0. As the encoder feedback resolution is different from pulses per turn, calculated the passed turns, then multiply with the pulses per turn to obtain the pulses of actual passed distance.

③if running in forward direction, so homing needs negative pulses, which saved in UHD[500].

①get the absolute value of real-time passed distance encoder feedback.

②As the encoder feedback resolution is different from pulses per turn, do the operation of last step ②.

5.7 Auxiliary functions

5.7.1 Anti-blocking

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	300	%	0～300	Anytime	At once
P3-39	Anti-blocking alarm internal reverse torque limit	300	%	0～300	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

5.7.2 Torque limit

1.Internal torque limit

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-28	Internal Forward torque limit	300	%	0～300	Anytime	At once
P3-29	Internal reverse torque limit	300	%	0～300	Anytime	At once
1.if this parameter value is less than external torque limit value, the final limit value is this parameter. 2.The unit is percent of the motor rated torque. the default value is 300%. The real max output torque is limited by motor overload times.						

2.External torque limit(via input signal)

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-30	Forward external torque limit	300	%	0～300	Anytime	At once
P3-31	Reverse external torque limit	300	%	0～300	Anytime	At once
The unit is the percent of motor rated torque, the default value is 300%.						

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.						

5.7.3 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.						

5.7.4 I/O signal distribution

5.7.4.1 Input terminal distribution

1.Input signal distribution

Parameter	Parameter Meaning	Set value	Meaning
P5-20～P5-36	n. 0 □ □ □ Distribute input terminal no. 0: NO signal 1: NC signal Basic filter time No meaning	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

Input terminal	SI1	SI2	SI3	SI4
Signal	Undistributed	Undistributed	New HOME signal	Undistributed

3.Filtering time of input terminal

■ Related parameter

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

The filtering time is determined by the IO parameter values and P5-18, for example:

Pulse deviation clear set to SI1 terminal, and 30ms Filtering Time.

The parameters are set as follows:

P5-34=n. 0 3 0 1

P5-34.0

P5-34.2

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.

5.7.4.2 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	/ALM	/S-RDY

5.7.5 Output terminal function

5.7.5.1 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 section 3.2.2 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.						

1.**Servo ready signal output condition**

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.

5.7.5.2 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

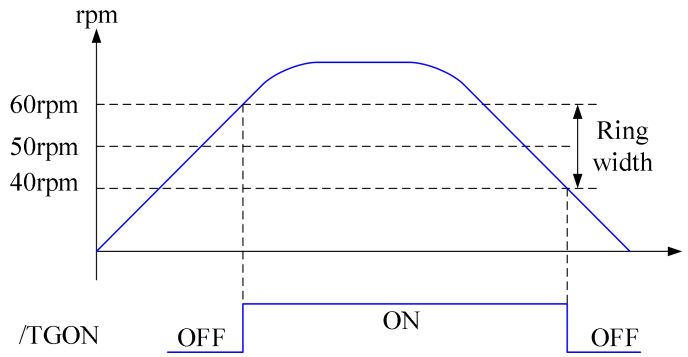
Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P5-03	Rotating detection speed /TGON	50	rpm	0～10000	Anytime	At once
If the speed of the servo motor exceeds the set value of P5-03, it is judged that the servo motor is rotating and the output of the rotation detection (/TGON) signal.						

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.



5.7.5.3 Same speed detection (/V-CMP)

Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	Effective
P5-39	/V-CMP	n.0000	3	Same speed detection signal	Anytime	At once
Defaulted is not 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

Note:There is default 10rpm hysteresis loop, please refer to chapter 5-12-3 for hysteresis loop.

5.7.5.4 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 name	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.

5.7.5.5 Alarm output (/ALM)

1.Servo alarm output /ALM

Parameter	Signal name	Default 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:

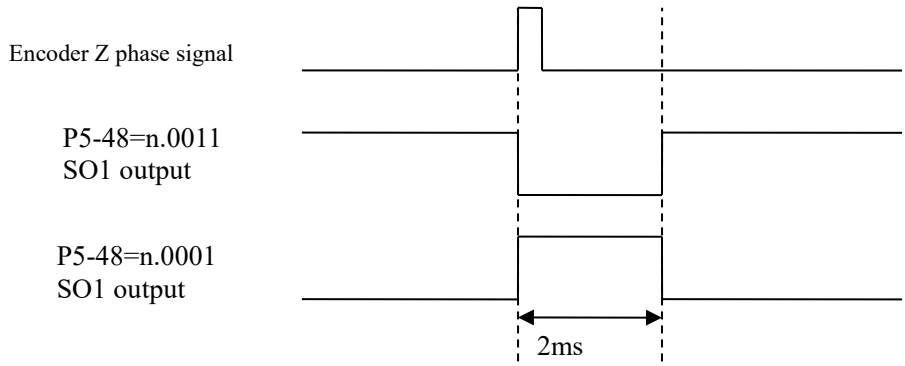
① When an alarm occurs, the servo unit is forced to set OFF, and the motor will move with external forces (including gravity). If you need to keep the motor in position, please select the motor with power loss brake (also known as brake) and use / BK signal. Refer to Section 5.2.5.

② The output of the functional parameters can't be repeated.

5.7.5.6 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	2～20	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 is not related to the motor speed.



5.7.5.7 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	Modify	Effective
	E	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	Modify	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	Modify	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	Modify	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	Modify
	User-defined output 1	n.0000	Default setting is not 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	Modify	Effective
	0	See below table: optional trigger condition	Related to trigger condition	Related to trigger condition	Anytime	At once

P5-15	The comparison value for the trigger condition of user-defined output 2					
	Unit	Default setting	Range	Suitable mode	Modify	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 value	Function	Default setting	Suitable mode	Modify	Effective
	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	Modify	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	Modify
	User-defined output 2	n.0000	Default setting is not 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	1command

4404	Position feedback	1command
1405	Position deviation	1command
502	Bus voltage	V
503	Drive internal temperature	℃
506	Average output power	W
508	Average thermal power	W

5.7.5.8 Other SO terminal function

Terminal name	Description	Chapter
/COIN-HD	Positioning completion hold	5.3.1.2
/COIN	Positioning end	5.3.1.2
/CLT	Torque limit detection	5.7.2
/VLT	Speed limit detection	5.5.1.3
/MRUN	Internal position mode motion start	5.3.1.7
/V-RDY	Speed arriving signal	5.4.1.3
/PREFA	Internal position selection signal	5.3.2.2
/PREFB	Internal position selection signal	5.3.2.2
/PREFC	Internal position selection signal	5.3.2.2

5.7.6 Input terminal function

5.7.6.1 Proportion action command (/P-CON)

Parameter	Signal name	Type	Default setting	State	Meaning	Modify	Effective
P5-21	/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. 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.							

5.7.6.2 Alarm reset (/ALM-RST)

■ Alarm reset /ALM-RST

Parameter	Signal name	Default setting	Suitable mode	Meaning	Modify	Effective
P5-24	/ALM-RST	n.0002	All	Input normally open signal	Anytime	At once
1.The parameter range is 0000-0015, 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't be set to be always valid (n.0010).						

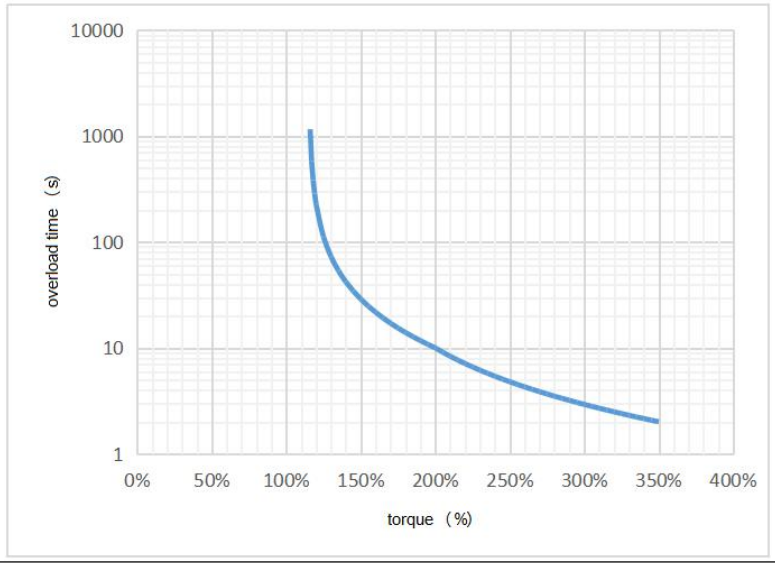
5.7.6.3 Other SI terminal function

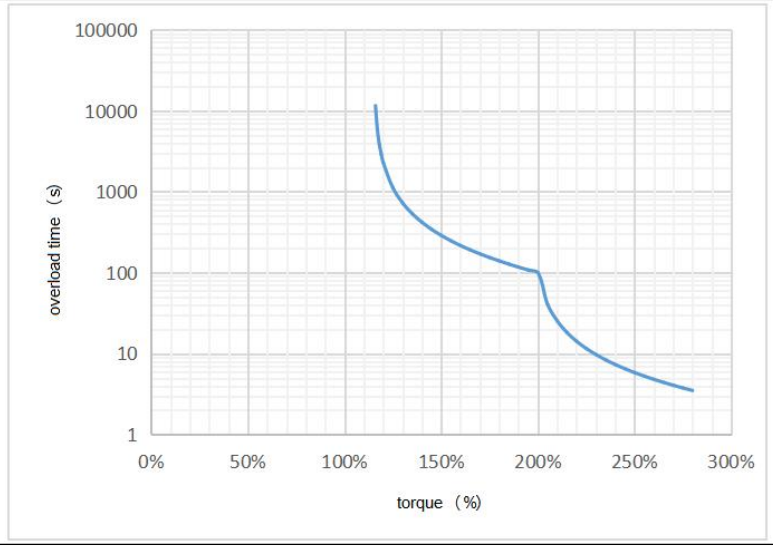
Terminal name	Description	Chapter
/S-ON	Servo enable	5.2.2
/P-OT	No forward driving	5.2.4
/N-OT	No reverse driving	5.2.4
/P-CL	Forward side external torque limit	5.7.2
/N-CL	Reverse side external torque limit	5.7.2
/SPD-D	Internal speed direction	5.4.2
/SPD-A	Internal setting speed	5.4.2
	Position mode reference origin triggering	5.3.1.7
/SPD-B	Internal setting speed	5.4.2
	Position mode reference origin triggering	5.3.1.8

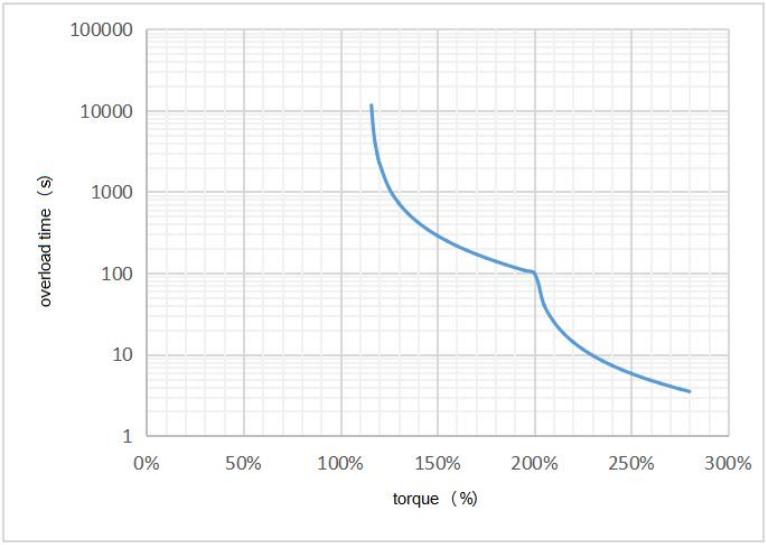
/C-SEL	Control mode selection	5.1.2
/ZCLAMP	Command pulse inhibit	5.4.1.2

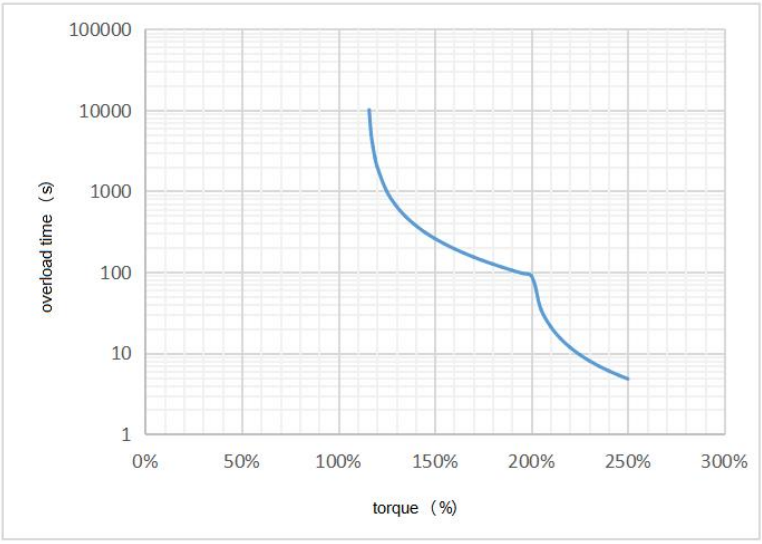
5.7.7 Overload protection time limit curve

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 5.

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 PROFINET Bus communication

6.1 PROFINET overview

Profinet, launched by PROFIBUS International (PROFIBUS International, PI), is a new generation of automation bus standards based on industrial Ethernet technology, which is a real-time automation technology based on Ethernet standards for 100% switched networks.

Profinet provides two types of real-time communication: Profinet IO RT and Profinet IO IRT. Profinet has higher communication transmission rates, flexible network technology, fast IO communication functions, fault safety, and system diagnosis functions.

6.2 Message overview

6.2.1 Supported message

The DS5P servo driver supports standard messages and Siemens messages to achieve speed and position control. Auxiliary messages can only be used together with the main message and cannot be used separately. From the perspective of the driving device, the received process data is the receiving word, and the process data to be sent is the sending word. The detailed explanation is shown in the table below.

Messages	Maximum number of PZDs (one PZD=one word)	
Standard message 1	2	2
Standard message 2	4	4
Standard message 3	5	9
Siemens Message 102	6	10
Siemens Message 105	10	10
Siemens Message 111	12	12
Siemens Message 750(Auxiliary message)	3	1

■ Message for speed control mode

Message	1		2		3		102		105	
Application level	1		1		1, 4		1, 4		4	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOL L_A	NIST_ A	NSOLL_ B	NIST_B	NSOL L_B	NIST_ B	NSOL L_B	NIST_ B	NSOL L_B	NIST_ B
PZD3										
PZD4			STW2	ZSW2	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
PZD5					G1_S TW	G1_Z TW	MOM RED	MELD W	MOM RED	MELD W
PZD6						G1_XI ST1	G1_S TW	G1_Z SW	G1_S TW	G1_Z SW
PZD7								G1_X1 ST1	XERR	G1_X IST1
PZD8						G1_XI ST2				
PZD9								G1_XI ST2	KPC	G1_X IST2
PZD10										

■ Message for basic locator mode

Message	111	
Application level	3	
PZD1	STW1	ZSW1
PZD2	POS_ST W1	POS_ZS W1

PZD3	POS_ST W2	POS_ZS W2
PZD4	STW2	ZSW2
PZD5	OVERRID E	MELDW
PZD6	MDI_TAR POS	XIST_A
PZD7		
PZD8	MDI_VEL O CITY	NIST_B
PZD9		
PZD10	MDI_ACC	FAULT_C ODE
PZD11	MDI_DEC	WARN_C ODE
PZD12	user	user

Note: User customizes the receive/send word for the user.

■ Auxiliary message

Before using auxiliary messages, it is necessary to first select a main message, which is supported in versions 3792 and later. You can monitor parameter U5-01 to view the auxiliary messages of the current Profinet communication.

Message	750	
Application level	-	
PZD1	M_ADD1	M_ACT
PZD2	M_LIMIT_POS	
PZD3	M_LIMIT_NEG	

6.3 Message 111 Function Introduction

6.3.1 Overview

S7-1200, 1500 PLC can connect DS5P servo drive through Profinet communication, PLC can realize DS5P basic position control (EPOS) through the function block SINA_POS (FB284) in Siemens driver library.

6.3.2 FB284 Function Block Pin Introduction

Pin	Data type	Default value	Describe
Input			
ModePos	INT	0	Operation mode: 1：Relative positioning 2：Absolute positioning 3：Continuous operation mode (Run at specified speed)(Supported in 3793 and later versions) 4：Zero return operation 5：Directly set the return to zero position 6：Run program segments 0-15 (not supported) 7：Jog at the specified speed 8：Jog according to specified distance (supported in 3793 and later versions)
EnableAxis	BOOL	0	0：OFF1 1：ON
CancelTransing	BOOL	1	0：Reject activated running tasks 1：not reject
IntermediateStop	BOOL	1	0：Stop running tasks in the middle 1：Don't stop
Jog1	BOOL	0	Reverse dotting

<table>
<tr><th>Pin</th><th>Data type</th><th>Default value</th><th>Describe</th></tr>
<tr><td colspan="4">Input</td></tr>
<tr><td>Jog2</td><td>BOOL</td><td>0</td><td>Forward dotting</td></tr>
<tr><td>AckError</td><td>BOOL</td><td>0</td><td>Fault reset</td></tr>
<tr><td>ExecuteMode</td><td>BOOL</td><td>0</td><td>Activate a positioning job or receive a set point</td></tr>
<tr><td>Position</td><td>DINT</td><td>0 [LU]</td><td>MDI position value</td></tr>
<tr><td>Velocity</td><td>DINT</td><td>0 [LU/min]</td><td>MDI Speed setting [1000LU/min]</td></tr>
<tr><td>OverV</td><td>INT</td><td>0[%]</td><td>Velocity ratio 0~199%</td></tr>
<tr><td>OverAcc</td><td>INT</td><td>0[%]</td><td>Acceleration rate 0~100%</td></tr>
<tr><td>OverDec</td><td>INT</td><td>0[%]</td><td>Deceleration rate 0~100%</td></tr>
<tr><td>ConfigEPOS</td><td>DWORD</td><td>0</td><td>The control bit of the 111 message transmission can be used to transmit signals such as hard limit enable and origin switch. If variable allocation is made to this pin in the program, ConfigEPos.% must be ensured X0 and ConfigEPos.% The drive can only run when X1 is all 1.
<table>
<tr><th>ConfigEPos bit</th><th>111 message bit</th></tr>
<tr><td>ConfigEPos.%X0</td><td>STW1.%X1</td></tr>
<tr><td>ConfigEPos.%X1</td><td>STW1.%X2</td></tr>
<tr><td>ConfigEPos.%X2</td><td>EposSTW2.%X14</td></tr>
<tr><td>ConfigEPos.%X3</td><td>EposSTW2.%X15</td></tr>
<tr><td>ConfigEPos.%X6</td><td>EposSTW2.%X2</td></tr>
<tr><td>ConfigEPos.%X7</td><td>STW1.%X13</td></tr>
<tr><td>ConfigEPos.%X8</td><td>EposSTW1.%X12</td></tr>
</table></td></tr>
<tr><td>HWIDSTW</td><td>HW_IO</td><td>0</td><td>Hardware identifier for message 111</td></tr>
<tr><td>HWIDZSW</td><td>HW_IO</td><td>0</td><td>Hardware identifier for message 111</td></tr>
<tr><td colspan="4">Output</td></tr>
<tr><td>Error</td><td>BOOL</td><td>0</td><td>1：Error occurred</td></tr>
<tr><td>Status</td><td>Word</td><td>0</td><td>Display status</td></tr>
<tr><td>DiagID</td><td>Word</td><td>0</td><td>Extended communication failure</td></tr>
<tr><td>ErrorID</td><td>INT</td><td>0</td><td>Run mode error/Block error:
0：No errors
1：Communication activation
2：Choose the incorrect operation mode
3：The parameter set is incorrect
4：Invalid run block number
5：Drive fault activation
6：Drive fault activation
7：Running back to zero cannot start</td></tr>
<tr><td>AxisEnabled</td><td>BOOL</td><td>0</td><td>The driver is enabled</td></tr>
<tr><td>AxisError</td><td>BOOL</td><td>0</td><td>Driver malfunction</td></tr>
<tr><td>AxisWarn</td><td>BOOL</td><td>0</td><td>Drive the alarm</td></tr>
<tr><td>AxisPosOk</td><td>BOOL</td><td>0</td><td>Target location reached</td></tr>
<tr><td>AxisRef</td><td>BOOL</td><td>0</td><td>Zero return completed</td></tr>
<tr><td>ActVelocity</td><td>DINT</td><td>0</td><td>Actual speed (40000000h in hexadecimal corresponds to rated speed)</td></tr>
<tr><td>ActPosition</td><td>DINT</td><td>0 [LU]</td><td>Current position LU</td></tr>
<tr><td>ActMode</td><td>INT</td><td>0</td><td>The actual mode currently set</td></tr>
<tr><td>EPosZSW1</td><td>WORD</td><td>0</td><td>Status of EPOS ZSW1</td></tr>
<tr><td>EPosZSW2</td><td>WORD</td><td>0</td><td>Status of EPOS ZSW2</td></tr>
<tr><td>ActWarn</td><td>WORD</td><td>0</td><td>alarm code</td></tr>
<tr><td>ActFault</td><td>WORD</td><td>0</td><td>Fault codes</td></tr>
</table>

6.4 Operating condition

6.4.1 The P group parameters involved in the drive

Parameter	Data type	Default value	Minimum value	Maximum value	Unit	Describe
P0 group parameter settings						
P0-00	U16	1	0	1	-	Bus type 1: PN bus
P0-01	U16	3	3	5	-	Control model 1：Internal torque mode 3：Internal speed mode 5：Internal position mode
P0-02	U16	3	0	255	-	Main control message number (control mode can be automatically changed based on the added message)
P0-03	U16	3	0	3	-	Enabling method 3: PN bus enabling
P0-05	U16	0	0	1	-	Drive polarity 0: forward 1: reverse
P0-11	U16	0	0	9999	1LU	Low order pulse instructions per cycle
P0-12	U16	1	0	9999	1LU	1 * 10000 pulse instructions per cycle
P0-13	U16	1	0	65535	-	Electronic gear ratio molecules
P0-14	U16	1	0	65535		Electronic gear score
P0-31	U16	200	0	5000	ms	Ramp parking deceleration time, OFF parking
P0-32	U16	10	0	3000	ms	Emergency stop deceleration time, OFF3 stop
Group P5 Signal terminal assignment Settings						
P5-22	U16	0	0	65535	-	POT function signal allocation
P5-23	U16	0	0	65535	-	POT function signal allocation
P5-27	U16	3	0	65535	-	HOME function signal allocation
PA group parameter settings, EPOS function related parameters						
PA-00	U16	0	0	9999	1000[LU/min]	Epos maximum speed low bit
PA-01	U16	4	0	9999	1000[LU/min]	Epos maximum speed high bit * 10000
PA-02	U16	3000	0	9999	1000[LU/s^2]	Epos maximum acceleration low bit
PA-03	U16	0	0	9999	1000[LU/s^2]	Epos maximum acceleration high position * 10000
PA-04	U16	3000	0	9999	1000[LU/s^2]	Epos maximum deceleration low position
PA-05	U16	0	0	9999	1000[LU/s^2]	Epos maximum deceleration high position * 10000
PA-06	U16	100	0	9999	1000[LU/s^2]	Epos slope deceleration low position
PA-07	U16	0	0	9999	1000[LU/s^2]	Epos slope deceleration high position * 10000
PA-08	U16	0	0	9999	1LU	Epos deviation threshold low bit
PA-09	U16	3	0	30000	1LU	Epos deviation threshold high bit * 10000
PA-10	U16	0	0	32767	ms	Epos deviation threshold arrival time
PA-11	U16	11	0	9999	1LU	Epos positioning reaches the low bit of the threshold
PA-12	U16	0	0	30000	1LU	Epos positioning reaches high threshold * 10000
PA-13	U16	0	0	32767	ms	Epos positioning arrival time
PA-14	I16	-300	-9999	9999	1000[LU/min]	JOG1 jog speed low position
PA-15	I16	0	-200	200	1000[LU/min]	JOG1 Jog Speed High * 10000
PA-16	I16	300	-9999	9999	1000[LU/min]	JOG2 jog speed low position
PA-17	I16	0	-200	200	1000[LU/min]	JOG2 Jog Speed High * 10000
PA-18	U16	16384	0	32767	0x4000-100%	Jog acceleration/deceleration ratio
PA-19	I16	0	0	35	-	Origin restoration type

Parameter	Data type	Default value	Minimum value	Maximum value	Unit	Describe
PA-20	U16	5000	0	9999	1000[LU/min]	Origin reset, high speed, low position
PA-21	U16	0	0	400	1000[LU/min]	Origin recovery High speed high speed *10000
PA-22	U16	300	0	9999	1000[LU/min]	Origin reset low speed low speed
PA-23	U16	0	0	400	1000[LU/min]	Origin reset Low speed high speed *10000
PA-24	U16	16384	0	32767	0x4000-100%	Origin resetting addition and subtraction velocity multiplier
PA-25	U16	0	0	1	-	Origin reset offset type
PA-26	I16	0	-9999	9999	1LU	The origin reset offset is low
PA-27	I16	0	-9999	9999	1LU	Origin reset offset high *10000
PA-28	U16	32767	0	32767	ms	Origin reset timeout
PA-29	U16	1	0	100	-	Return to the origin to find the Z number
PA-30	U16	100	0	1000	ms	Z-phase positioning completion time delay
PA-31	U16	1	1	2	-	Back to the source of the switch signal
PA-32	I16	1000	0	9999	LU	JOG1 runs low
PA-33	I16	0	0	200	LU	JOG1 running stroke high *10000
PA-34	I16	1000	0	9999	LU	JOG2 runs low
PA-35	I16	0	0	200	LU	JOG2 running stroke high *10000

Note: The above are P group parameters used in EPOS function.

6.4.2 FB284 Function block pin Settings

1)If EnableAxis=1 is entered, OFF2 and OFF3 are set to 1. If the shaft is ready and driven without failure (AxisErr= "0") and EnableAxis is set to 1, the output pin AxisEnabled signal changes to 1, and the motor is enabled.

2)The input signal is CancelTransing, IntermediateStop is valid for all operation modes except point and backfield. When EPOS is run, set it to 1. The setting description is as follows：

① If CancelTransing=0 is set, the shaft stops at the maximum deceleration speed, and the working data is discarded, and the running mode can be switched after the shaft stops.

② If IntermediateStop=0 is set, the slope stop is performed using the currently applied deceleration value without dismissing the work data. If IntermediateStop=1 is set again, the shaft will continue to run, which can be understood as a suspension of the shaft. The operating mode can be changed after the shaft is stationary.

3)The input pin ConfigEPos.%X3 (POS_STW2.15) of the FB284 function block needs to be set to 1 to activate the hardware limit function of the drive. The positive and negative hardware limit switches can be connected to the DI terminal points of the driver defined as the forward overrange switch and the reverse overrange switch. (This feature is not currently supported).

4) If the software limit switch is used, set the input pin ConfigEPos.%X2(POS_STW2.14) of the FB284 function block to 1, activate the software limit function of the DS5P, and set the positive and negative soft limit positions in the DS5P. (This feature is not currently supported).

5)ConfigEpos Basic location relationship table：

ConfigEPOS bit	Function description
ConfigEpos.%X0	OFF2 stop
ConfigEpos.%X1	OFF3 stop
ConfigEpos.%X2	Activation software limit (not supported yet)
ConfigEpos.%X3	Activation Hardware limits (currently not supported)
ConfigEpos.%X6	Zero switch signal
ConfigEpos.%X7	External block switching (not supported yet)
ConfigEpos.%X8	When ModePos=2, the set value can be changed continuously and takes effect immediately

6.5 Packet 111 Indicates the relative and absolute location function

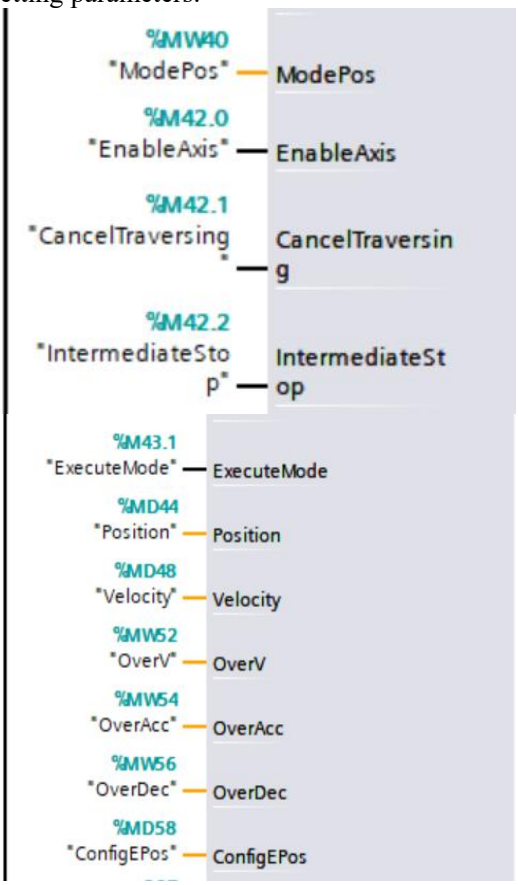
6.5.1 Positioning motion trajectory generation

1)In the FB284 function block, input pins CancelTransing and IntermediateStop are valid for all operation modes except point and return. They must be set to 1 when EPOS is run.
2)The unit of position is LU and the unit of Velocity is 1000LU/min.
3)The currently running command can be replaced with a new command via ExecuteMode rising edge, but only for run mode ModPOS=1, 2. ModPOS = 3 same as ModPOS =2.
4)AxisPosOK is false during positioning, and AxisPosOK is True after positioning.
5)The speed is affected by Velocity and OverV in the FB284 function block, and the actual speed is set to Velocity * OverV% * 1000 / per turn pulse instruction, which is converted to unit rpm.
6)The pulse command is affected by the electronic gear ratio, and the parameters P0-11/P0-12, P0-13/P0-14 set the electronic gear ratio of the driver. By default, P0-11=0, P0-12=1, and the default set pulse instruction per turn is 10000.
7)The positioning acceleration is affected by the PA-02/PA-03 combination, and the deceleration is affected by PA-04/PA-05.
Acc (acceleration) = (PA-02 + (PA-03 * 10000))*1000 * OverAcc%/ pulse instruction per turn
Unit: (r/s2), where OverAcc is a percentage.
Dec (deceleration) = (PA-04 + (PA-05 * 10000))*1000 * OverDec%/ pulse command per turn
Unit: (r/s2), where OverDec is a percentage
8)The maximum speed instruction setting is affected by the PA-00/PA-01 combination, limiting the speed instruction set.

Servo parameter configuration in positioning mode:

Parameter	Data type	Default value	Minimum value	Maximum value	Unit	Describe
P0-00	U16	1	0	1	-	Bus type 1: PN bus
P0-01	U16	3	3	5	-	Control model 1：Internal torque mode 3：Internal speed mode 5：Internal position mode
P0-02	U16	3	0	255	-	Main control message number (control mode can be automatically changed based on the added message)
P0-03	U16	3	0	3	-	Enabling method 3: PN bus enabling
P0-05	U16	0	0	1	-	Drive polarity 0: forward 1: reverse
P0-11	U16	0	0	9999	1LU	Low order pulse instructions per cycle
P0-12	U16	1	0	9999	1LU	High order pulse instructions per cycle * 10000
P0-13	U16	1	0	65535	-	Electronic gear ratio molecules
P0-14	U16	1	0	65535		Denominator of electronic gear ratio
PA-00	U16	0	0	9999	1000[LU/min]	Epos maximum speed low bit
PA-01	U16	4	0	9999	1000[LU/min]	Epos maximum speed high bit * 10000
PA-02	U16	3000	0	9999	1000[LU/s^2]	Epos maximum acceleration low bit
PA-03	U16	0	0	9999	1000[LU/s^2]	Epos maximum acceleration high position * 10000
PA-04	U16	3000	0	9999	1000[LU/s^2]	Epos maximum deceleration low position
PA-05	U16	0	0	9999	1000[LU/s^2]	Epos maximum deceleration high position * 10000
PA-06	U16	100	0	9999	1000[LU/s^2]	Epos slope deceleration low position
PA-07	U16	0	0	9999	1000[LU/s^2]	Epos slope deceleration high position * 10000

PLC side SinaPoa function block setting parameters:



1)Set ModePos to 1, 2, or 3 (2 and 3 functions are temporarily the same).
2)Enable Axis settings to enable motors.
3)CancelTraversing is used to cancel the current positioning motion, slow down and stop.
4)IntermediateStop is used to pause the current positioning motion and slow down to stop.
5)IntermediateStop is used to pause the current positioning motion and slow down to stop.
6)Position is used to set the relative or absolute position point of the current motion.
7)Velocity is used to set the speed point of the current motion, which is also affected by the percentage of OverV.
8)OverV is used to set the speed multiplier (percentage).
9)OverAcc is used to set the acceleration value multiplier (percentage) for the current motion acceleration process.
10)OverDec is used to set the acceleration value multiplier (percentage) for the current motion deceleration process.
11)ConfigEPos has certain special features, please refer to the relevant introduction in the previous text.

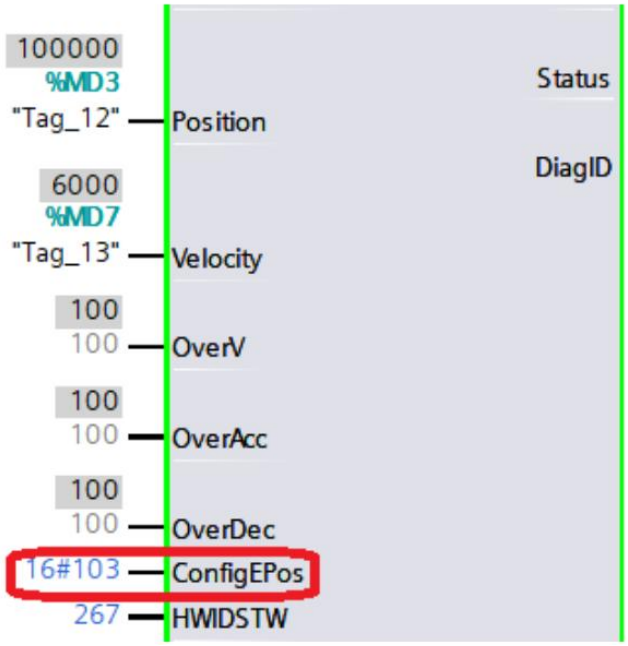
Summary of parameter settings:
Relative positioning motor turns =Position* gear ratio/encoder resolution.
Relative positioning motor speed (RPM) =Velocity*1000* gear ratio/encoder resolution.
Relative positioning motor acceleration time (seconds)= Velocity*OverV%/ (60* (PA-02 + (PA-03*10000))*OverAcc%).
Relative positioning motor deceleration time (seconds)= Velocity*OverV%/ (60* (PA-04 + (PA-05*10000))*OverDec%).

6.5.2 Positioning motion trajectory generation

1)Input signal CancelTraversion, Intermediatestop is valid for all operating modes except for jog, when running EPOS, it must be set to "1".
2)Setting CancelTraversin=0, the shaft slows to a halt at maximum speed, dismisses work data, and doesn't continue if Intermediatestop=1 is set again.
3)Set Intermediatestop=0, use the deceleration value of the current application for slope parking without discarding work data. If you reset Intermediatestop=1, the rear axle will continue to run, which can be understood as a pause of the axle. The operating mode can be switched after the axle is stationary.
4)The deceleration time of CancelTraversion is related to PA-06/PA-07, while the deceleration time of Intermediatestop is related to P3-PA-04/PA-05.

6.5.3 Continuous position assignment

In ModPos=2 or 3 (absolute positioning mode), through the set 111 message ConfigEpos.% X8, after updating Position, Velocity, and OverV on the PLC side, there is no need to trigger ExecuteMode, just enable it and it will run immediately. The servo will update the corresponding values in real time and take effect.
Case analysis:
Using 111 message mode 2 or 3, configEpos is assigned a value of 16 # 103, Velocity is assigned a value of 6000, and the position data is updated from -100000 to 100000, as shown in the figure:

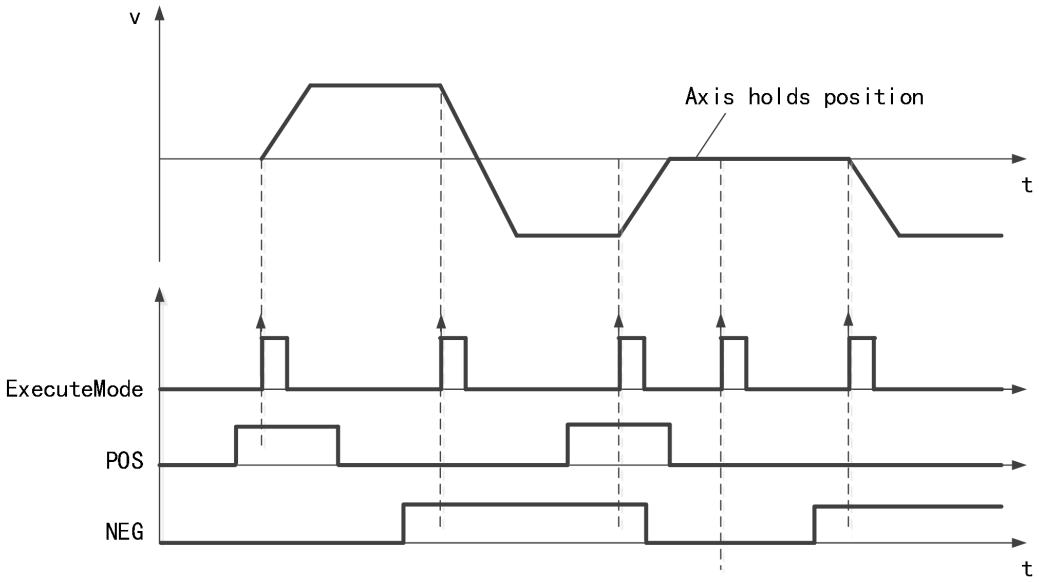


6.6 Message 111 continuous operation mode (running at specified speed)

The continuous operation mode allows the shaft to run at a constant speed in the forward or reverse direction (supported by 3793 and later versions).
Requirement:
1)ModePos set to 3.
2)Enable Axis set to True, drive enabled.
3)Specify the running speed in LU/min by inputting the parameter Velocity.
4)By inputting parameters OverV, OverAcc, and OverDec, specify the speed and percentage of acceleration and deceleration.
5)Trigger positioning motion through the rising edge of ExecuteMode.

NOTE:
① The direction of operation is determined by Positive and Negative.
② The operating conditions CancelTraversing and IntermediateStop must be set to 1, and Jog1 and Jog2 must be set to 0.
③ If the switching mode is greater than 3, the axis must be in a stationary state and can be switched at any time when ModePos=1, 2, 3.

The control timing in continuous jog mode is shown in the following figure:



6.7 Message 111 homing function

6.7.1 Homing motion function

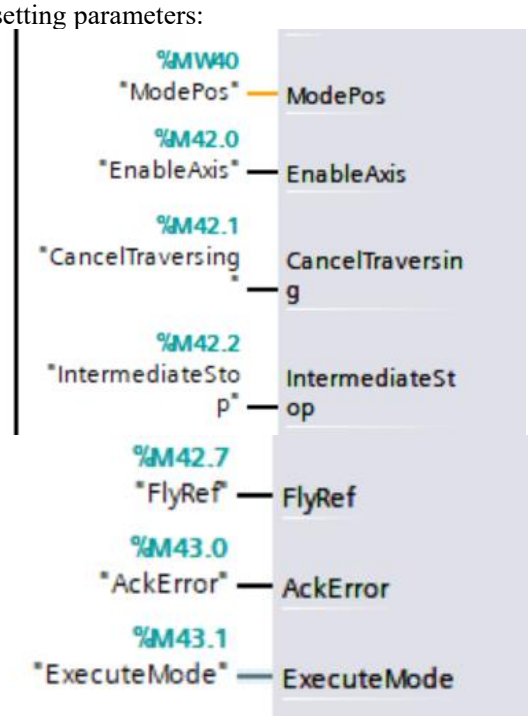
The return signal in the 111 message is automatically planned by the servo (ModPos=4), and the PLC only provides the signal to trigger the return signal. The driver has configured the parameters for the return signal.
If absolute homing (PA-25=0) is selected, the homing is the value of the PA-26/PA-27 combination as the homing value. If the relative homing (PA-25=1) is selected, the homing is the value of the combination of PA-26/PA-27 + the current position value as the position after homing.
Before the homing is complete, the ExcuteMode signal of the Sina_POS function block must always be TRUE to complete the homing action.When set to absolute value mode, AxisRef is set to 1 after the first return, and even if the servo is powered off and restarted, AxisRef is 1 and the return position is saved (this feature is not supported yet).
Select the homing switch signal source by parameter PA-31. When PA-31=1 (default), the homing switch signal is connected to the driver, or when PA-31=2 (supported by 3791 and later versions), the homing switch signal is connected to the input point of PLC. Its signal status is sent to the driver via the ConfigEPos.%X6 of the FB284 function block.
Parameter setting involved in the homing motion:

Parameter	Data type	Default value	Minimum	Maximum	Unit	Description
P0-00	U16	1	0	1	-	Bus type 1: PN bus
P0-01	U16	3	3	5	-	Control mode 1: Internal torque mode 3: Internal speed mode 5: Internal location mode
P0-02	U16	3	0	255	-	Master control message number (automatically changes control mode based on added messages)
P0-03	U16	3	0	3	-	Enabling method 3: PN bus enabling
P0-05	U16	0	0	1	-	Drive polarity 0: forward 1: reverse
P0-11	U16	0	0	9999	1LU	Low order pulse instructions per cycle
P0-12	U16	1	0	9999	1LU	High order pulse instructions per cycle * 10000
P0-13	U16	1	0	65535	-	Electronic gear ratio molecules
P0-14	U16	1	0	65535		Denominator of electronic gear ratio
P5-22	U16	0	0	65535	-	POT function signal allocation
P5-23	U16	0	0	65535	-	NOT function signal allocation
P5-27	U16	3	0	65535	-	HOME function signal allocation
PA-19	I16	0	0	35	-	Homing type
PA-20	U16	5000	0	9999	1000[LU/min]	Low bit of homing high speed
PA-21	U16	0	0	400	1000[LU/min]	High bit of homing high speed *10000
PA-22	U16	300	0	9999	1000[LU/min]	Low bit of homing low speed
PA-23	U16	0	0	400	1000[LU/min]	High bit of homing low speed *10000
PA-24	U16	16384	0	32767	0x4000-100%	Homing acceleration/deceleration ratio
PA-25	U16	0	0	1	-	Homing offset type (not currently supported)
PA-26	I16	0	-9999	9999	1LU	Homing offset low bit
PA-27	I16	0	-9999	9999	1LU	Homing offset high bit * 10000
PA-28	U16	32767	0	32767	ms	Homing timeout (not currently supported)
PA-29	U16	1	0	100	-	Finding Z Numbers for homing
PA-30	U16	100	0	1000	ms	Z-phase positioning completion time delay (not currently supported)
PA-31	U16	1	1	2	-	Homing mode switch signal source
PA-02	U16	3000	0	9999	1000[LU/s^2]	Epos maximum acceleration low bit
PA-03	U16	0	0	9999	1000[LU/s^2]	Epos maximum acceleration high bit *

Parameter	Data type	Default value	Minimum	Maximum	Unit	Description
						10000
PA-04	U16	3000	0	9999	1000[LU/s^2]	Epos maximum deceleration low bit
PA-05	U16	0	0	9999	1000[LU/s^2]	Epos maximum deceleration high bit * 10000

1)Set PA-25, homing offset type, absolute homing or relative homing.
2)Set PA-19, homing mode, which includes 1-14, 17-30, 33, 34.
3)Set PA-20/PA-21 to search for the limit and high speed of the origin switch during the return process.
4)Set PA-22/PA-23, low speed for searching for zero point during the return process (with and without searching for Z-phase mode).
5)Set PA-24, homing acceleration/deceleration ratio, PA-02/PA-03, PA-04/PA-05, maximum acceleration/deceleration ratio. Homing acceleration/deceleration=maximum acceleration/deceleration * rate of homing acceleration/deceleration.
6)Set PA-29 to find the number of Z-phases.
7)Set PA-30 and set the delay time for positioning completion after searching for the Z-phase.
8)Set PA-31 and select whether the limit switch and origin signal are connected to the PLC or servo.

PLC side SinaPoa function block setting parameters:

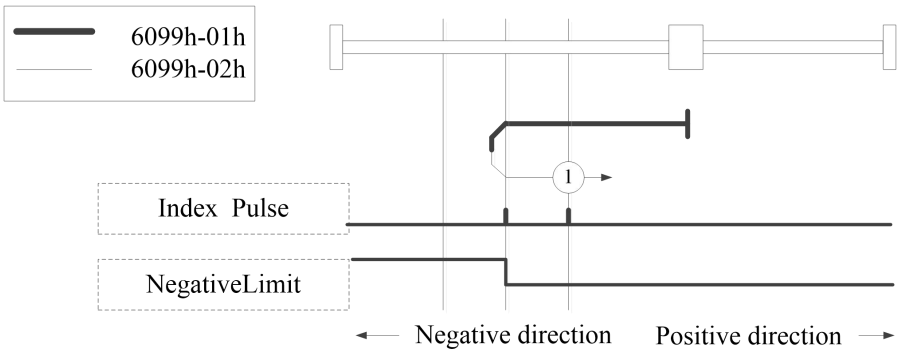


1)Set ModePos to 4.
2)Set enableAxis to True and enable the drive.
3)ExecuteMode triggers a homing motion through the rising edge of ExecuteMode, and should remain at a high level during the return to zero process.
4)When ModePos is not set to 4 or 5, when the motor is in a stationary state in other motion modes, FlyRef can be enabled to directly homing motion.

6.7.2 Homing mode function

The homing method used in the driver parameter PA-19 is set. Currently, the homing methods supported by the Xinje DS5P series servo include 1-14, 17-30, 33, and 34.

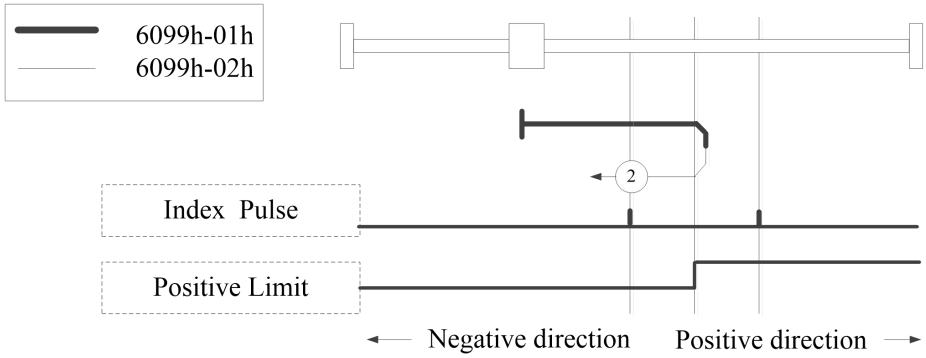
■ Method 1:
When using this homing method 1, if the reverse limit switch is in a non triggered state, the initial direction of movement is left. The first Z-phase pulse on the right side of the position where the negative limit switch becomes invalid at the origin position.



Homing on negative limit switch and index pulse

■ Method 2:

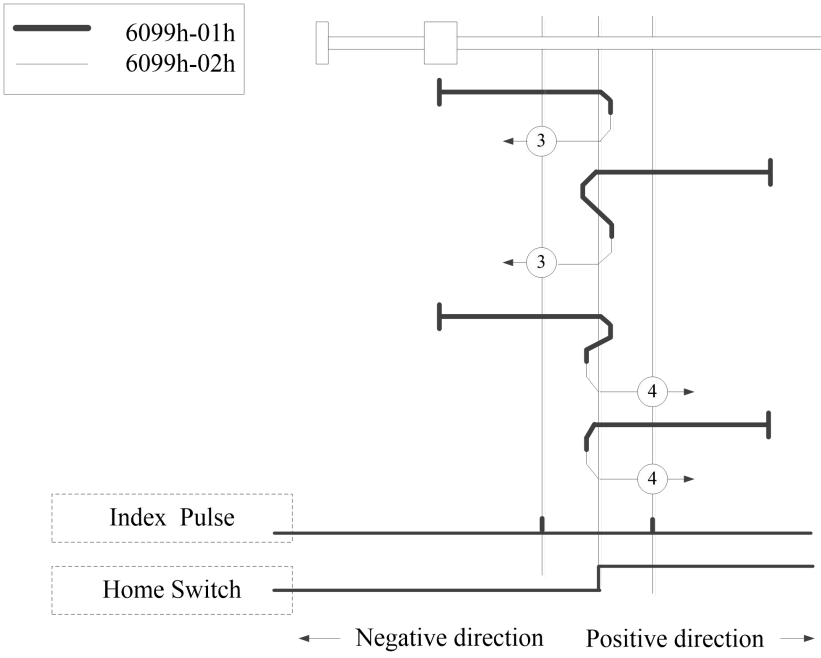
When using method 2, if the forward limit switch is not triggered, the initial movement direction is to the right. The origin position is at the first Z-phase pulse to the left of the position where the forward limit switch becomes invalid.



Homing on positive limit switch and index pulse

■ Methods 3 and 4:

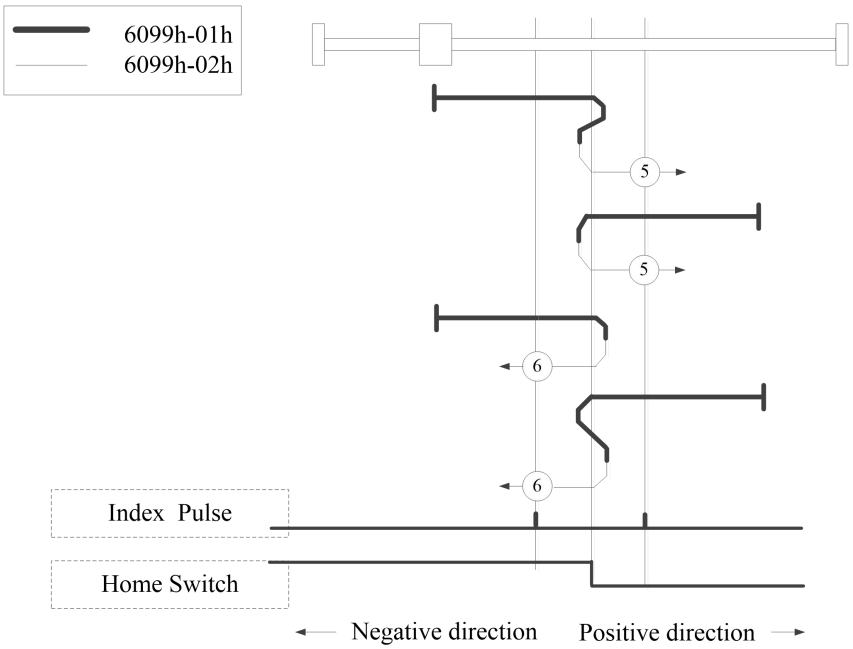
The initial direction of movement using method 3 or 4 depends on the state of the origin switch. The origin position is on the reverse side of the origin switch or the initial detected Z-phase position in the forward direction.



Homing on positive home switch and index pulse

■ Methods 5 and 6:

The initial direction of movement for method 5 or 6 depends on the state of the origin switch. The origin position is on the reverse side of the origin switch or the initial detected Z-phase position in the forward direction.



Homing on negative home switch and index pulse

■ Methods 7-14:

Both 7-14 use origin switches and Z-phase signals.

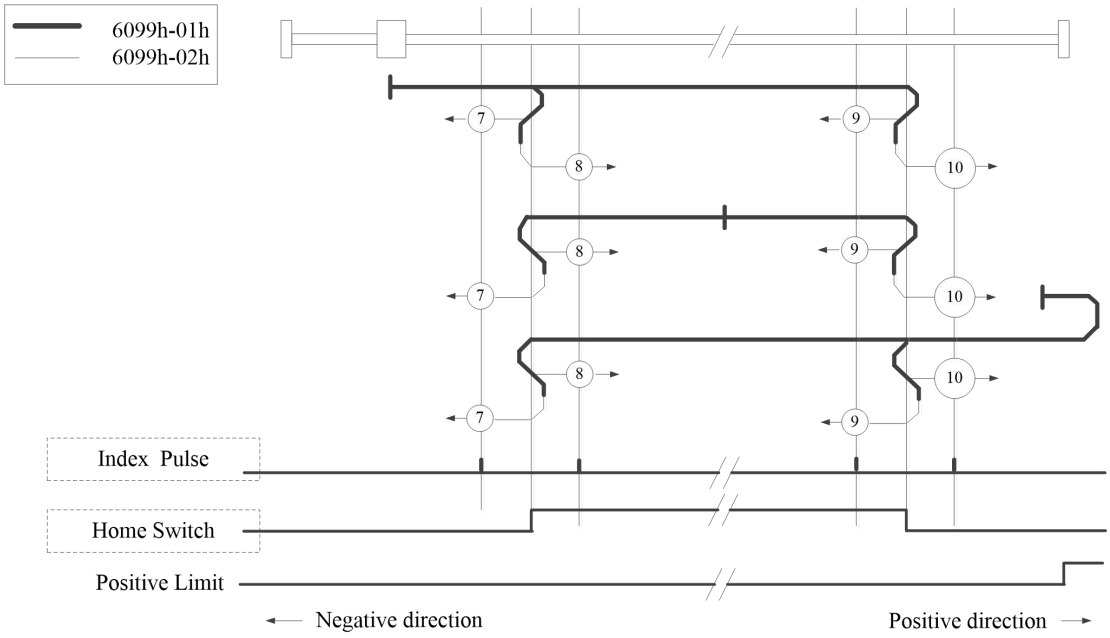
The initial action direction of modes 7 and 8 is negative if the origin switch has been activated at the beginning of the action.

The initialization action direction of modes 9 and 10 is positive if the origin switch has been activated at the beginning of the action.

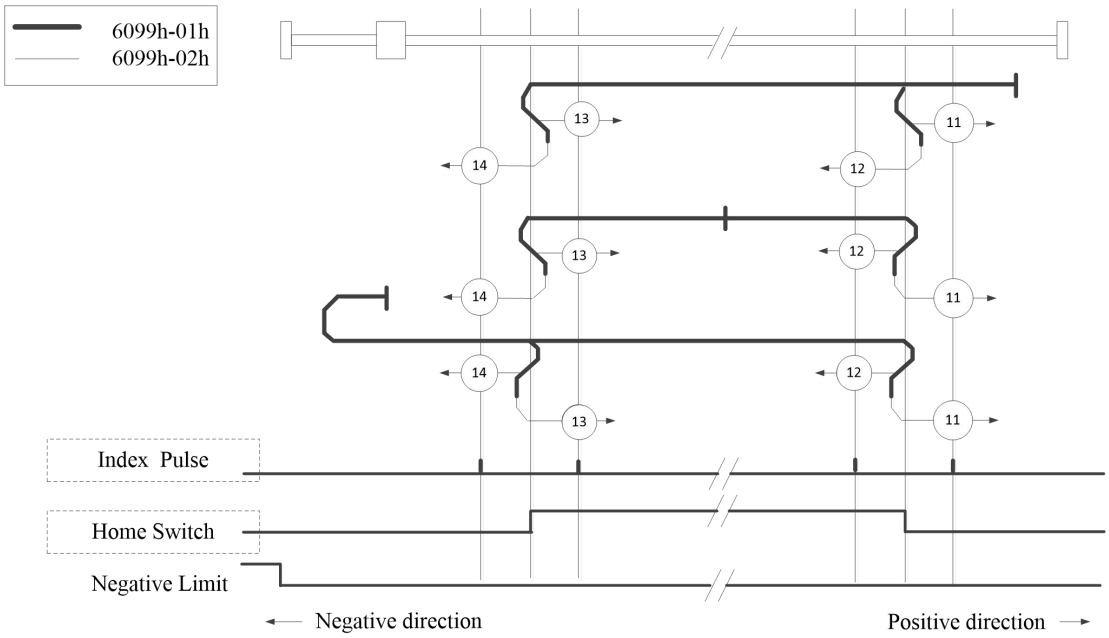
The initialization action direction of modes 11 and 12 is positive if the origin switch has been activated at the beginning of the action.

The initialization action direction for modes 13 and 14 is negative if the origin switch has already been activated at the beginning of the action.

The final return to the origin position is the Z-phase signal near the rising or falling edge of the origin switch.



Homing on home switch and index pulse – positive initial motion



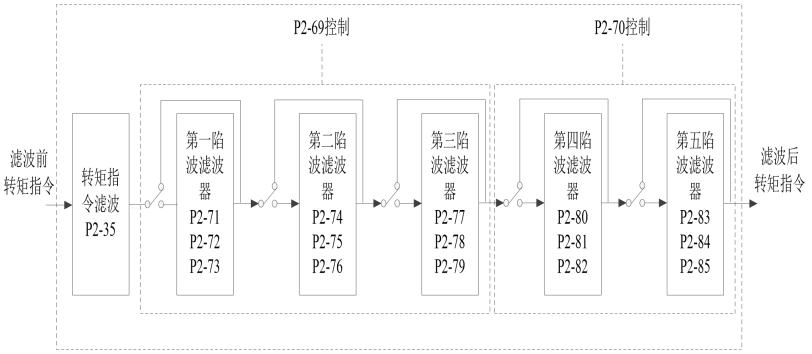
Homing on home switch and index pulse – Negative initial motion

■ Method 17:

This method is similar to Method1.

The difference is that the origin detection position is not the index pulse, but the position where the Limit switch changes. (Please refer to the following figure)

When NOT is not allocated, Homing error=1.

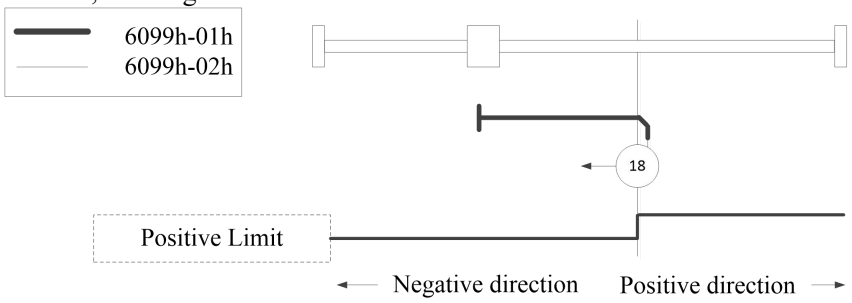


■ Method 18:

This method is similar to Method2.

The difference is that the origin detection position is not the index pulse, but the position where the Limit switch changes. (Please refer to the following figure)

When POT is not allocated, Homing error=1.



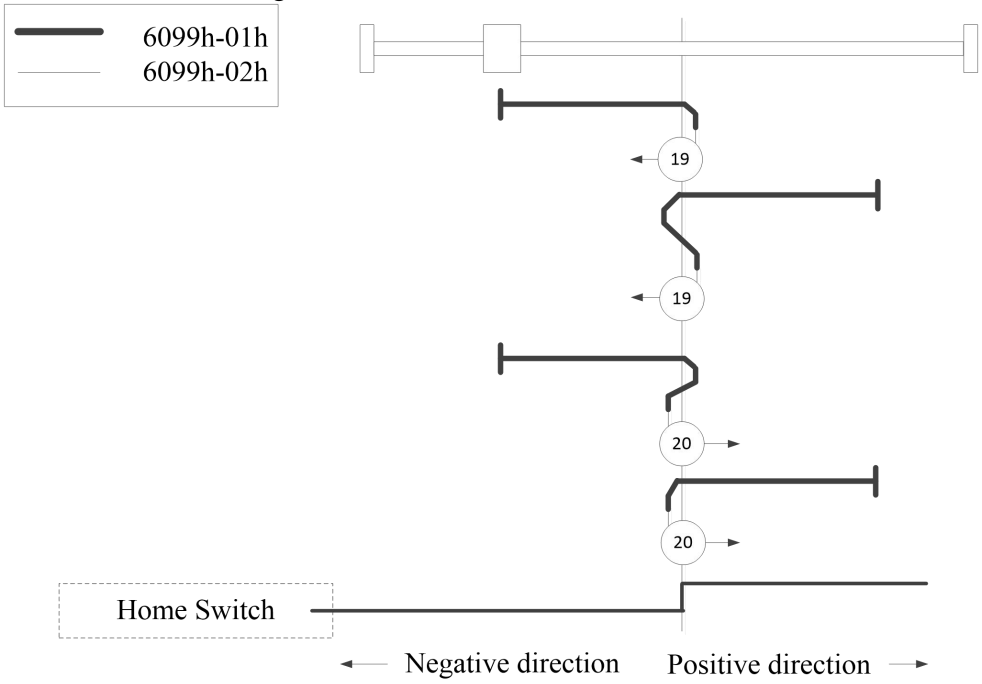
Homing on positive limit switch

■ Method 19, 20:

This method is similar to Method3, 4.

The difference is that the origin detection position is not the index pulse, but the position where the Home switch changes. (Please refer to the following figure)

When HOME is not allocated, Homing error=1.



Homing on positive home switch

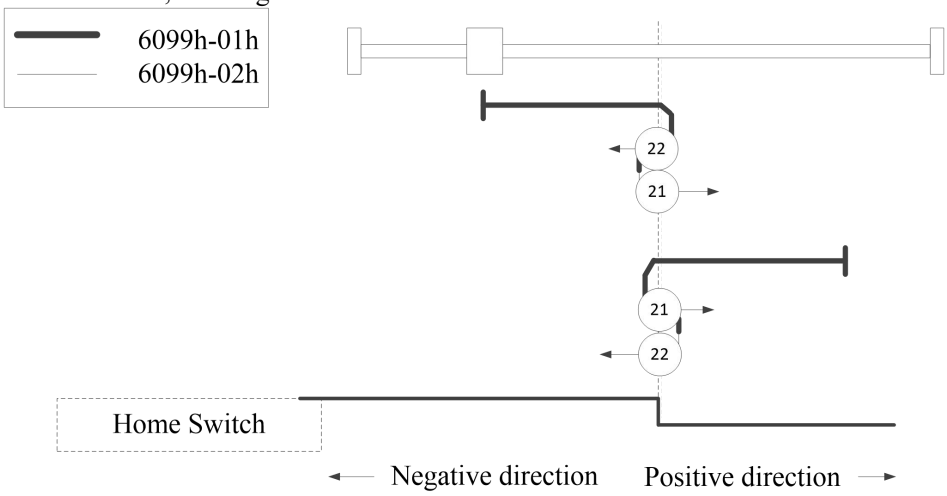
■ Method 21, 22:

This method is similar to Method5, 6.

The difference is that the origin detection position is not the index pulse, but the position where the Home switch changes.

(Please refer to the following figure)

When HOME is not allocated, Homing error=1.



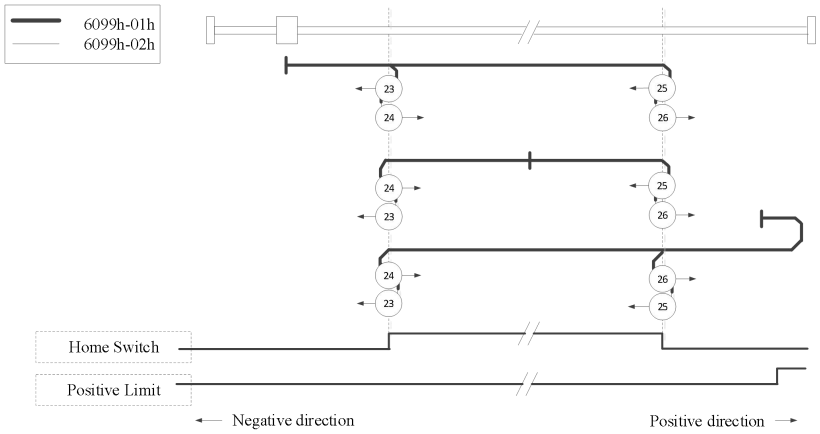
Homing on positive home switch and index pulse

■ Method 23, 24, 25, 26:

This method is similar to Method7, 8, 9, 10.

The difference is that the origin detection position is not the index pulse, but the position where the Home switch changes. (Please refer to the following figure)

When HOME and POT are not allocated, Homing error=1.



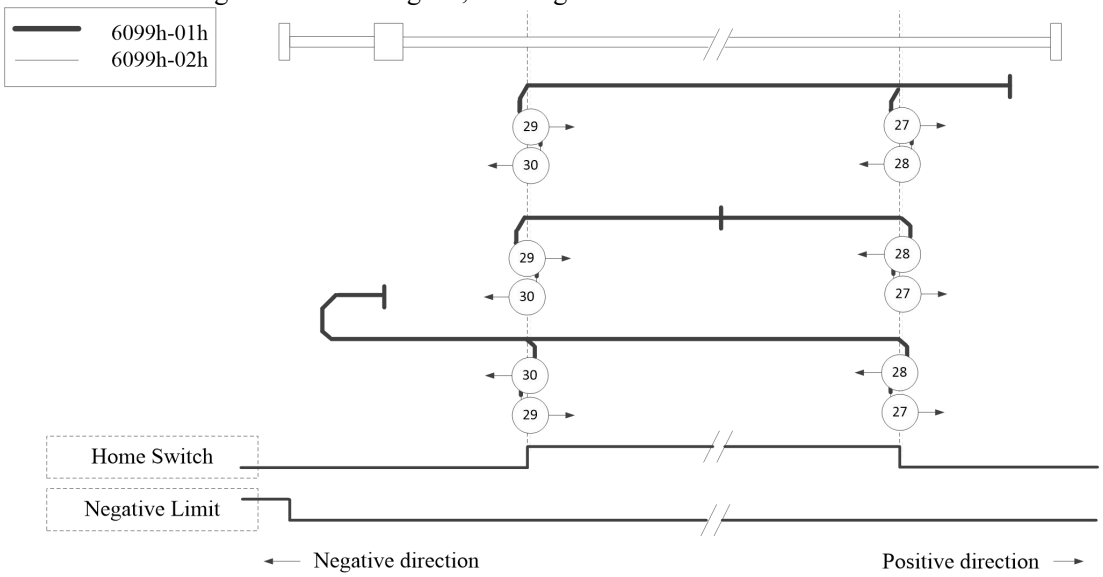
Homing on home switch and index pulse – positive initial motion

■ Method 27, 28, 29, 30:

This method is, like Method11, 12, 13, 14.

The difference is that the original point check out location is not the index pulse, but the Home switch change location. (Please refer to the picture below)

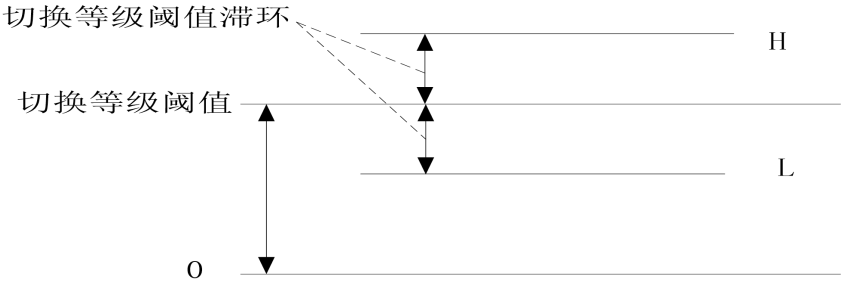
HOME, NOT If the Homing error is not assigned, Homing error = 1.



Homing on home switch and index pulse – Negative initial motion

■ Method 33, 34:

Using method 33 or 34, the direction of return to the origin is negative or positive, respectively. The original location is located in the selected direction near Z along.



6.8 Message 111 set homing position

This operation mode allows the axis to be set to zero position at any position.
Requirements:
1) Set ModePos to 5.
2) Set the zero position of the axis through the rising edge of the ExecuteMode. The axis must be at rest when executing mode.
The zero position of the shaft can be set by the drive parameters PA-26 and PA-27.

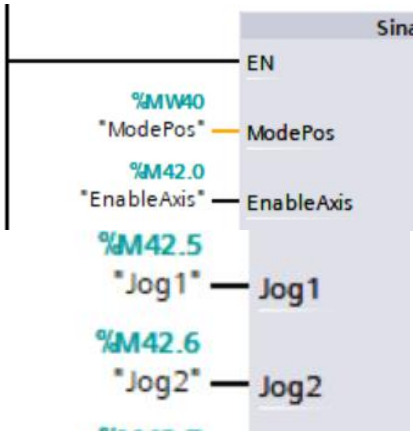
Parameters	Data type	Default value	Minimum value	Maximum value	Unit	Description
PA-26	I16	0	-9999	9999	1LU	The origin reset offset is low
PA-27	I16	0	-9999	9999	1LU	Origin reset offset high *10000

6.9 Message 111 jog running at the specified speed

The jog function in message 111 is automatically planned within the servo (ModPos=7), PLC only provides the jog signal JOG1, JOG2, the driver only needs to set the jog parameters.
Parameters involved in tapping at the specified speed:

Parameters	Data type	Default value	Minimum value	Maximum value	Unit	Description
P0-00	U16	1	0	1	-	Bus type 1: PN bus
P0-01	U16	3	3	5	-	Control mode 1：Internal torque pattern 3：Internal velocity mode 5：Internal position model
P0-02	U16	3	0	255	-	Master control message number (automatically changes control mode based on added messages)
P0-03	U16	3	0	3	-	Enable Mode 3: Enables the PN bus
P0-05	U16	0	0	1	-	Drive polarity 0: forward 1: reverse
P0-11	U16	0	0	9999	1LU	Pulses per turn low bit
P0-12	U16	1	0	9999	1LU	Pulse per turn high bit *10000
P0-13	U16	1	0	65535	-	Electronic gear ratio numerator
P0-14	U16	1	0	65535		Electronic gear denominator
PA-14	I16	-300	-9999	9999	1000[LU/min]	JOG1 jog speed low bit
PA-15	I16	0	-200	200	1000[LU/min]	JOG1 jog speed high bit*10000
PA-16	I16	300	-9999	9999	1000[LU/min]	JOG2 jog speed low bit
PA-17	I16	0	-200	200	1000[LU/min]	JOG2 jog speed high bit*10000
PA-18	U16	16384	0	32767	0x4000-100%	Jog acceleration/deceleration speed ratio

PLC SinaPoa block Setting parameters:



1)Set ModePos to 7 or 8.
2)Set EnableAxis to True to enable the drive.

3)If JOG1 or JOG2 is set to TRUE separately, JOG1 and JOG2 cannot be TRUE at the same time. If both are TRUE, the jog motion stops.
4)JOG1 is generally set to reverse motion, JOG2 is generally set to forward motion.

6.10 Message 111 jog running at specified distance

The function of jog according to the specified incremental distance in message 111 is automatically planned by the servo internal (ModPos=8). PLC only provides the jog signals JOG1 and JOG2, and the driver can be configured with the jogging parameters (supported by 3793 and later versions).
Parameters involved in jogging at the specified speed:

Parameters	Data type	Default value	Minimum value	Maximum value	Unit	Description
PA-14	I16	-300	-9999	9999	1000[LU/min]	JOG1 jog speed low bit
PA-15	I16	0	-200	200	1000[LU/min]	JOG1 jog speed high bit *10000
PA-16	I16	300	-9999	9999	1000[LU/min]	JOG2 jog speed low bit
PA-17	I16	0	-200	200	1000[LU/min]	JOG2 jog speed high bit *10000
PA-32	I16	1000	0	9999	LU	JOG1 running travel low bit
PA-33	I16	0	0	200	LU	JOG1 running travel high bit *10000
PA-34	I16	1000	0	9999	LU	JOG2 running travel low bit
PA-35	I16	0	0	200	LU	JOG2 running travel high bit *10000

Requirements:
1)Set ModePos to 8.
2)If EnableAxis is set to True, the drive is enabled.
3)Jog1 and Jog2 are used to control the shaft to jog run at the specified distance, and the jog speed and direction of movement are determined by the size and positive or negative of the speed set in the drive.
4)The OverV parameter of the speed scales the jog speed set value by percentage.
5)The default value of the incremental jog distance is Jog1 traversing distance/Jog2 traversing distance =1000LU, which is independent of Positive and Negative parameters.

Note: The run conditions CancelTraversing and IntermediateStop are independent of the point run mode and are set to 1 by default.

6.11 Switch between the message 111 function modes

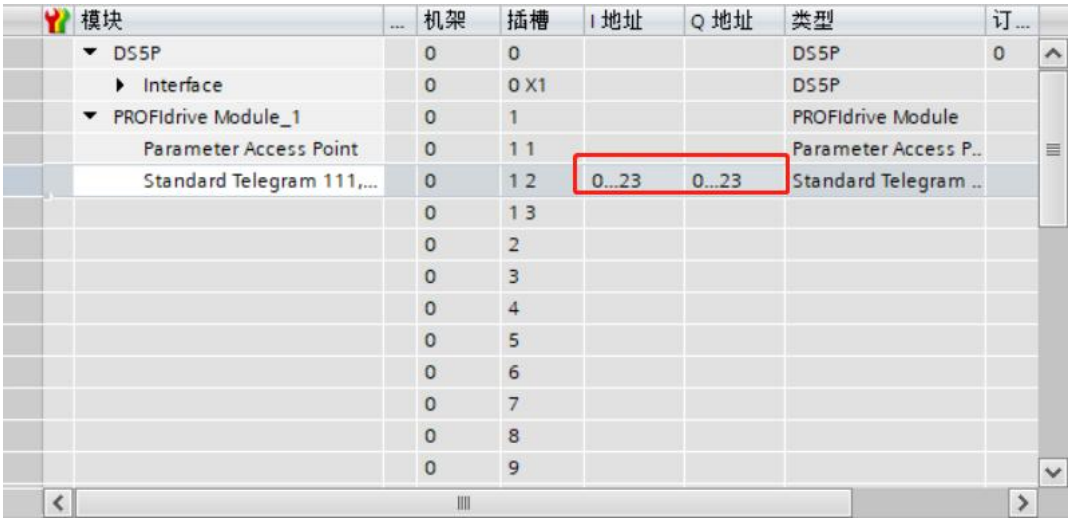
1)When the working mode is in the positioning mode (mode 1, 2, 3), the driver is in the enabled state and the motor cannot be switched to the original when it is in the running state. In the point mode, the motor can only be switched to the original or the point mode when it is at rest.Motor stop The motor can be stopped by positioning to reach or cancel the task (CancelTraversing) or by suspending the task (Intermediatestop).
2)When the working mode is in the homing mode (mode 4) and ModePos is set to other modes, the homing motion stops immediately and the motor is in a static state.
3)When the operating mode is in the homing position setting mode (Mode 5), the motor is at rest, and the ExecuteMode signal is set to True. If ModePos is set to another mode, the mode switches immediately.
4)When the working mode is in mode 6 (function is not supported), the motor is in a static state, and when the ModePos switches to other modes, it will switch immediately.
5)When the working mode is in the jog mode (mode 7, 8) and ModePos is set to other modes, the jog motion stops immediately and the motor is at rest.
6)When the working mode is not in the homing mode 4, 5 working state, if the motor is at rest, you can directly use FlyRef signal set TRUE to carry out the homing operation, if the motor is in the motion state, it can't carry out the homing operation.
7)When the working mode is between 1 and 8, when the ModePos is set to 0, or greater than 8, the motor stops running.
8)After switching to the set value continuous change mode, the switch needs to trigger an ExecuteMode for the first movement. Then, the MDI target position and MDI speed can be directly modified to realize continuous change of the set value.

These are the points to note for switching between all modes.

6.12 PROFINET status word, control word details

6.12.1 Address of the receiving/sending area of message 111

Usually, we use FB284 function block to operate the message 111 indirectly. This time, we directly operate the address of the message 111 to realize the motion control of the servo. After configuring message 111, the system automatically allocated a receiving and sending area of 24 bytes, as shown in the following figure:



Next, a detailed breakdown of the receiving and sending address areas is shown in the table below:

Process data channel	Address	Signal	Description
PLC→Driver			
PZD1	QW0	STW1	Control word 1
PZD2	QW2	POS_STW1	Control word 1 of the basic locator
PZD3	QW4	POS_STW2	Control word 2 of the basic locator
PZD4	QW6	STW2	Control word 2
PZD5	QW8	Override	Velocity multiplier
PZD6~7	QD10	MDI_TARPOS	MDI position
PZD8~9	QD14	MDI_Velocity	MDI speed Set value
PZD10	QW18	MDI_ACC	MDI acceleration
PZD11	QW20	MDI_DEC	MDI deceleration
PZD12	QW22	User_Connection	User-defined sending area
Driver→PLC			
PZD1	IW0	ZSW1	Status word 1
PZD2	IW2	POS_ZSW1	Status word 1 of the basic locator
PZD3	IW4	POS_ZSW2	Status word 2 of the basic locator
PZD4	IW6	ZSW2	Status word 2
PZD5	IW8	MELLDW	Information status word
PZD6~7	ID10	XIST_A	Position actual value
PZD8~9	ID14	NIST_B	Actual speed value
PZD10	IW18	Fault_Code	Fault codes
PZD11	IW20	Warn_Code	Warning codes
PZD12	IW22	User_Connection	User defined receiving area

Several operating modes of EPOS are implemented by I/O read and write of message 111. The mapping table is as follows：

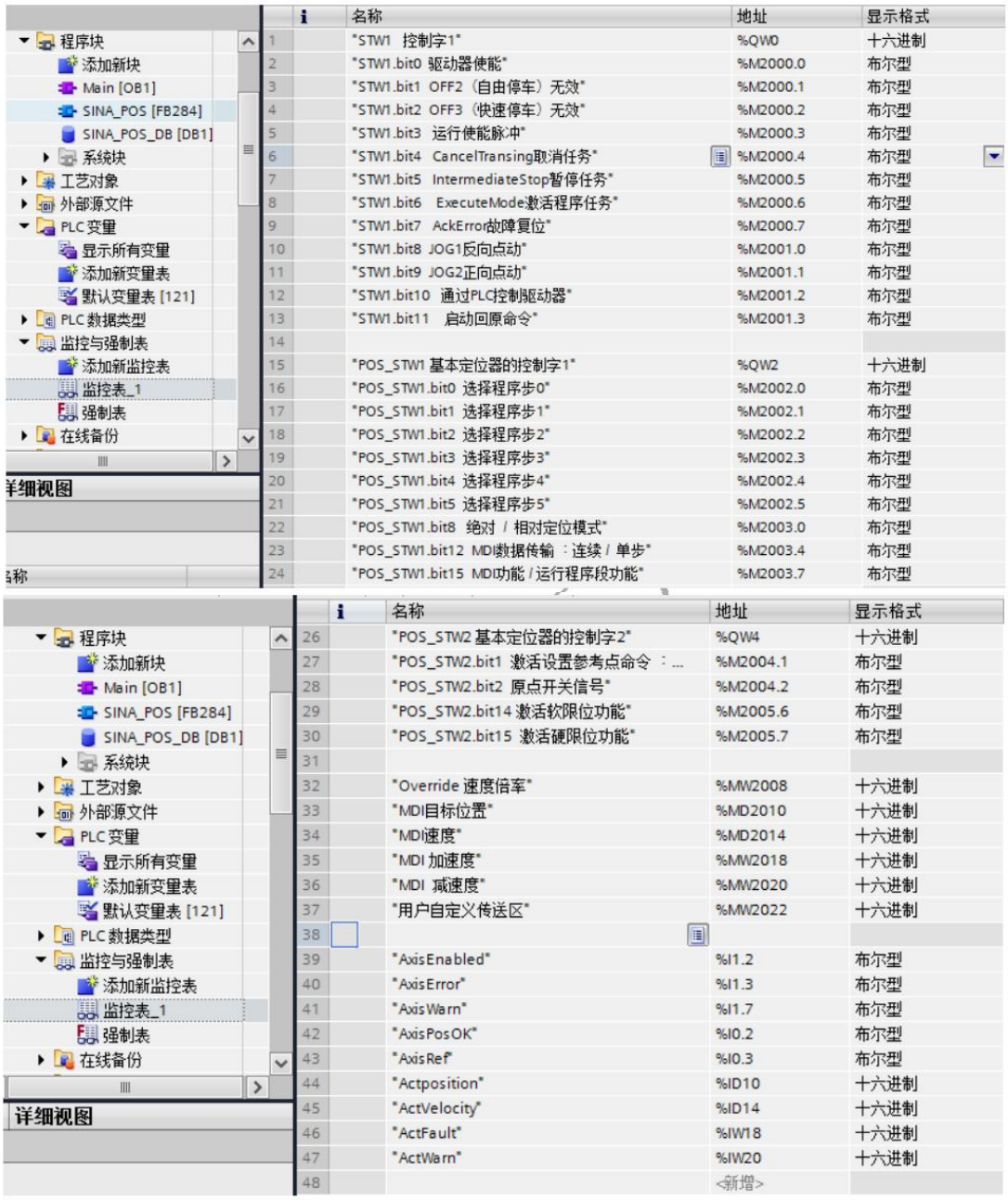
FB284 Pin	Message 111	Address area	Function description
PLC→Driver			
EnableAxis	STW1_bit0	Q1.0	1：Driver main loop is connected
ConfigEpos.%X0	STW1_bit1	Q1.1	1：OFF2(Free parking) is invalid
ConfigEpos.%X1	STW1_bit2	Q1.2	1：OFF3(Free parking) is invalid

FB284 Pin	Message 111	Address area	Function description
-	STW1_bit3	Q1.3	1：Servo enable 0：Enable prohibited, free parking
CancelTransing	STW1_bit4	Q1.4	0：Refuse to perform a task 1：Don't refuse to perform tasks
IntermediateStop	STW1_bit5	Q1.5	0：Suspend a running task 1：Don't suspend running tasks
ExecuteMode	STW1_bit6	Q1.6	Activator task
AckError	STW1_bit7	Q1.7	Fault confirmation
JOG1	STW1_bit8	Q0.0	Reverse dotting
JOG2	STW1_bi9	Q0.1	Forward dotting
-	STW1_bit10	Q0.2	The drive is controlled by PLC
-	STW1_bit11	Q0.3	Start the back reference point command
-	Pos_STW1_bit8	Q2.0	MDI locating mode 1：Absolute positioning 0：Relative positioning
ConfigEpos.%X8	Pos_STW1_bit12	Q2.4	MDIData transmission mode 1：Continuous (can be changed in real time) 0：Single step (STW1_bit6 receives changes to the position set value after going from 0 to 1)
-	Pos_STW1_bit15	Q2.7	1：MDI mode 0：Run segment
-	Pos_STW2_bit1	Q5.1	Activate the axis set reference point command to set the current position to zero
-	Pos_STW2_bit2	Q5.2	Origin switch signal (can be connected to the PLC side)
-	Pos_STW2_bit14	Q4.6	Activate the soft limit
-	Pos_STW2_bit15	Q4.7	Activate the hard limit
-	Override	QW8	Velocity multiplier
-	MDI_TARPOS	QD10	MDI target location
-	MDI_Velocity	QD14	MDI target speed
-	MDI_Acc	QW18	MDI acceleration rate
-	MDI_Dec	QW20	MDI deceleration rate

FB284 Pin	Message 111	Address area	Function description
Driver→PLC			
AxisEnabled	ZSW1_bit2	I1.2	Run Enable
AxisError	ZSW1_bit3	I1.3	Fault existed
AxisWarn	ZSW1_bit7	I1.7	Alarm existed
AxisPosOK	ZSW1_bit10	I0.2	Reaching the target location
AxisRef	ZSW1_bit11	I0.3	Homing completed
Actposition	Xist_A	ID10	Position actual value
ActVelocity	Nist_B	ID14	Speed actual value
ActFault	Fault_Code	IW18	Fault codes
ActWarn	Warn_Code	IW20	Alarm codes

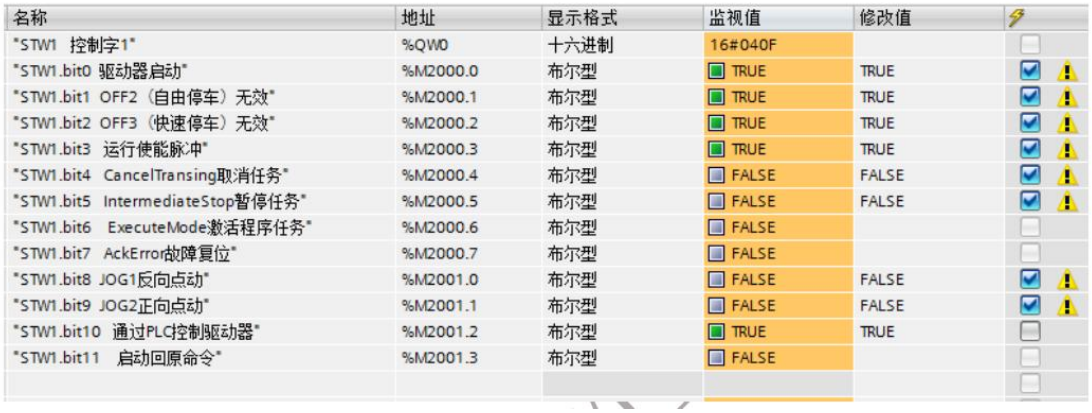
6.12.2 Address mapping

Send area address mapping in the program, as shown in the following figure：



6.12.3 Enable control word (STW1:16#406h→16#40Fh or 16#436h→16#43Fh)

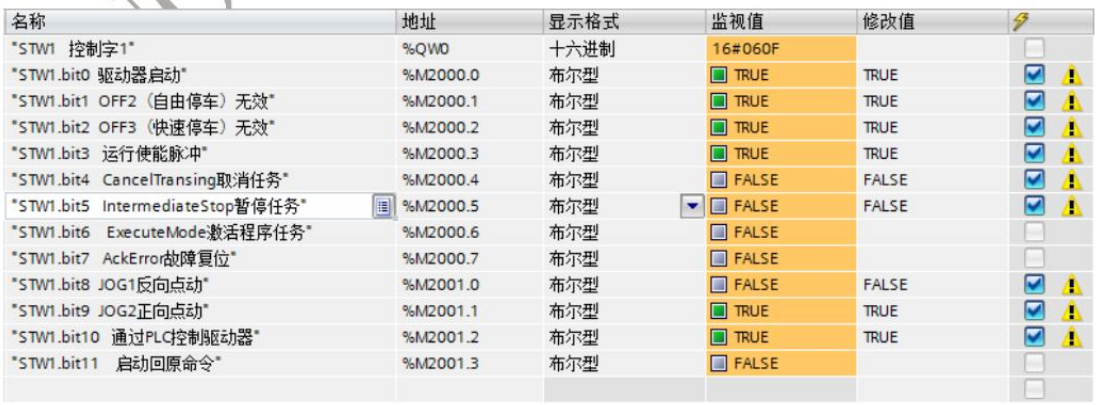
1)STW1.bit10=1(Drive controlled by PLC).
2)STW1.bit1=1(OFF2 Free parking is invalid), STW1.bit2=1(OFF3 Quick parking invalid).
3)STW1.bit0=1(Driver main loop is connected).
4)STW1.bit3=1(Servo enable).



名称	地址	显示格式	监视值	修改值
"STW1 控制字1"	%QW0	十六进制	16#040F	
"STW1.bit0 驱动器启动"	%M2000.0	布尔型	TRUE	TRUE
"STW1.bit1 OFF2（自由停车）无效"	%M2000.1	布尔型	TRUE	TRUE
"STW1.bit2 OFF3（快速停车）无效"	%M2000.2	布尔型	TRUE	TRUE
"STW1.bit3 运行使能脉冲"	%M2000.3	布尔型	TRUE	TRUE
"STW1.bit4 CancelTransing取消任务"	%M2000.4	布尔型	FALSE	FALSE
"STW1.bit5 IntermediateStop暂停任务"	%M2000.5	布尔型	FALSE	FALSE
"STW1.bit6 ExecuteMode激活程序任务"	%M2000.6	布尔型	FALSE	
"STW1.bit7 AckError故障复位"	%M2000.7	布尔型	FALSE	
"STW1.bit8 JOG1反向点动"	%M2001.0	布尔型	FALSE	FALSE
"STW1.bit9 JOG2正向点动"	%M2001.1	布尔型	FALSE	FALSE
"STW1.bit10 通过PLC控制驱动器"	%M2001.2	布尔型	TRUE	TRUE
"STW1.bit11 启动回原命令"	%M2001.3	布尔型	FALSE	

6.12.4 Speed point control word (forward point STW1:16#40Fh→16#60Fh or 16#43Fh→16#63Fh)

1)Override(Velocity ratio)= 16#4000h.
2)STW1.bit8=1(JOG1 reverse jogging) or STW1.bit9 =1(JOG2 forward jogging).



名称	地址	显示格式	监视值	修改值
"STW1 控制字1"	%QW0	十六进制	16#060F	
"STW1.bit0 驱动器启动"	%M2000.0	布尔型	TRUE	TRUE
"STW1.bit1 OFF2（自由停车）无效"	%M2000.1	布尔型	TRUE	TRUE
"STW1.bit2 OFF3（快速停车）无效"	%M2000.2	布尔型	TRUE	TRUE
"STW1.bit3 运行使能脉冲"	%M2000.3	布尔型	TRUE	TRUE
"STW1.bit4 CancelTransing取消任务"	%M2000.4	布尔型	FALSE	FALSE
"STW1.bit5 IntermediateStop暂停任务"	%M2000.5	布尔型	FALSE	FALSE
"STW1.bit6 ExecuteMode激活程序任务"	%M2000.6	布尔型	FALSE	
"STW1.bit7 AckError故障复位"	%M2000.7	布尔型	FALSE	
"STW1.bit8 JOG1反向点动"	%M2001.0	布尔型	FALSE	FALSE
"STW1.bit9 JOG2正向点动"	%M2001.1	布尔型	TRUE	TRUE
"STW1.bit10 通过PLC控制驱动器"	%M2001.2	布尔型	TRUE	TRUE
"STW1.bit11 启动回原命令"	%M2001.3	布尔型	FALSE	

6.12.5 Homing control word (STW1：16#40Fh→16#C0Fh or 16#43Fh→16#C3Fh)

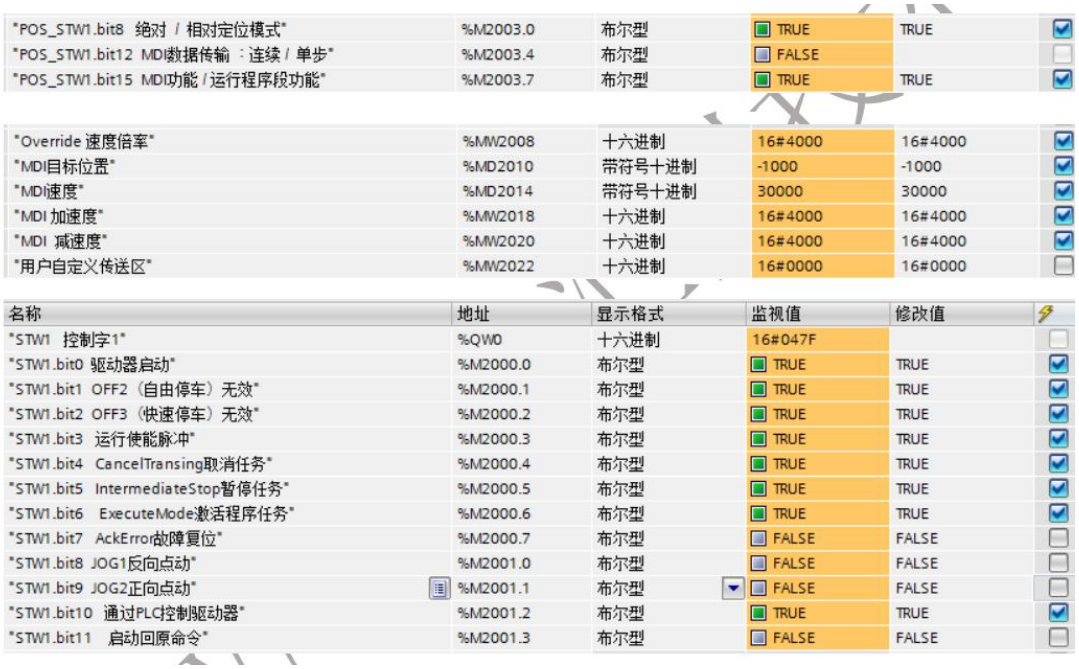
1)The homing mode and speed are set in parameters PA-19 to PA-24, and the specific homing mode can be viewed in the homing function mode. The terminal number of forward and reverse overrange and origin signal can be set in the terminal function of group P5. The parameter functions are P5-22, P5-23, and P5-27.
2)STW1.bit11=1 (start back reference point command: the level is valid), POS_ZSW1.bit11=1 in the process of homing, ZSW1.bit11 will automatically set to 1 after the completion of homing.
3)If the origin switch signal is connected to the PLC instead of the servo DI terminal, the origin switch signal needs to be associated with POS_STW2.bit2, and the servo DI terminal function doesn't need to set the origin switch function.
4)Directly set reference point function: POS_STW2.bit1=1 (Set reference point, take the current position as the origin), don't need to set STW1.bit11=1.

6.12.6 Communication failure reset and activate the hard limit control word

1)For communication fault alarm, STW1.bit7 should be set to 1 and AckError should be used to reset the fault.
2)For positive and negative overrange signals, POS_STW2.bit15 needs to be set to 1 to activate the hard limit function.

6.12.7 Absolute/relative positioning motion control word

1)POS_STW1.bit15=1(MDI operation mode).
2)POS_STW1.bit8=1Or 0 (1= absolute positioning, 0= relative positioning).
3)Override (speed multiplier) =16#4000h, set MDI_TarPos (target position), MDI_Velocity (target speed, unit 1000LU/min), MDI_Acc=16#4000h, MDI_Dec=16#4000h.
4)STW1.bit4=1 (CancelTransing, cancel the task), STW1.bit5=1 (Intermediatestop, suspend the task).
5)STW1.bit6=1 (ExcuteMode, activation program task: triggered along the signal).



"POS_STW1.bit8 绝对 / 相对定位模式"	%M2003.0	布尔型	TRUE	TRUE
"POS_STW1.bit12 MDI数据传输 ：连续 / 单步"	%M2003.4	布尔型	FALSE	
"POS_STW1.bit15 MDI功能 / 运行程序段功能"	%M2003.7	布尔型	TRUE	TRUE
"Override 速度倍率"	%MW2008	十六进制	16#4000	16#4000
"MDI目标位置"	%MD2010	带符号十进制	-1000	-1000
"MDI速度"	%MD2014	带符号十进制	30000	30000
"MDI 加速度"	%MW2018	十六进制	16#4000	16#4000
"MDI 减速度"	%MW2020	十六进制	16#4000	16#4000
"用户自定义传送区"	%MW2022	十六进制	16#0000	16#0000

名称	地址	显示格式	监视值	修改值
"STW1 控制字1"	%QW0	十六进制	16#047F	
"STW1.bit0 驱动器启动"	%M2000.0	布尔型	TRUE	TRUE
"STW1.bit1 OFF2（自由停车）无效"	%M2000.1	布尔型	TRUE	TRUE
"STW1.bit2 OFF3（快速停车）无效"	%M2000.2	布尔型	TRUE	TRUE
"STW1.bit3 运行使能脉冲"	%M2000.3	布尔型	TRUE	TRUE
"STW1.bit4 CancelTransing取消任务"	%M2000.4	布尔型	TRUE	TRUE
"STW1.bit5 IntermediateStop暂停任务"	%M2000.5	布尔型	TRUE	TRUE
"STW1.bit6 ExecuteMode激活程序任务"	%M2000.6	布尔型	TRUE	TRUE
"STW1.bit7 AckError故障复位"	%M2000.7	布尔型	FALSE	FALSE
"STW1.bit8 JOG1反向点动"	%M2001.0	布尔型	FALSE	FALSE
"STW1.bit9 JOG2正向点动"	%M2001.1	布尔型	FALSE	FALSE
"STW1.bit10 通过PLC控制驱动器"	%M2001.2	布尔型	TRUE	TRUE
"STW1.bit11 启动回原命令"	%M2001.3	布尔型	FALSE	FALSE

6)The set value changes continuously: POS_STW1.bit8=1 (absolute positioning), POS_STW1.bit12=1 (MDI data transmission: continuous).
7)After switching to the set value continuous change mode, the switch needs to trigger an ExecuteMode for the first movement. Then, the MDI target position and MDI speed can be directly modified to realize continuous change of the set value.

6.12.8 Message 111 Enables the state machine test of the control word and status word

Function	Control word	Status word
Enable	None	ZSW1.bit0(Connected ready)=0 ZSW1.bit1(Operated ready)=0 ZSW1.bit2(Run AxisEnable)=0 ZSW1.bit6(Prohibited connection takes effect)=1
	STW1.bit0(Drive startup) =0 STW1.bit1 OFF2 (No Free Parking) =1 STW1.bit2 OFF3 (No fast parking) =1 STW1.bit10 (Control the driver through PLC) =1	ZSW1.bit0(Connected ready)=1 ZSW1.bit1(Operated ready)=0 ZSW1.bit2(Run AxisEnable)=0 ZSW1.bit6(Prohibited connection takes effect)=0
	STW1.bit0(Drive startup)=1 STW1.bit1 OFF2 (No Free Parking)=1 STW1.bit2 OFF3 (No fast parking) =1 STW1.bit10(Control the driver through PLC)=1	ZSW1.bit0(Connected ready)=1 ZSW1.bit1(Operated ready)=1 ZSW1.bit2(Run AxisEnable)=0 ZSW1.bit6(Prohibited connection takes effect)=0
	STW1.bit0(Drive startup)=1 STW1.bit1 OFF2 (No Free Parking)=1 STW1.bit2 OFF3 (No fast parking) =1 STW1.bit3(Run enable pulse)=1 STW1.bit10(Control the driver through PLC)=1	ZSW1.bit0(Connected ready)=1 ZSW1.bit1(Operated ready)=1 ZSW1.bit2(Run AxisEnable)=1 ZSW1.bit6(Prohibited connection takes effect)=0
Slope stop	STW1.bit0(Drive startup)=0 STW1.bit1 OFF2 (No Free Parking)=1 STW1.bit2 OFF3 (No fast parking) =1 STW1.bit3 (Run enable pulse)=1 STW1.bit10 (Control the driver through PLC)=1	ZSW1.bit0(Connected ready)=1 ZSW1.bit1(Operated ready)=0 ZSW1.bit2(Run AxisEnable)=0 ZSW1.bit6(Prohibited connection takes effect)=0
Free stop	STW1.bit0(Drive startup)=1 STW1.bit1 OFF2 (No Free Parking)=0 STW1.bit2 OFF3 (No fast parking) =1	ZSW1.bit0(Connected ready)=0 ZSW1.bit1(Operated ready)=0 ZSW1.bit2(Run AxisEnable)=0

Function	Control word	Status word
	STW1.bit3 (Run enable pulse) =1 STW1.bit10(Control the driver through PLC)=1	ZSW1.bit6(Prohibited connection takes effect)=1
Fast stop	STW1.bit0 (Drive startup)=1 STW1.bit1 OFF2 (No Free Parking)=1 STW1.bit2 OFF3 (No fast parking) =0 STW1.bit3 (Run enable pulse) =1 STW1.bit10(Control the driver through PLC)=1	ZSW1.bit0(Connected ready)=0 ZSW1.bit1(Operated ready)=0 ZSW1.bit2(Run AxisEnable)=0 ZSW1.bit6(Prohibited connection takes effect)=1

1)Ramp stop (OFF1 ramp stop), execute ramp stop after STW1. bit0=0, where the ramp stop deceleration time constant is set in P0-31, where P0-31 represents the deceleration time at maximum speed.
2)Free stop (OFF2 free stop), execute free stop after STW1. bit1=0.
3)Fast stop (OFF 3 emergency stop), if the control word STW1. bit2=false, the motor will execute a fast stop. The fast stop time is determined by the servo parameter P0-32, which represents the deceleration time at the maximum motor speed.

7 Parameter reading and writing function

7.1 Parameters

1. Parameter values

Parameter values represent a single data value or multiple data values (arrays) of a data type.

Subindex	Meaning	Data type
1	Identifier (ID)	V2(2)
2	The number of array elements or strings	Unsigned16(2)
3	Normalization Factor	Floating point(4)
4	Variable attribute	OctetString 2(2)
5	Reserve	OctetString4(4)
6	Name	VisibleString 16(16)
7	Minimum limit	OctetString 4(4)
8	Maximum limit	OctetString 4(4)
9	Reserve	OctetString2(2)
10	ID extension	V2(2)
11	DO IO Data Reference parameter	Unsigned 16(2)
12	DO IO Data standardization	V2(2)
0	Complete description	OctetString46(46)

2. Parameter description

Parameter description contains the relevant information elements of the respective parameters. Relevant information is shown in the following figure:

1)Identifier (subindex1)

Bit	Meaning	Explanation
0-7	Data type identification (ID) for parameter values	-
8	Standard factors are irrelevant to variable attributes	-
9	Parameter not writable	-
10	The extra text array is valid	-
11	Reserve	-
12	Change parameters through parameter factory Settings	When this bit is set, the parameter value can only be set to the parameter factory value
13	Parameters can only be reset	This bit is set and the parameter can be incremented internally, but can only be set to 0
14	Array type	-
15	Reserve	-

2)The number of array elements and the number of characters in the string. (subindex2).
3)Standard factor(subindex3).
4)Parameter attributes: variable index and transformation index (subindex4).
5)Parameter name Contains a maximum of 16 characters.(subindex6).
6)Minimum/maximum limit.(subindex7/subindex8).
7)IDextension(subindex10).
8)IO data reference variable /IO data normalization(subindex 11/subindex 12).

7.2 Parameter specification

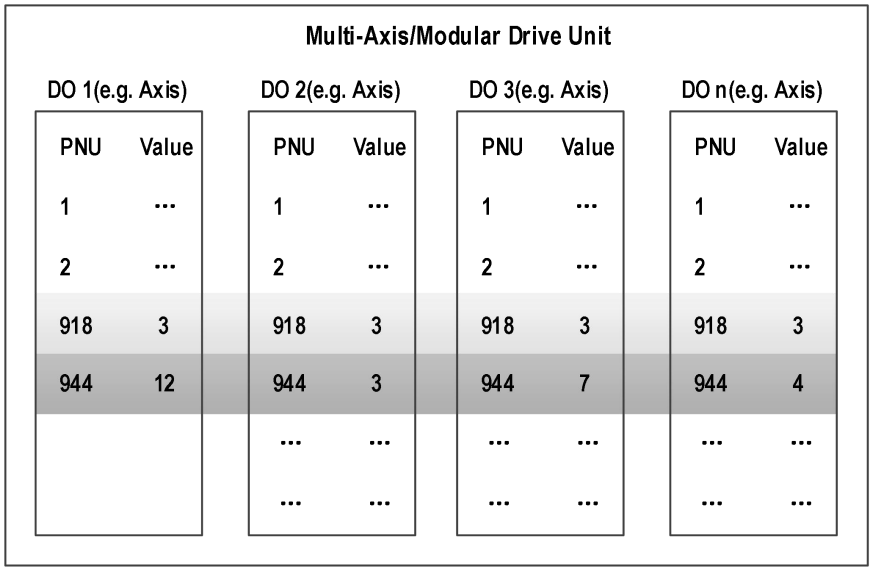
Global parameters and local parameters
A driver object consists of its own driver device and one or more driver objects. The drive shaft is associated with the shaft type drive object.
For multi-axis or modular drive units, each drive object has a separate parameter number space.
Two classes of variables with different range values are defined in the protocol.

7.2.1 Global parameter variable

Global variables are associated with the entire device (such as parameters related to communication interfaces). If different driver objects in the driver unit are addressed, a global variable always specifies the same value.

7.2.2 Drive object/axis specifies parameters

These parameters are associated with the driver object. The driver object/axis specifies that the object has different parameter values in each driver object.
Parameters are divided into global parameters and drive/shaft specification parameters.
The following figure shows the global parameters and drive/shaft specified parameters:



7.3 Basic mode parameter access

7.3.1 General

In this subset, parameter access via "basic mode" is defined. In order to access a request language is defined, the request and response are transmitted asynchronously periodically using the "asynchronous communication interaction" mechanism in the communication system.

7.3.2 General Features

- For each parameter index and subindex is 16 bits wide.
- Transmission of complete arrays or partial or whole parameter descriptions within them.
- Access to different parameters in a transmission. The device must place the maximum number of parameter accesses in a parameter access request.
- Only one parameter request can be processed at a time.
- A parameter request/parameter response should be filled in a single data block, (default 240 bytes), the request/response cannot be split into several data blocks. The maximum length of the data block may not be equal to 240 bytes, depending on the device characteristics or bus system. Limited to 240 bytes under PROFIBUS and 2^32-65 bytes under ProfiNet. If the size is not the default size of 240 bytes, the device should place the maximum length of the request/response in PN948.
- The optimal multi-parameter simultaneous access, multi-parameter access is defined.
- No periodic parameter access request.
- After the device is started, the parameters specified by the protocol can be at least as many in each state.

7.3.3 Drive object access mode

Basic mode parameter access is defined as two different access modes:
① Basic mode parameter access - Local.
② Basic mode parameter access - Global.

7.3.4 Parameter request/parameter response

Parameter request has 3 parts, request header, request address, request value.
Basic mode request:

Block definition	Byte n	Byte n+1	n
Request header	Request reference	Request ID	0
	Axis-No./DO-ID	No. of parameters = i	2
1st Parameter address	Attribute	No. of elements	4
	Parameter number(PNU)		
	Subindex		
ith Parameter address	…		4+6×(i-1)
1st Parameter value(s) (only for request "Change parameter")	Format	No. of values	4+6×i
	Values		
	…		
ith Parameter values	…		
			4+6×i+…+(Format_n×Qty_n)

Request header:
◆ Request reference
Unique identification of the host's request/response pair. The host can change the identification number for each request.
◆ Request ID
Two kinds of ID: request ID and value change ID.
Value change Please change the value to save to volatile or non-volatile RAM.
◆ Axis-No./DO-ID
Access in Basic mode - Local, not relevant. In Basic mode access - global, Axis-No./DO-ID
Used for shaft number setting under multiple axes.
◆ No. of parameters
Parameter number of the request

Request address：
◆ Attribute
(1)value, (2) parameter description, (3) text description.
◆ Number of elements
◆ Parameter number (PNU)
Parameter number, value range (1-65535)
◆ Subindex
Subindex, value range (0-65534)

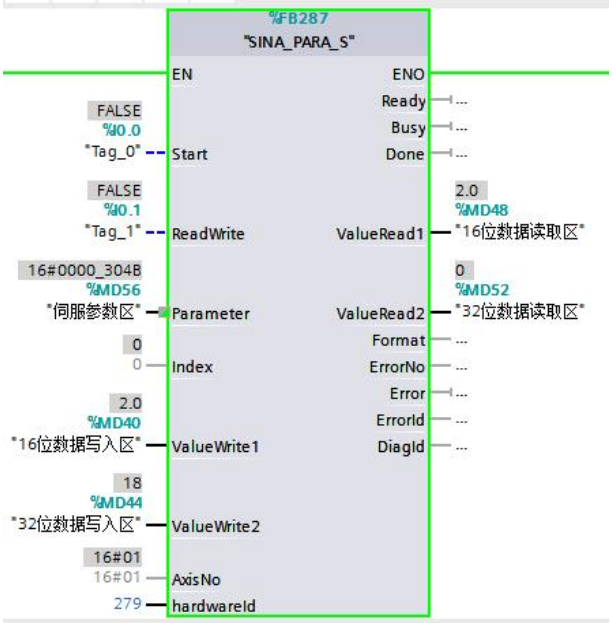
Request value:
◆ Format
Data format, type.
◆ Number of values
◆ Values

Allowed attributes, number of arguments, subindex combinations:

Attribute	No. of elements	Subindex	Related data
Value (single parameter)	0	0	The value(recommended)
	1	0	The value(for compatibility, Don't use for request)
Value (array parameter)	0	0	One value, under subindex 0
	1	0 - m	One value, under subindex
	2 - n[a]	0 - m	Several values, starting with subindex

Value (string parameter)	0	0	The entire string (if the response exceedes the block size, the string is cut at the end to match the block size)
	1	0 - m	One character, under subindex
	2 - n[a]	0 - m	Several characters, starting with subindex
Description	0 (irrelevant)	0	The entire description
	1	1 - 12	One description element
Text (from text array)	1	0 - m	One text(16bytes), under subindex
	2 - n	0 - m	Several texts, starting with subindex
If the number of elements available in the device doesn't match with the number of elements which are requested or shall be changed, an error shall be output.			

In Siemens PLC, aperiodic read and write can be performed through the FB287 function block Sina-Para-S.This function realizes the non-periodic data interaction function of PLC and DS5P driver, which is mainly servo read and write access operation. Currently, only single-parameter operations are supported.

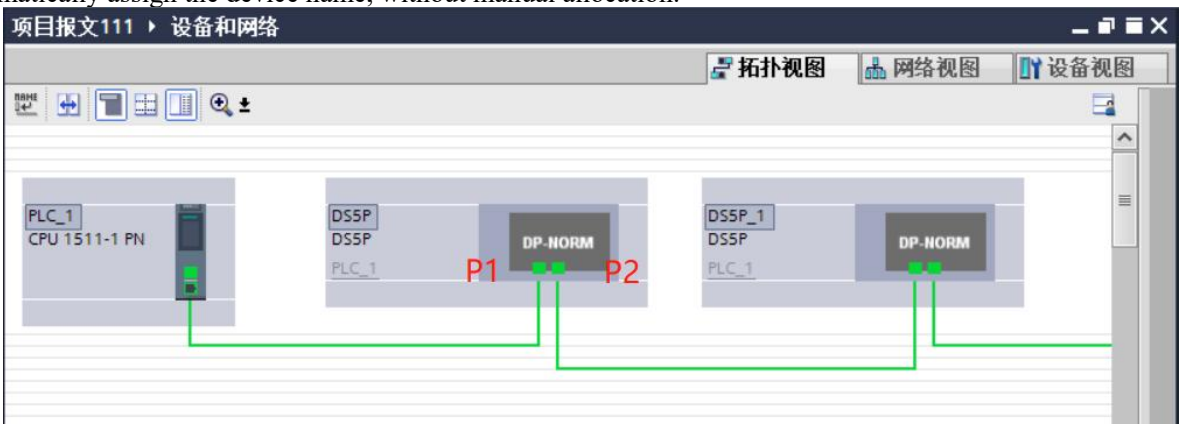


1) For DS5P, AxisNO in SINA_PARA_S starts at 1 by default, and AxisNO is set to 1 regardless of how many servos are behind it, with axes differentiated by hardWare ports.
2) Function block input parameters Parameter_No are set as follows: On the host, the address of Parameter_NO (in hexadecimal format) is set to 0x1000-0x1FFF. The hexadecimal number is added to the function code by 10000, where bit8-bit11 indicates the function code group number (in hexadecimal format). bit0-bit7 indicates bias within the function code group. For example, 0x1000 indicates P0-00. 0x1302 indicates P3-02. 0x150C indicates P5-12. 0x2000 indicates U0-00. 0x3000 indicates F0-00.
3) valueWriter1 is a 16-bit data write area, valueWriter2 is a 32-bit data write area, ValueRead1 is a 16-bit data read area, ValueRead2 is a 32-bit data read area. When the data range of the servo parameter is within the 16-bit data range, the value should be assigned in valueWriter1. When the data range of the servo parameter is outside the 16-bit data range, a value should be assigned in valueWriter2.

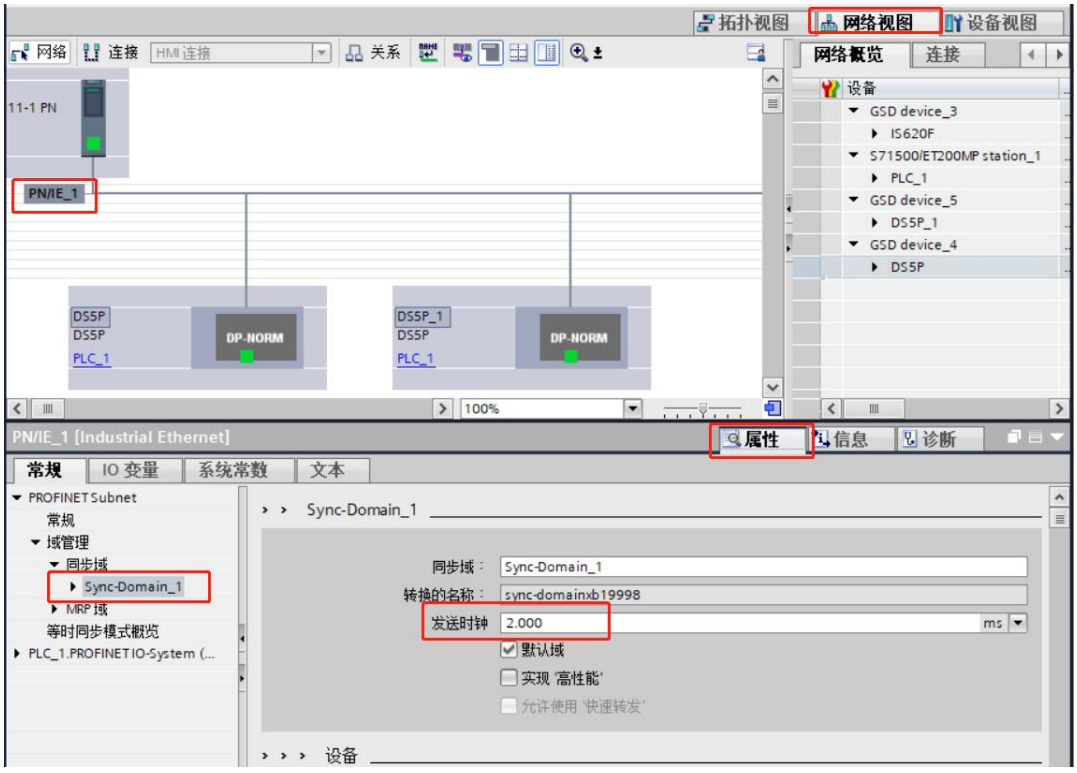
8 Example of configuring the IRT mode

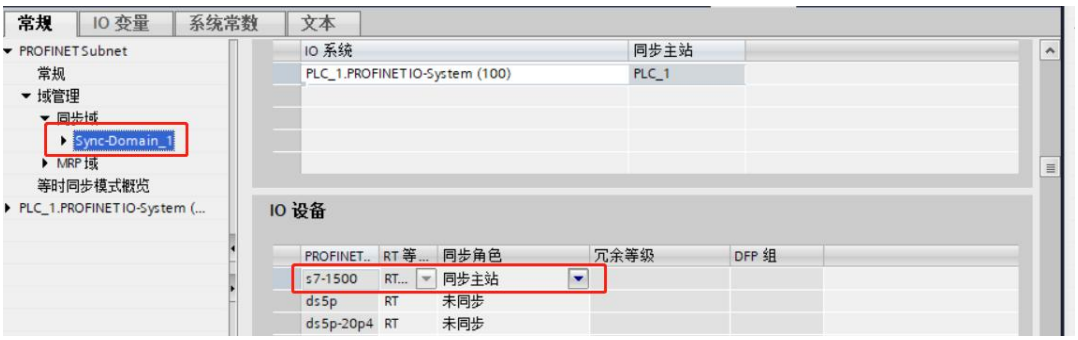
8.1 IRT project configuration

1. In the topology view, the configuration connection must be based on the actual physical connection (that is, the configuration connection must be consistent with the actual connection). Note: RT mode topology view can't be connected, IRT mode must be connected, S7-1200 PLC doesn't support IRT. And in the case of topology view connection, if the servo has just been factory application, in the case of no device name, the PLC will automatically assign the device name, without manual allocation.

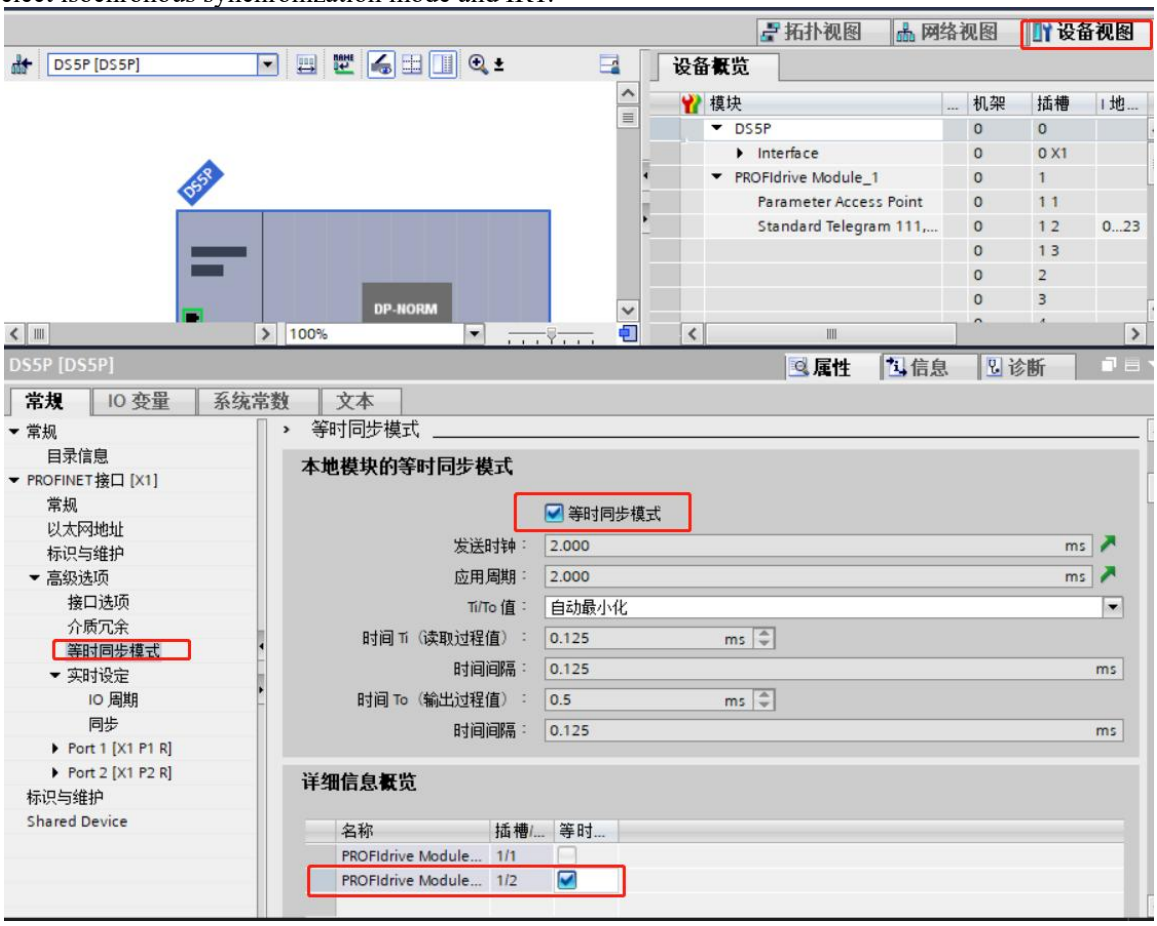


2. Modify the synchronization time: When configuring Profinet IRT communication in the network view, note that the minimum communication time of the current DS5P is 1ms.

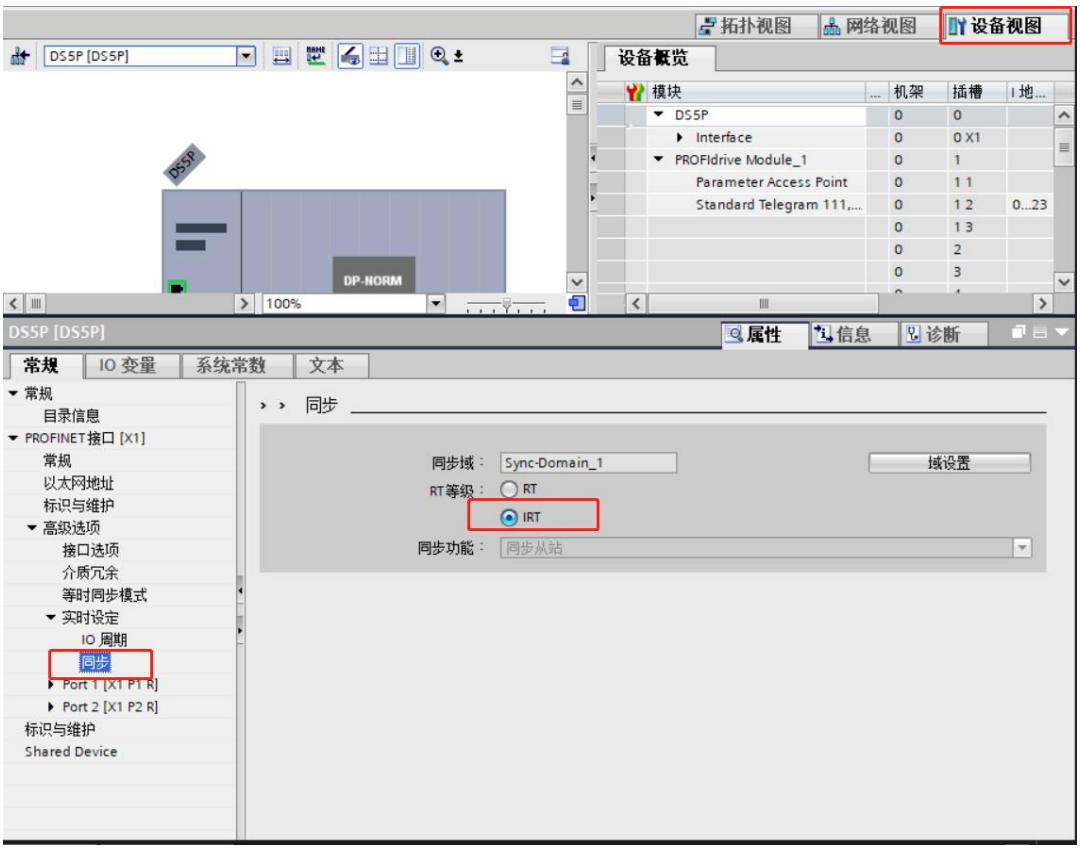




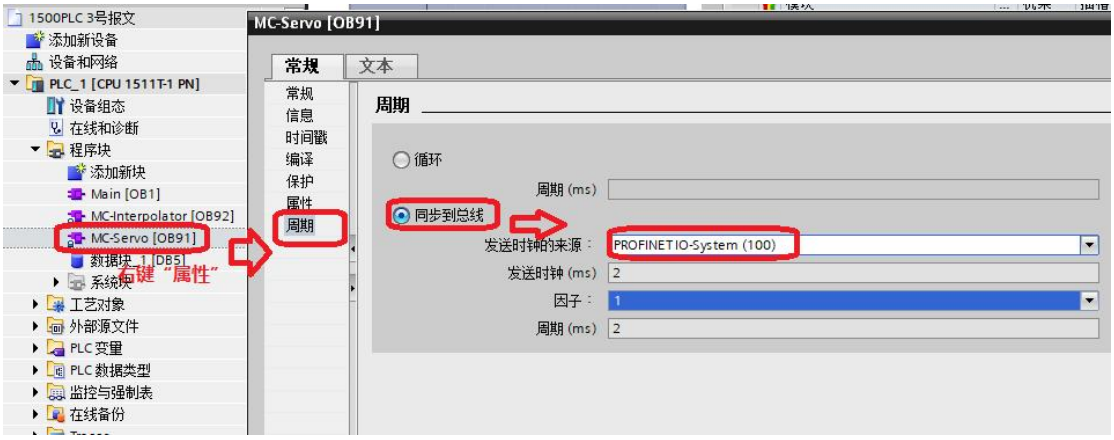
3. Select isochronous synchronization mode and IRT.



4. Select IRT.



5.Right-click OB91 and select "Sync with Bus option". Note: If the CPU performance is low, you need to consider adjusting the Factor parameter to 4 or 8 to reduce the CPU load.



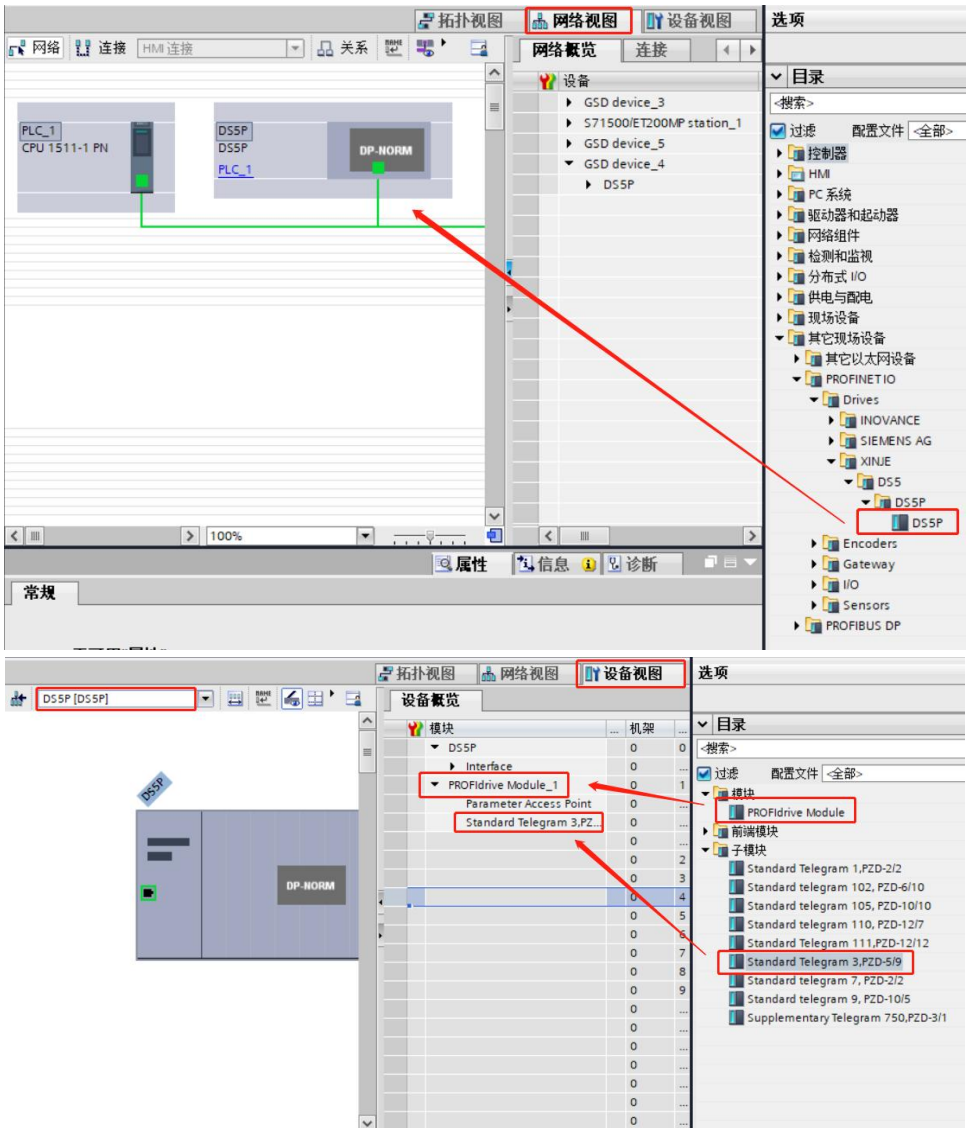
The IRT configuration is complete.

9 Application example of message 3/102

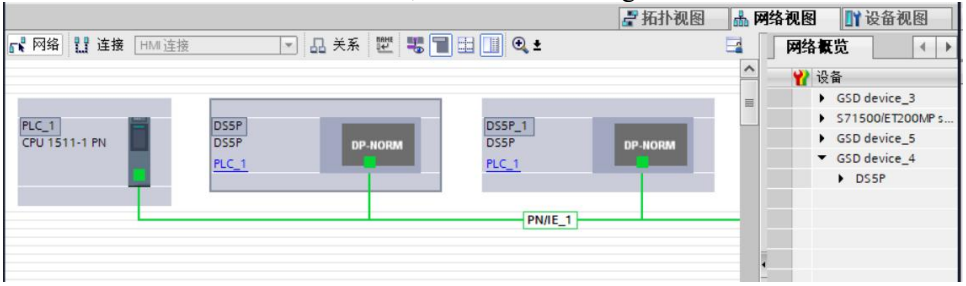
9.1 S7-1500 PLC message 3 configuration setting

9.1.1 Configuration setting

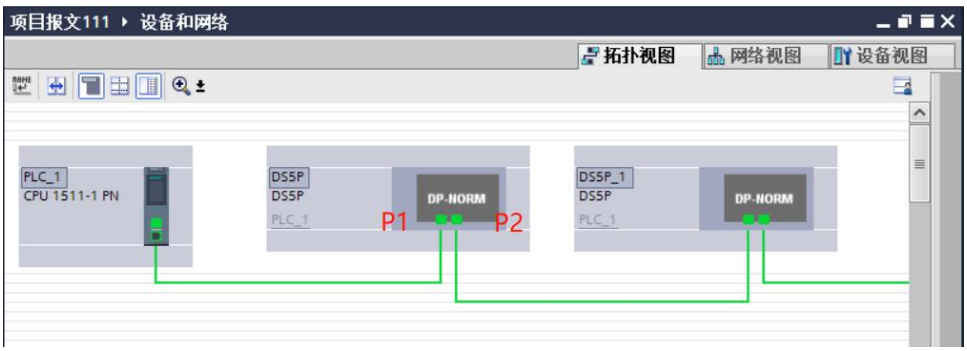
1. Configuration of DS5P and add message 3, as shown in the following figure:



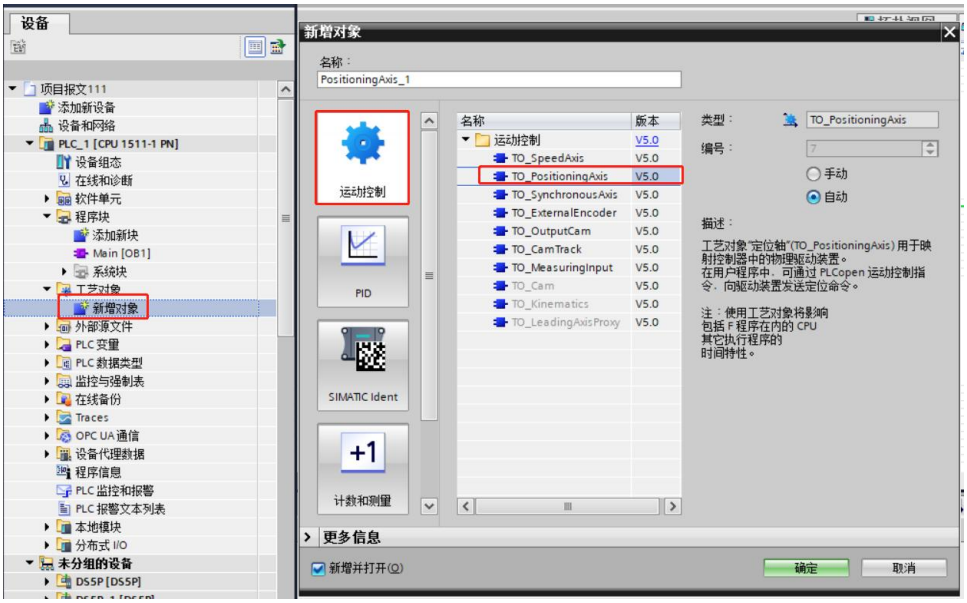
2. Connect the PLC to DS5P in the network view, as shown in the figure:



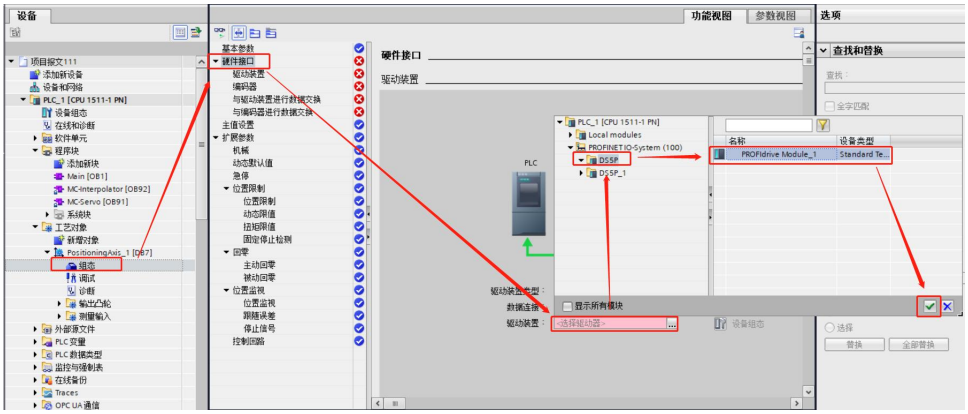
3. If IRT communication between PLC and DS5P is required, the topology view must be connected, and the actual physical connection must be consistent with the configuration. If only RT communication is performed (default), the topology view can be disconnected.



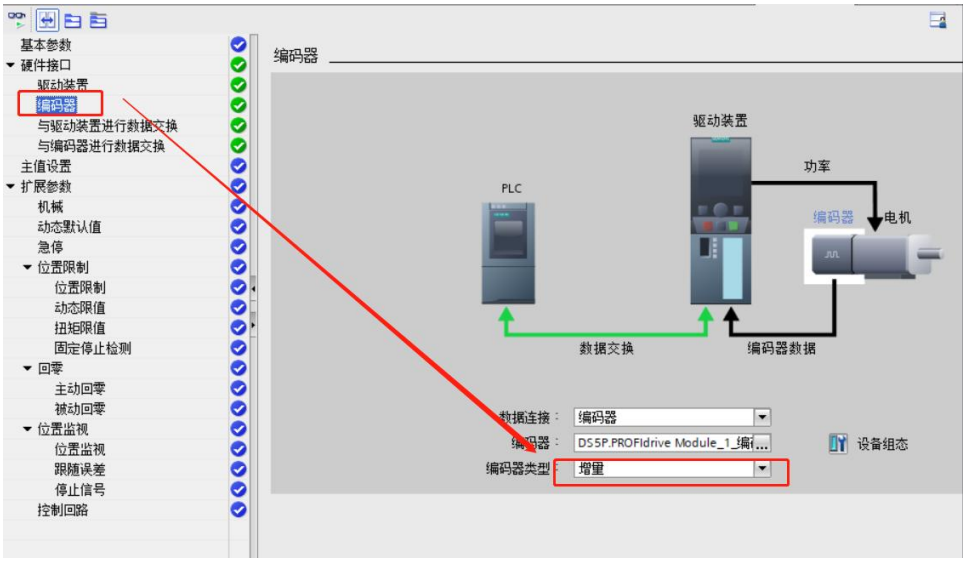
4. Then add the positioning axis, as shown in the figure:



5. Then select "Profidrive" and "Standard message 3" in the configuration setting, as shown in the figure:



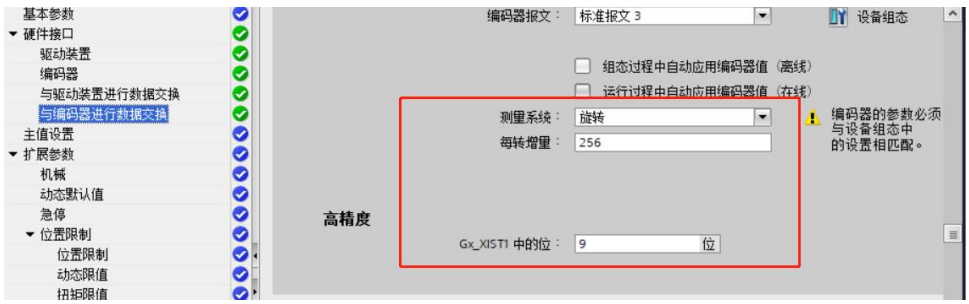
6. Then select the encoder type. If P0-79=1 (incremental position mode), select "Increment" for encoder type.



7. If P0-79=0 or 2 (absolute position linear mode), select "Cyclic Absolute encoder" as the encoder type.

8. For the reference speed, maximum speed and reference torque of the motor, "Automatic application of drive value during operation" cannot be checked, and it needs to be manually set according to the driver parameters. The reference speed is the rated speed of the motor and the maximum speed.

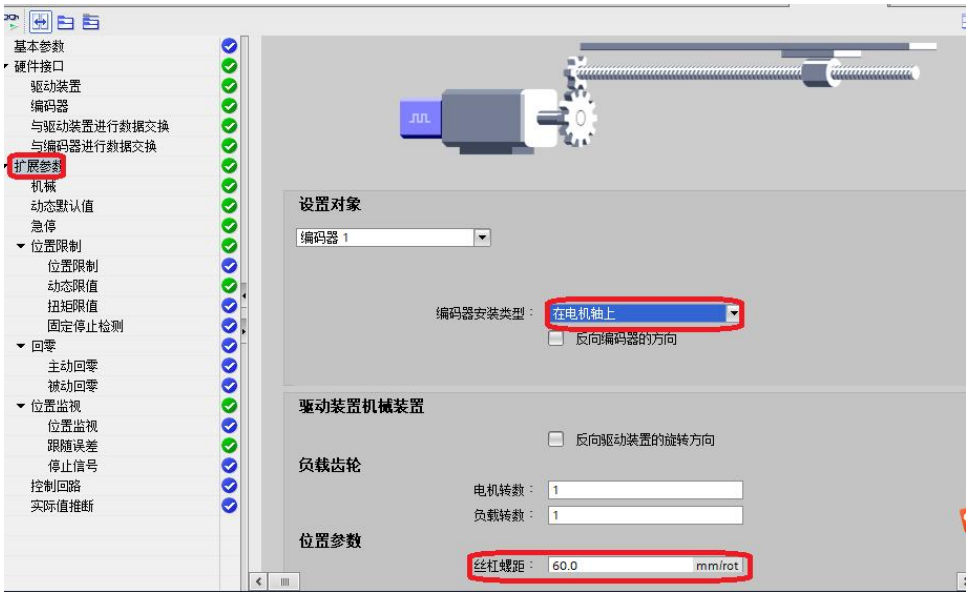
9.For Data exchange with encoder, if Automatically apply encoder value during running is not selected, the following configuration is required: If P0-79=1 (incremental position mode) and encoder type is set to Incremental, the following configuration is required.



The bit 15 in Gx_XIST1 in the figure above is changed to 9.

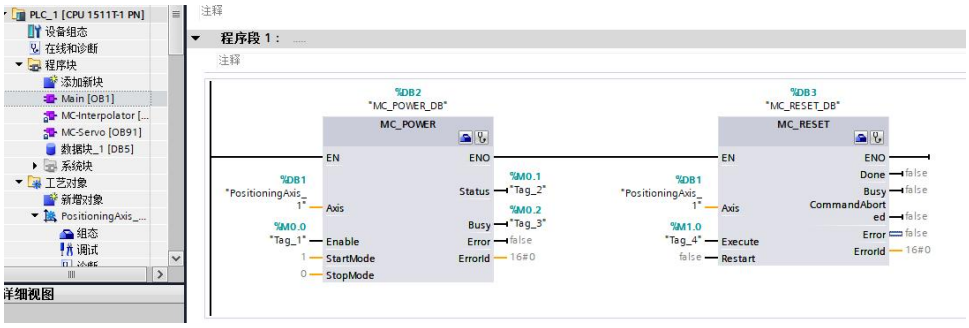
If P0-79=0 or 2 (absolute position linear mode), select Cyclic Absolute Encoder as the encoder type.

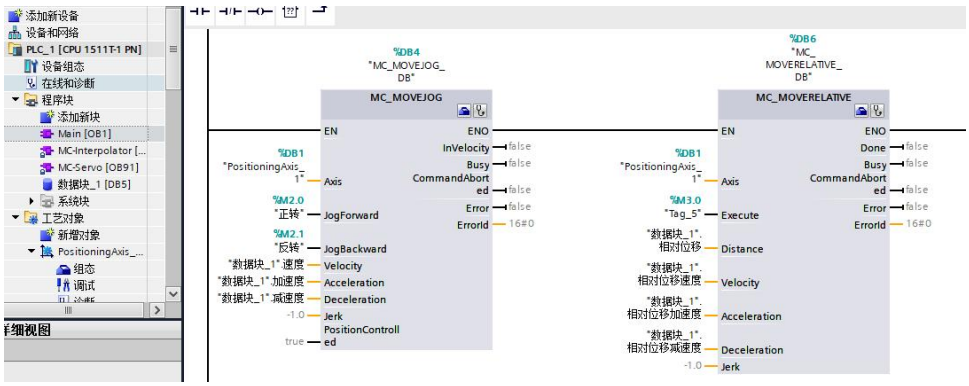
Then the extension parameters are set, the encoder installation type is selected as "on the motor shaft", and the position parameters are set.



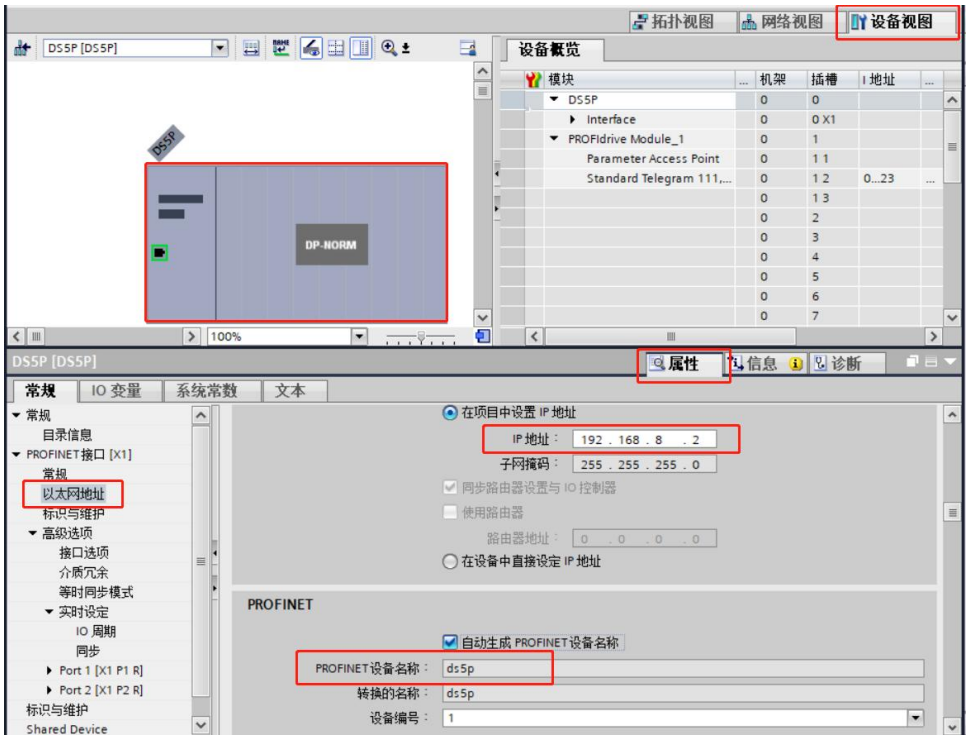
10.Disable the Enable Tracking Error Monitoring option. If this option is selected and the tracking error is set to a small value, the host may report errors when the function is enabled.

11. Write programs in the main program:



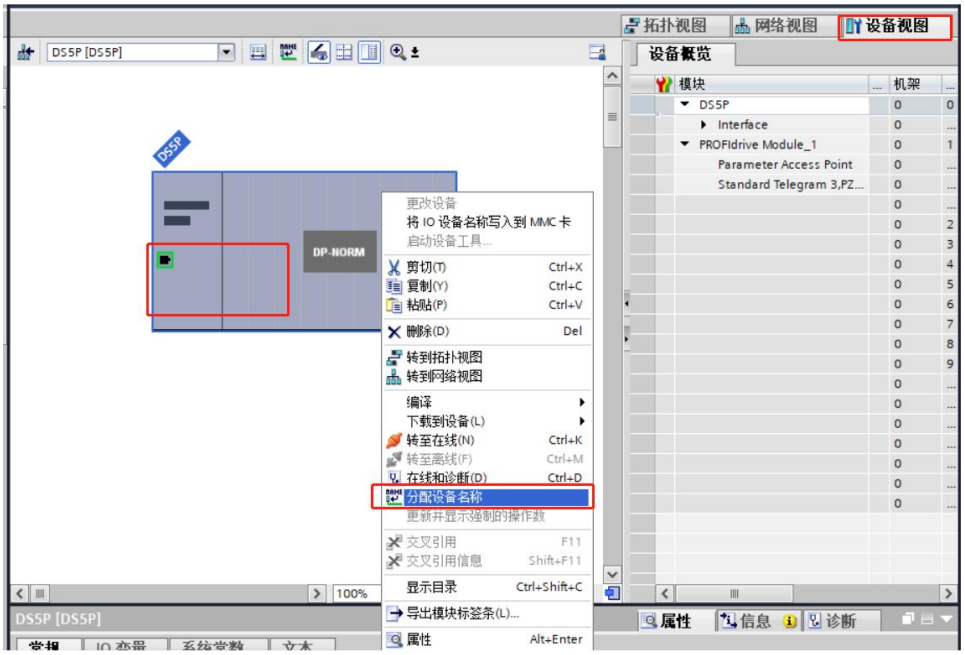


12.Double click on the DS5P device in the device view to set the IP address and device name for the DS5P, as shown in the figure:

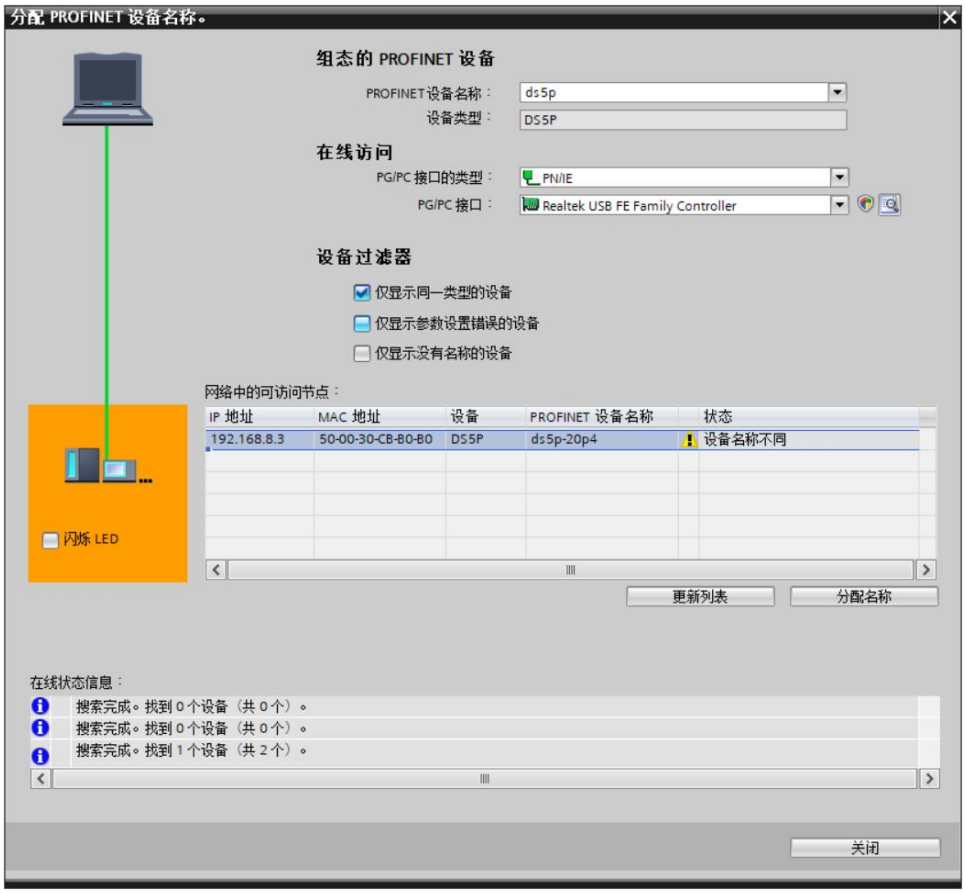


13.Download the PLC program, as shown in the following figure:

14.After downloading, monitor the PLC for any errors and ensure that the servo panel is in bb state. If there are any issues, right-click on DS5P in the device view and select Assign Device Name, as shown in the figure:



15.Finally, assign the device name to DS5P, first click "Update list", select the servo to be assigned, and then click "Assign device name", after completion, you can click "Update list" to observe whether the device name has been modified, and check whether the servo status and PLC status errors have been eliminated.



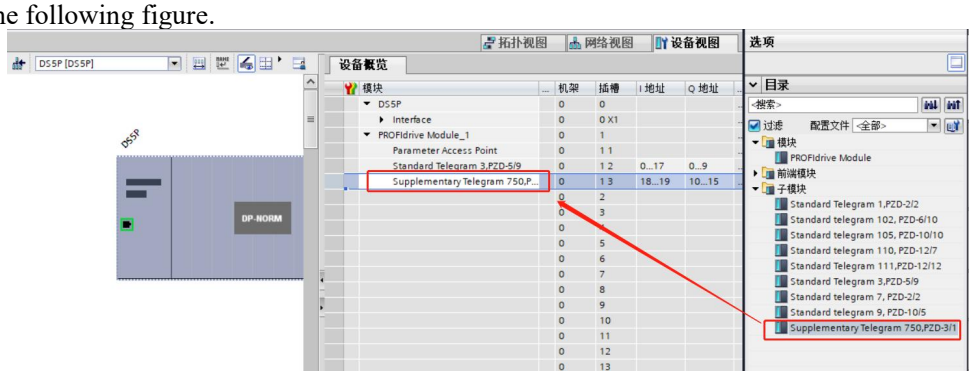
The configuration and programming of message 3 are complete.

When creating a closed-loop motion control process object, the S7-1200/1500 PLC automatically creates a process block for executing the process object, where MC_Servo [OB91] is used for the calculation of the position controller. MC_Interpolator [OB92] used to generate setpoints, evaluate motion control instructions, and position monitoring functions. The frequency relationship between the two tissue blocks is always 1:1, and MC_Servo

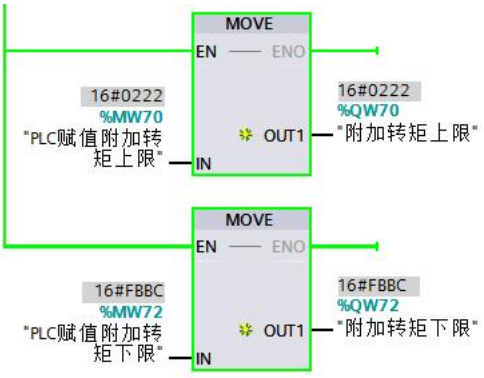
[OB91] is always executed before MC_Interpolator [OB92]. According to the control quality and system load requirements, the MC_Servo [OB91] application cycle call time can be specified. If the cycle time is too short, CPU overflow may cause CPU shutdown. Right mouse button OB91 tissue block, in the pop-up OB91 properties dialog box can modify its cycle time, according to the number of axes used to set the motion control application cycle, motion control application cycle time =2ms+ (the number of position control axes *2ms).

9.2 Message 3+750 torque limiting and read function

1. Support the message 3+750 torque limiting function. First, import the message 3+750 into the device manager, as shown in the following figure.



2. Set value for torque upper limit MW70, torque lower limit MW72. Note: the torque upper limit must be ≥0, the torque lower limit must be ≤0.



9.3 Example of message 105+750

In practical applications, it is not only necessary to control the position and speed of the shaft, but also sometimes to control the torque of the motor. The S7-1500(T) PLC and the control system are used to achieve torque control through 105+750 messages, and 750 additional messages are used to achieve the torque limiting of the shaft and the setting of additional torque. The MC_TorqueAdditive command is used to specify additional torque for the process object's drive, and the MC_TorqueRange command is used to specify the upper and lower limits of torque for the process object's drive.

Note:

① Whether the drive is in torque mode can be judged by bit14 of status word 1 of 105 packet. bit14=1 is torque mode, and bit14=0 is speed mode.

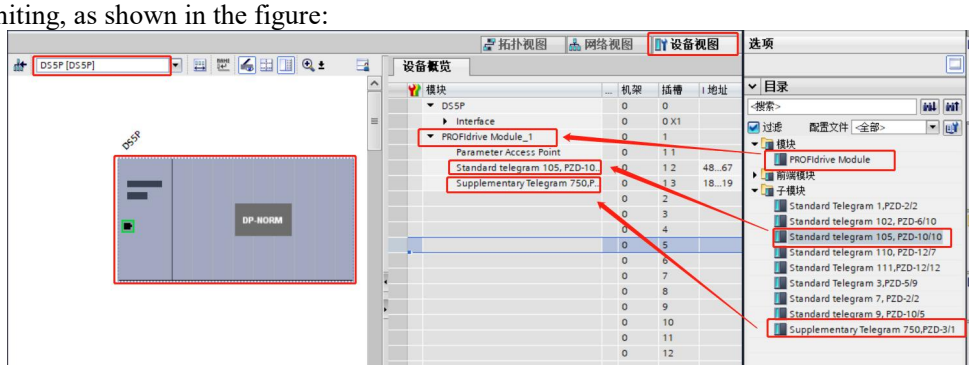
② "MC_TorqueAdditive" : Press "Enable=True" to activate the additional torque setting function of the drive and specify the additional torque setting Value in "value". You can modify the set value of the additional torque in real time. Remove the additional torque setting function of the drive by "Enable=False".

③ MC_TorqueRange: You can run the Enable=True command to activate the torque upper and lower limits of the drive, specify the upper limit of the torque in UpperLimit, and specify the lower limit of the torque in LowerLimit to change the upper and lower limits of the torque in real time, and run the Enable=False command to remove the torque upper and lower limits of the drive.

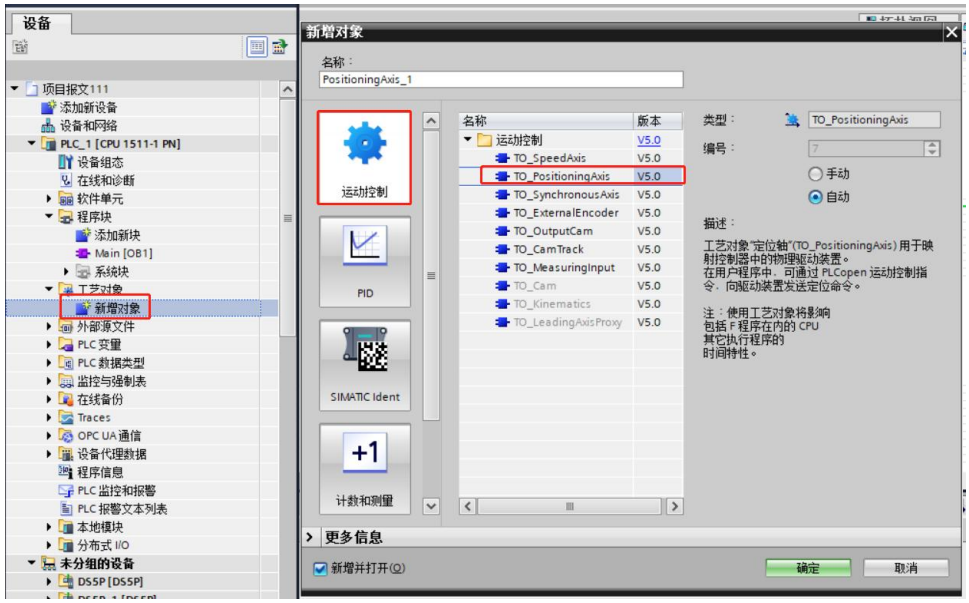
④ The DSC function of message 105 is not supported, so it must be noted that the DSC function cannot be enabled when applying the configuration configuration of message 105, as shown in the following figure.

9.3.1 The message 105+750 torque mode setting

1. Install the GSD file of DS5P in the TIA Portal software, and configure 105 and 750 messages in "Device View". Message 105 are used for shaft motion control, and 750 additional messages are used for attaching torque setting and torque limiting, as shown in the figure:

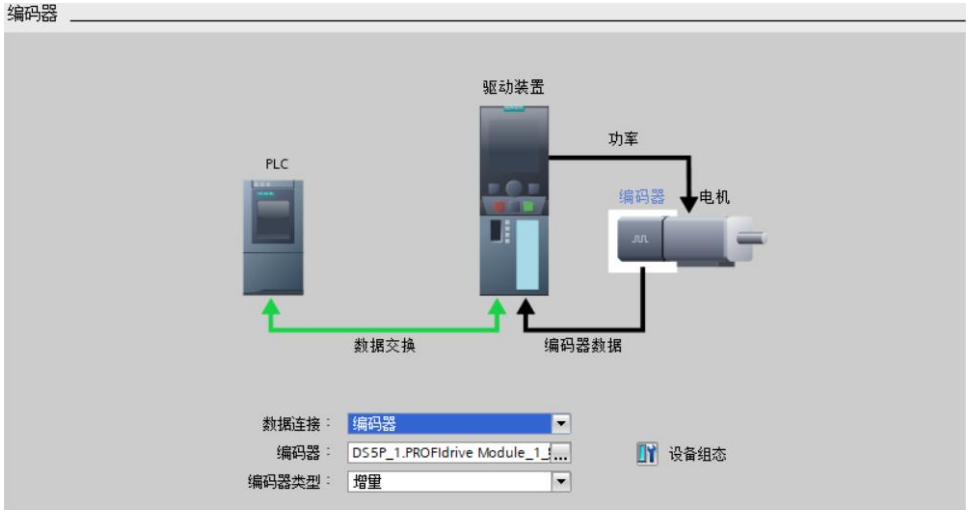


2. Create a new process object, and the axis can be configured in linear mode, as shown in the figure:



3. Select message 105 in the driver device, as shown in the figure:

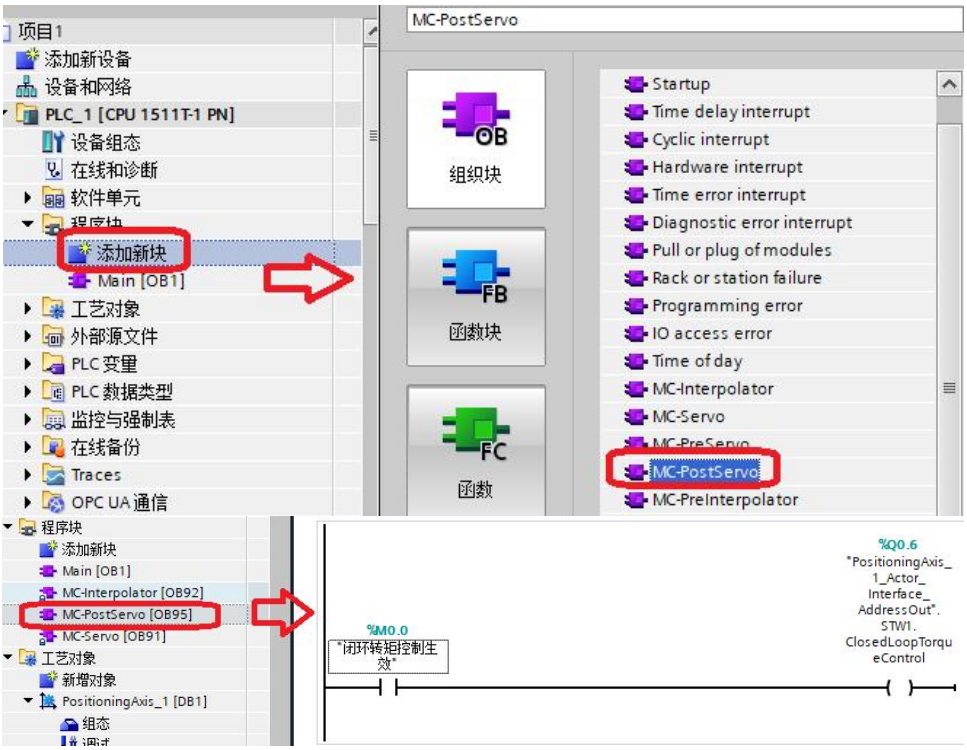
4. If P0-79=1 (increment position mode), select increment in Encoder Type, as shown in the figure:



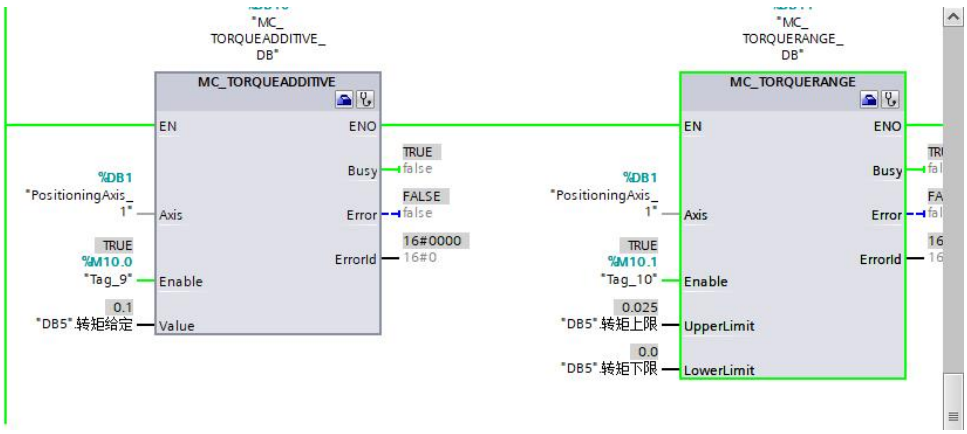
5. For the reference speed, maximum speed and reference torque of the motor, "Automatic application of drive value during operation" cannot be checked, and it needs to be manually set according to the driver parameters. The reference speed is the rated speed of the motor, and the maximum speed is the maximum torque of the servo. The reference torque is the maximum servo torque of the motor. As shown in the figure：

6. Due to the application of torque mode, "Enable following error monitoring" cannot be checked, as shown in the figure:

7. Add the MC_PostServo function block to the program block, in which the closed-loop torque control mode is turned on, as shown in the figure:



8. Call MC_Power, MC_TorqueAdditive, MC_TorqueRange function blocks in the OB1 main program, as shown in the figure:



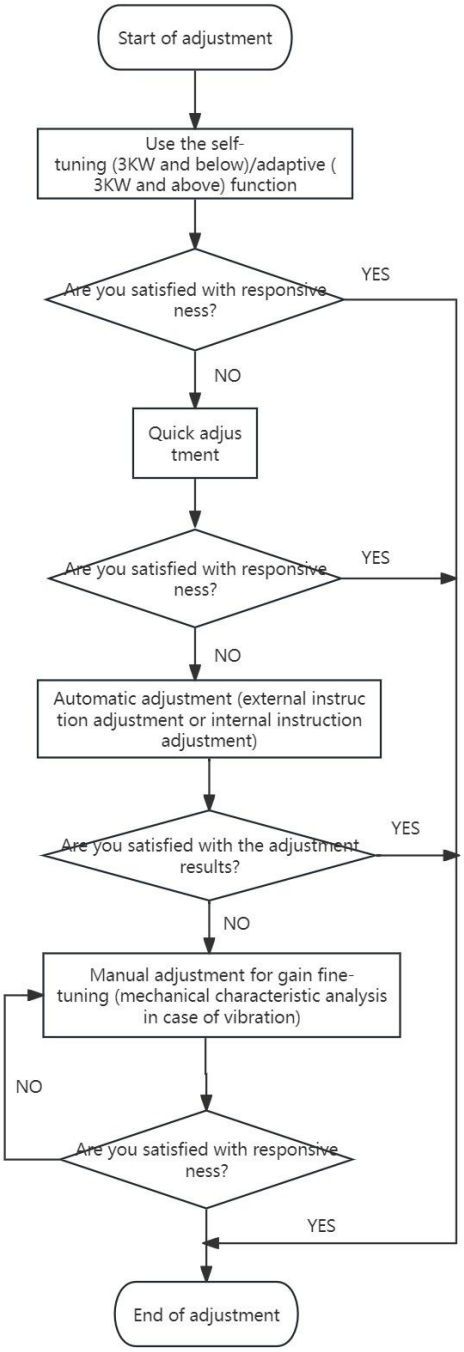
The torque limit is that both the message limit and the internal torque limit are valid at the same time, and whichever torque limit is small is used.

10 Servo gain adjustment

10.1 Overview of servo gain adjustment

10.1.1 Overview and process

The servo drive needs to drive the motor as quickly and accurately as possible to track instructions from the upper computer or internal Settings. In order to achieve this requirement, the servo gain must be adjusted reasonably.
The factory value of servo gain is adaptive mode, but different machines have different requirements for servo responsiveness. The following figure shows the basic gain adjustment process. Please make adjustments according to the current machine status and operating conditions.



Note: * Marked as 3730 version, versions below 3730 are default adaptive mode.

10.1.2 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	Medium	150ms	P2-05 Adaptive speed loop gain P2-10 Adaptive velocity loop integration P2-11 Adaptive position loop gain P2-07 Adaptive inertia ratio P2-08 Adaptive speed observer gain P2-12 Adaptive Stable Maximum Inertia Ratio
Auto-tuning	Fast adjusting	P2-01.0=0	High	10～50ms	P0-07 First inertia ratio P1-00 Velocity loop gain P1-01 Velocity loop integral P1-02 Position loop gain P2-35 Torque instruction filter time constant 1 P2-49 Model loop gain
	Automatic adjustment		High	10ms	
	Manual adjusting		High	By parameter	

10.2 Rotary inertia presumption

10.2.1 Overview

The moment of inertia calculation is the function of calculating the moment of inertia of the load during operation by automatic operation of the driver (through forward rotation and reverse).
The moment of inertia ratio (the ratio of the moment of inertia of the load to the moment of inertia of the motor rotor) is the reference parameter for performing the gain adjustment and must be set to the correct value as far as possible.

Parameters	Meaning	Default setting	Unit	Setting range	Modify	Effective
P0-07	The first inertia ratio	500	%	0～50000	Anytime	At once

10.2.2 Notes

Occasions where inertia cannot be presumed

- Mechanical systems can only operate in one direction.

Occasions 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

- Since both directions are rotatable 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 presumed inertia under default parameters runs jitter, indicating that the present load inertia is too large, please switch to large inertia mode (P2-03.3=1) and operate again. It is also possible to set the initial inertia to about twice the current one and execute again under larger loads.
- Driver inertia ratio recognition upper limit is 200 times (parameter upper limit is 20000). If the estimated inertia ratio is exactly 20000, it means that the inertia ratio has reached the upper limit and can't be used,

please replace the motor with larger rotor inertia.

Other notes

- At present, the inertia switching function is not 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).

10.2.3 Operating tool

The tools for calculating the moment of inertia of the load are the driver panel and XinJeServo PC software.

Operating tool	Description
Driver panel	Driver firmware needs 3700 and above version
XinJeServo software	All versions of software supported

Note: The driver firmware version is viewed through U2-07.

10.2.4 Operation steps

Estimate the inertia through the driver panel

1. Parameter configuration

Parameter	Description	Default setting	Unit	Range	Modify	Effective
P2-15	Inertia configured trip	100	0.01 circle	1~300	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

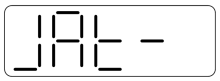
The recommended parameters of P2-17 are 500 rpm or more. Low instruction speed will lead to inaccurate identification of inertia ratio.

2. Execute the inertia identification

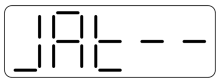
Before inertia identification, please confirm the direction of servo rotation by using F1-00 jog motion function. Initial direction of servo operation is determined by INC or DEC at the beginning of inertia identification.

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!

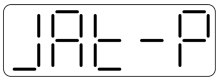
Servo entering parameter F0-07 in bb state:

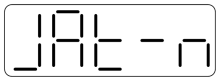


Press ENTER, servo is enabled:



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



or


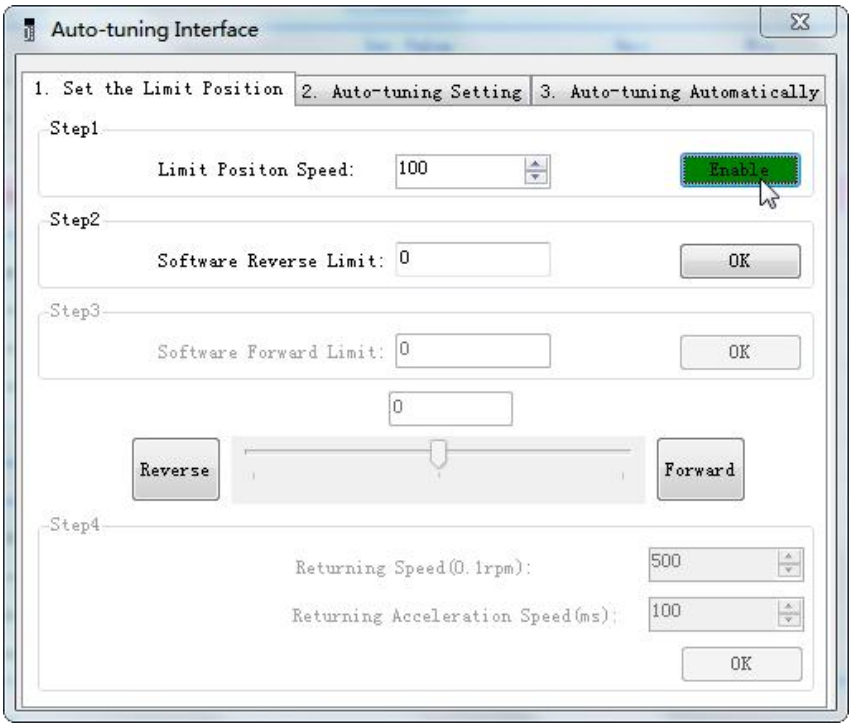
At this point, start action, under the condition of P-05 = 0 (initial positive direction), if press INC, then turn forward and then reverse. If press DEC, turn reverse and then forward. If the inertia identification is successful, the load inertia ratio is prompted and written to P0-07 automatically 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

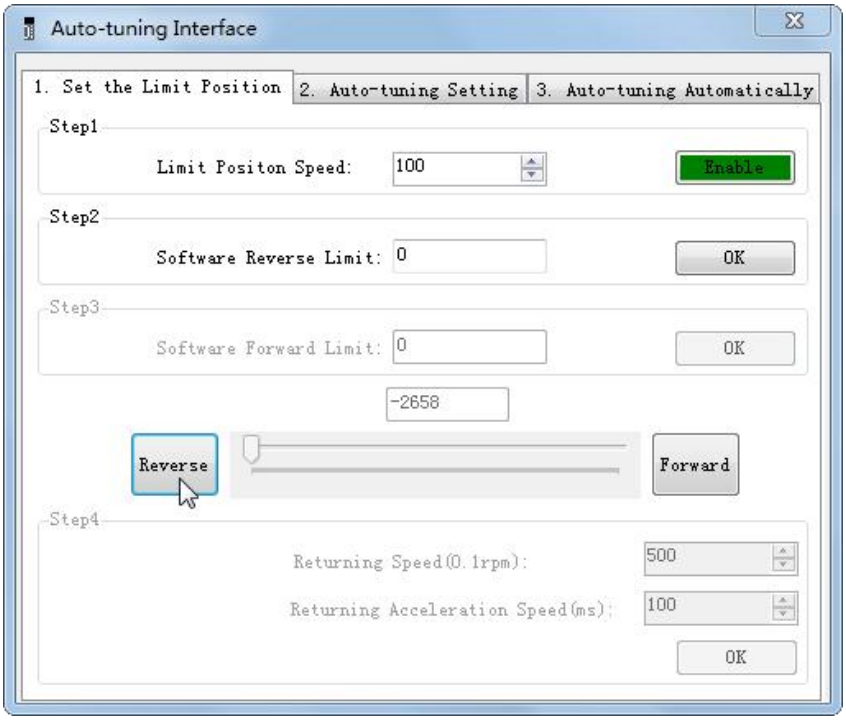
Error code	Meaning	Reasons and solutions	Reasons
Err-1	Motor Torque Saturation	① Initial inertia is too small. in adaptive mode, switch to large inertia mode P2-03.3=1 or the initial inertia of inertia identification P2-18 set to 2 times of the present value. ② The maximum speed is too high (P2-17), 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	Deviation 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	Driver internal trip calculation error	Unhandled vibration occurs	Unhandled vibration occurs
Err-6	Driver is not 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

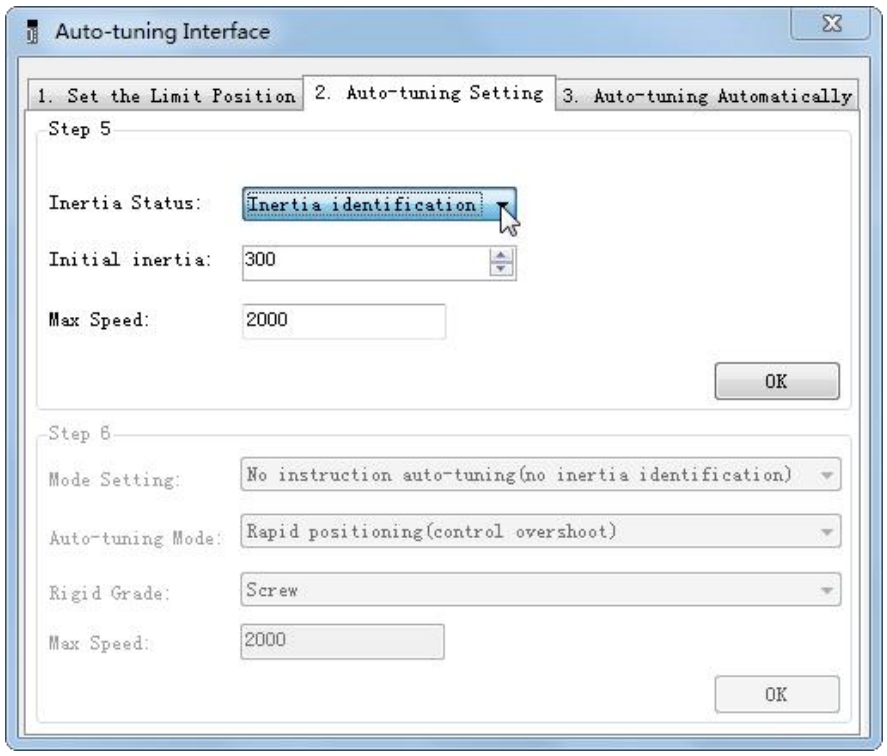
1. Click auto-tuning on the main interface of XinJeServo.



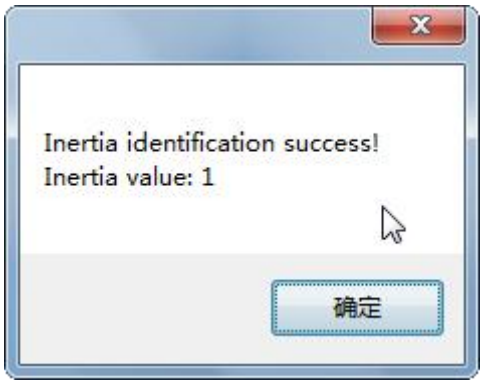
2. Select jog setting or manual setting to configure the inertia estimation trip.



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.

10.3 Fast adjustment

10.3.1 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. Servo firmware version 3640 and later versions support this function, and the version is viewed through U2-07. Fast adjustment of gain parameters belongs to auto-tuning mode.

10.3.2 Fast adjustment steps

1. Use the driver panel or XinJeServo PC software to calculate the load inertia, refer to 10.2. Calculation of moment of inertia.
2. Disable the adaptive mode and change P2-01.0 to 0.
3. Set the required stiffness level P0-04.

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

P2-01=n. 0 0 1 0
↳ P2-01.0

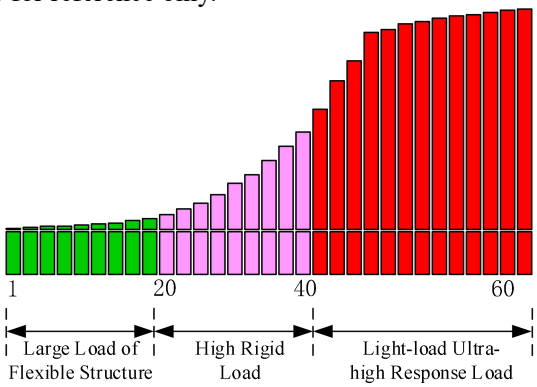
10.3.3 Rigidity level corresponding gain parameters

■ 3700 and later firmware rigidity classes

P0-04 Rigidity level	P1-00 Speed loop gain	P1-01 speed loop integral	P1-02 Position loop gain	P2-35 Torque instruction filter	P2-49 Model loop gain(version 3700~3720)	P2-49 Model loop gain(3730 and above)
1	20	31831	20	100	50	50
2	50	12732	50	100	80	80
3	70	9094	70	100	90	90
4	80	7957	80	100	100	100
5	100	6366	100	100	100	120
6	120	5305	120	100	150	150
7	140	4547	140	100	150	200
8	160	3978	160	100	200	250
9	180	3536	180	100	250	310
10	200	3183	200	100	300	350
11	220	2893	220	100	300	380
12	240	2652	240	100	350	410
13	260	2448	260	100	350	440
14	280	2273	280	100	350	470
15	300	2122	300	100	400	500
16	320	1989	320	100	400	540
17	340	1872	340	100	400	580
18	360	1768	360	100	450	620
19	380	1675	380	100	450	660
20	400	1591	400	100	500	700
21	450	1414	400	90	600	800
22	500	1273	450	80	700	950
23	550	1157	450	70	800	1100
24	600	1061	500	60	900	1300
25	650	979	550	50	1000	1500
26	700	909	600	40	1100	1800
27	750	848	650	30	1200	2100
28	800	795	700	20	1300	2400
29	850	748	750	10	1400	2700
30	900	707	800	10	1500	3000
31	950	670	900	10	1500	3100
32	1000	636	900	10	1600	3200

P0-04 Rigidity level	P1-00 Speed loop gain	P1-01 speed loop integral	P1-02 Position loop gain	P2-35 Torque instruction filter	P2-49 Model loop gain(version 3700~3720)	P2-49 Model loop gain(3730 and above)
33	1050	606	950	10	1800	3300
34	1100	578	1000	10	2000	3400
35	1150	553	1050	10	2200	3500
36	1200	530	1100	10	2400	3600
37	1250	509	1100	10	2500	3700
38	1300	489	1100	10	2600	3800
39	1350	471	1200	10	2700	3900
40	1400	454	1200	10	2800	4000
41	1450	439	1250	10	2900	4100
42	1500	424	1300	10	3000	4200
43	1550	410	1350	10	3200	4300
44	1600	397	1400	10	3500	4400
45	1650	385	1450	10	3800	4500
46	1700	374	1500	10	4000	4600
47	1750	363	1750	10	4500	4800
48	1800	353	1800	10	5000	5000
49	1850	344	1850	10	5000	5000
50	1900	335	1900	10	5000	5000
51	1950	326	1950	10	5000	5000
52	2000	318	2000	10	5000	5000
53	2050	310	2050	10	6000	6000
54	2100	303	2100	10	6000	6000
55	2150	296	2150	10	6000	6000
56	2200	289	2200	10	6000	6000
57	2250	282	2250	10	6000	6000
58	2300	276	2300	10	6000	6000
59	2350	270	2350	10	6000	6000
60	2400	265	2400	10	6000	6000
61	2450	259	2450	10	6000	6000
62	2500	254	2500	10	6000	6000
63	2600	244	2600	10	6000	6000

The rigidity class should be set according to the actual load, the larger the P0-04 value, the larger the servo gain. If vibration occurs in the process of increasing the rigidity level, it is not appropriate to continue to increase, if vibration suppression is used to eliminate vibration, you can try to continue to increase. The following rigidity levels for recommended loads are 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 3640 version	Rigidity level for firmware 3700 and higher versions
1.5kw and above	P1-00=200 P1-01=3300 P1-02=200 P2-35=100 P2-49=300	2	10
200w～750w	P1-00=300 P1-01=2200 P1-02=300 P2-35=100 P2-49=400	3	15
100w	P1-00=400 P1-01=1650 P1-02=400 P2-35=100 P2-49=500	4	20

10.3.4 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.
- At present, the gain switching function is not supported, and the second gain parameters such as P1-05, P1-06, and P1-07 are invalid.

10.4 Auto-tuning adjustment

10.4.1 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)

10.4.2 Notes

Untunable occasions

- 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.

10.4.3 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	All versions of upper computer software support
	Driver panel	Drive firmware requires version 3700 and above

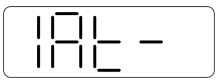
Note: please check the driver firmware version through U2-07.

10.4.4 Internal instruction auto-tuning step

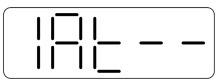
Driver panel auto-tuning steps

1. The inertia identification is carried out, and the inertia estimation steps please refer to chapter 6.2.4 operation steps.

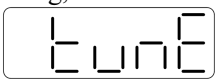
2. Enter F0-09, panel display is iat-.



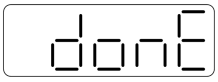
3.Press ENTER, panel display is iat--, servo is in enabled status right now.



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

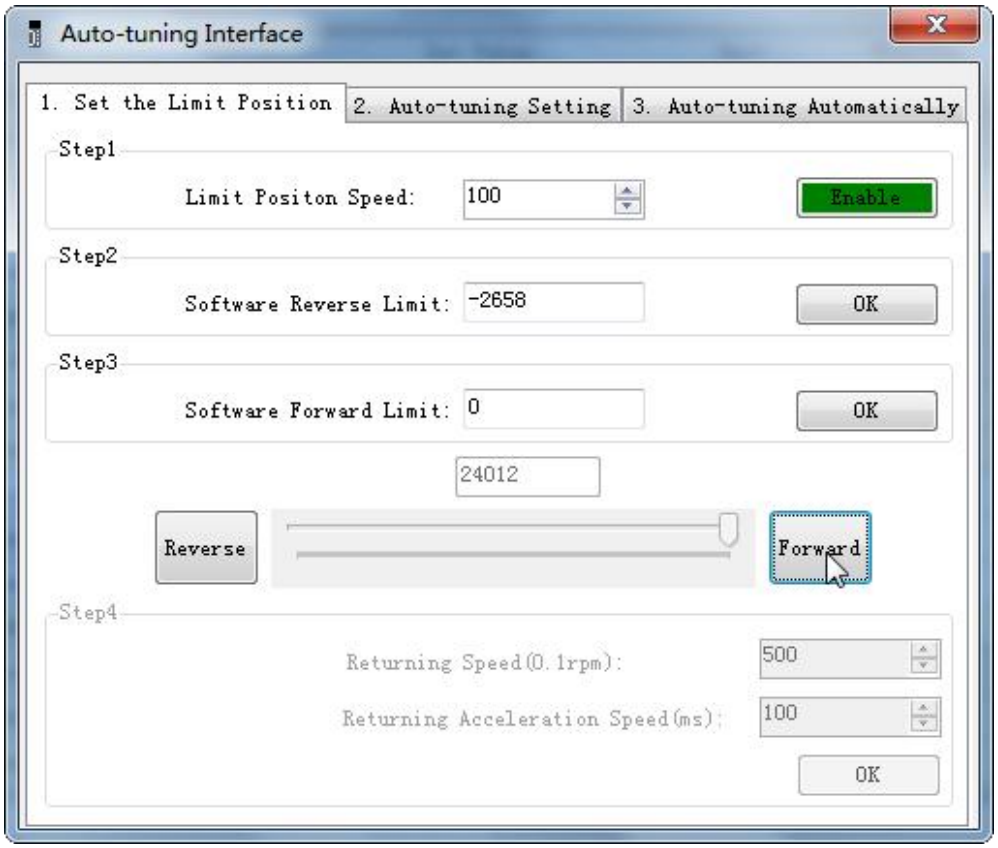
Note: In the process of auto-tuning, press STA/ESC will exit the auto-tuning operation and use the gain parameters at the exit time. If auto-tuning fails, it is necessary to initialize the driver before auto-tuning again.

■ Panel alarm in auto-tuning process

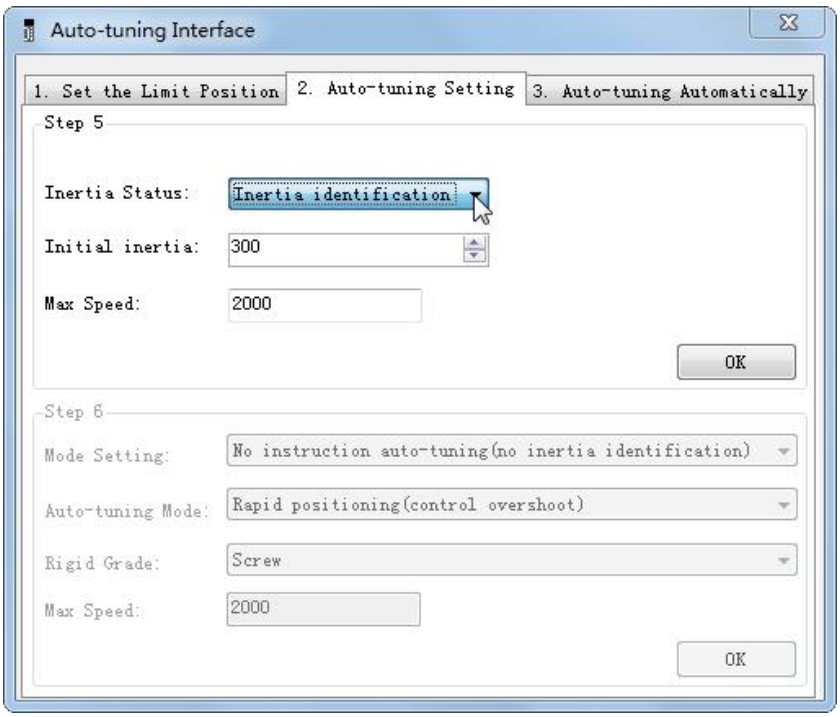
Error code	Meaning	Reasons
Err-1	Fail to search for optimal gain	Too large inertia ratio. Too weak rigidity of mechanism
Err-2	Overtrip alarm in auto-tuning process	Please make sure that there is no overrun and alarm before auto-tuning.
Err-6	Driver is not in "bb" state at the time of operation	Please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

XinJeServo software auto-tuning steps

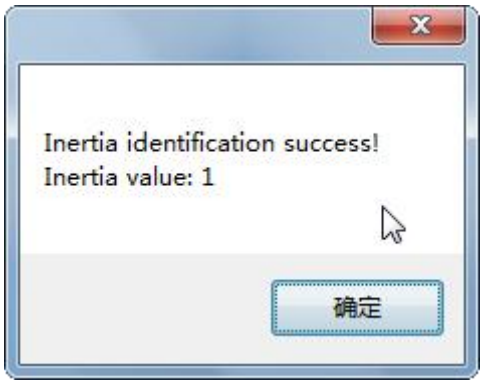
1. Click auto-tuning on the XinJeServo software main interface
2. Set the auto-tuning trip in jog mode or manually



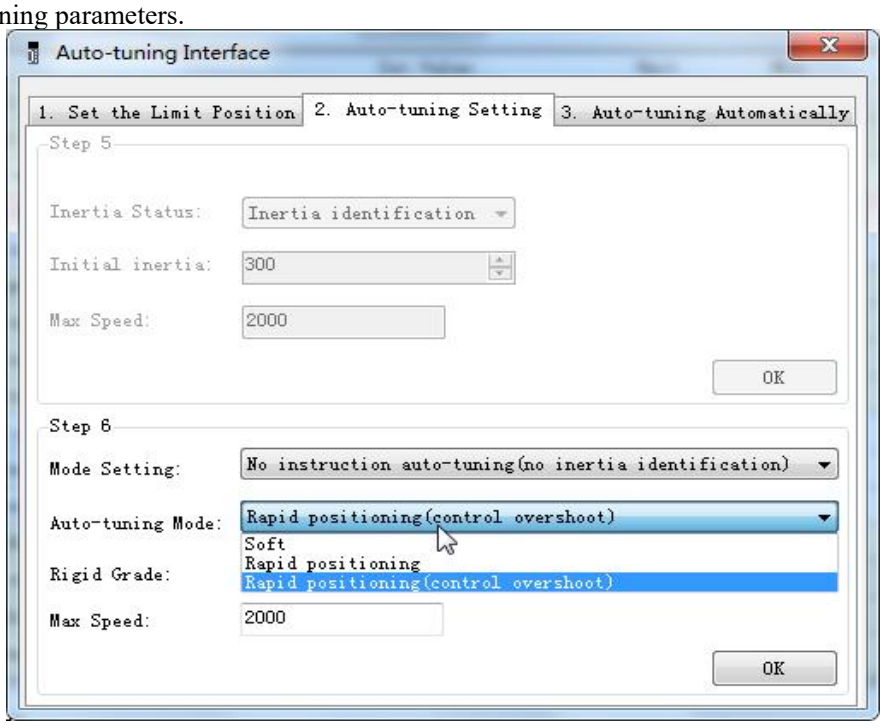
3. Set the auto-tuning interface.



4. Click ok to estimate the inertia.



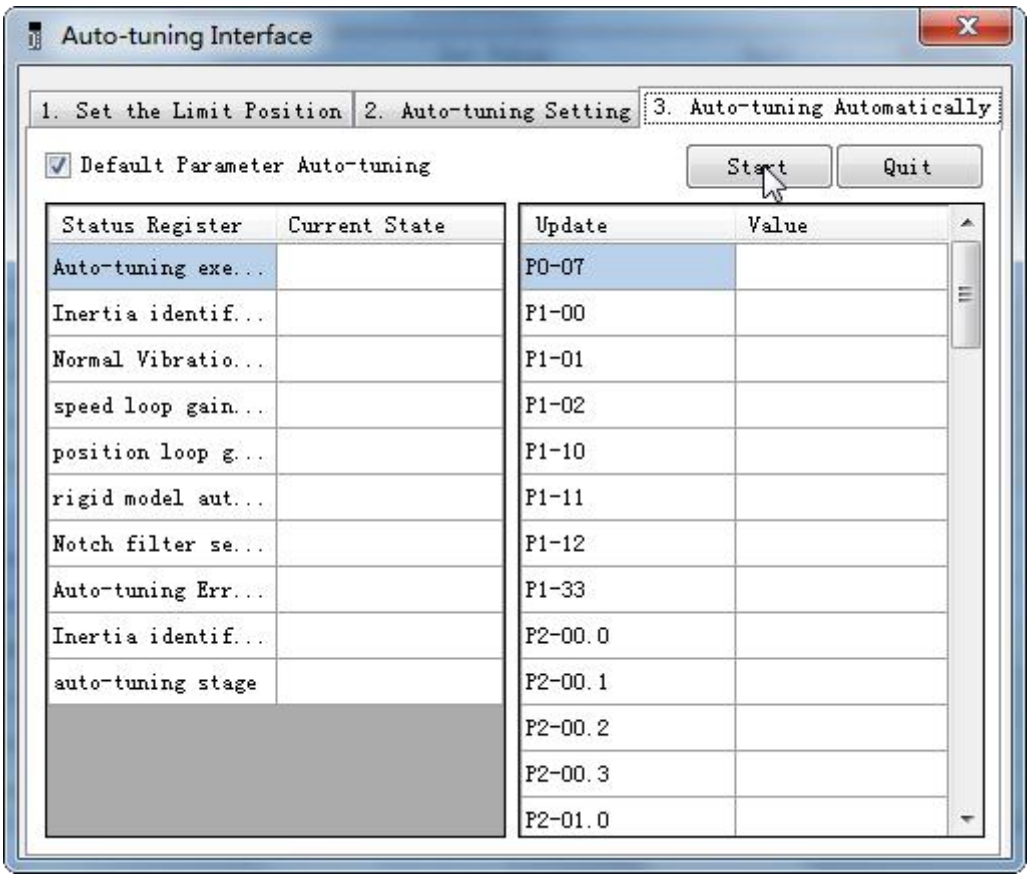
5. Set the auto-tuning parameters.



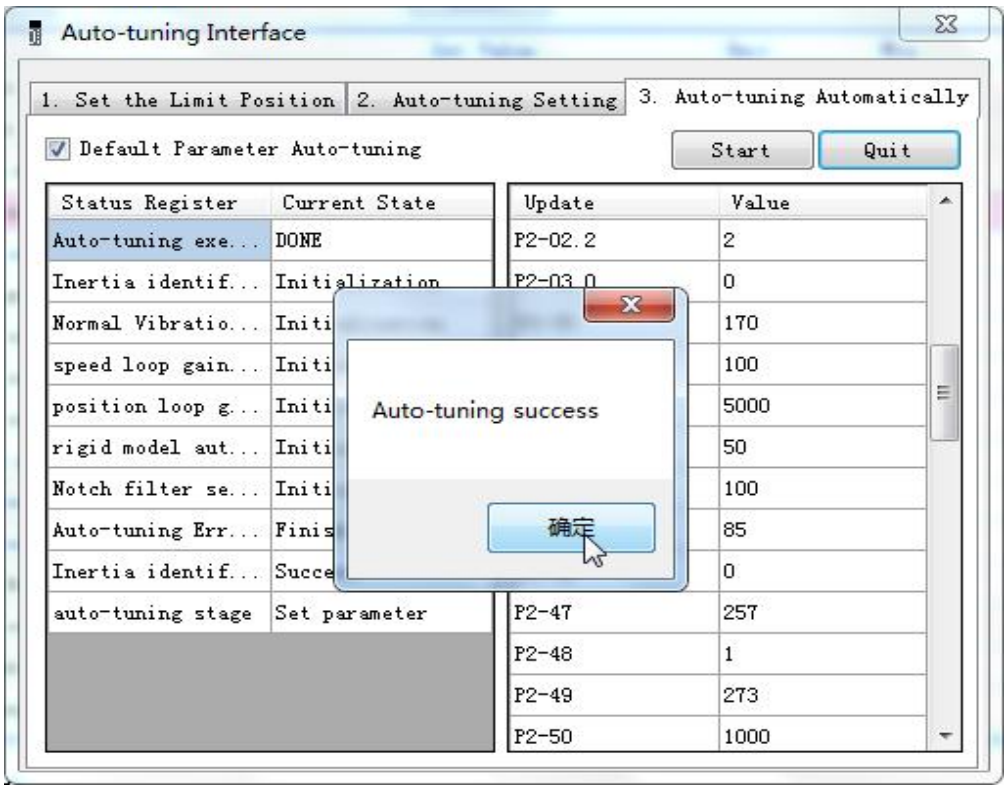
Auto-tuning mode	Description
Soft	Make a soft gain adjustment. Besides gain adjustment, notch filter is automatically adjusted.
Fast positioning	Make special adjustment for positioning purpose. Besides gain adjustment, the model loop gain and notch filter are automatically adjusted.
Fast positioning (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.

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.

6. Start auto-tuning.



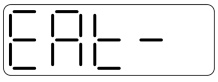
7. Wait for the end of the auto-tuning.



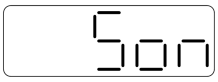
10.4.5 External instruction auto-tuning steps

Driver panel auto-tuning steps

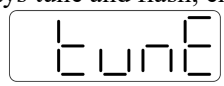
1. The inertia identification is carried out and the step of inertia estimation please refers to the driver panel inertia estimation (6.2.4 operation step).
2. Set P2-01.0=0 (Adaptive mode switch:OFF) and power on again.
3. Enter parameter F0-08, it will show Eat- (Exteral Refrence Auto-tuning).



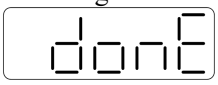
4. Short press ENTER, if diablesd, the panel displays Son and flash, waiting for enabling, if enabled, skip this step.



5. Enable the servo driver, the panel displays tune and flash, enter auto-tuning status.



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



7. Short 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.

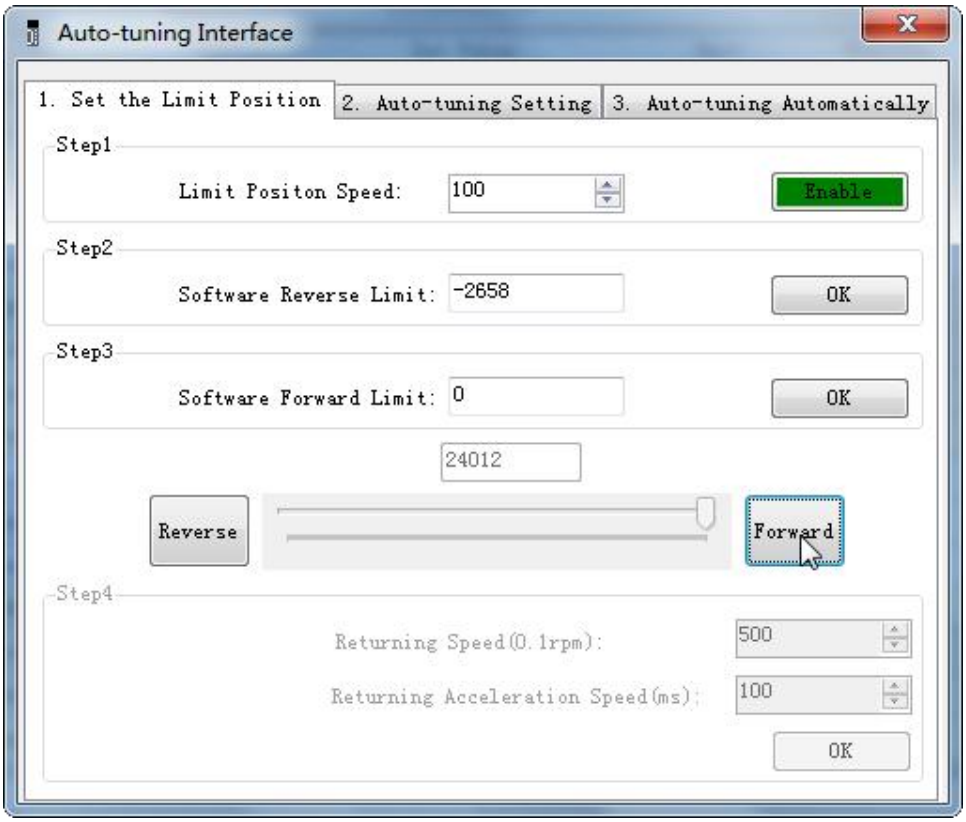
■ Panel error alarm in auto-tuning process

Error code	Description	Reasons
Err-1	Fail 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 is not 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

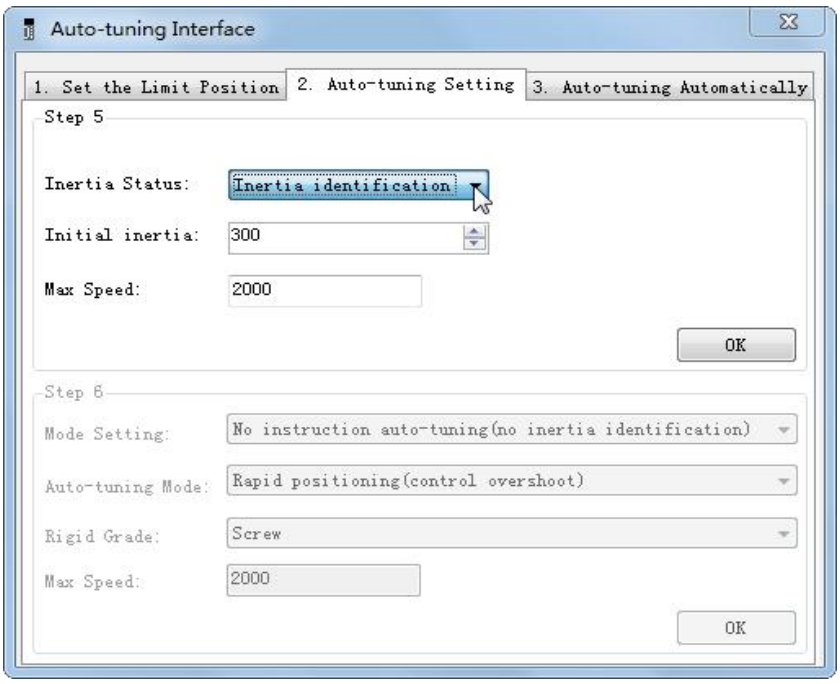
XinJeServo software auto-tuning steps

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



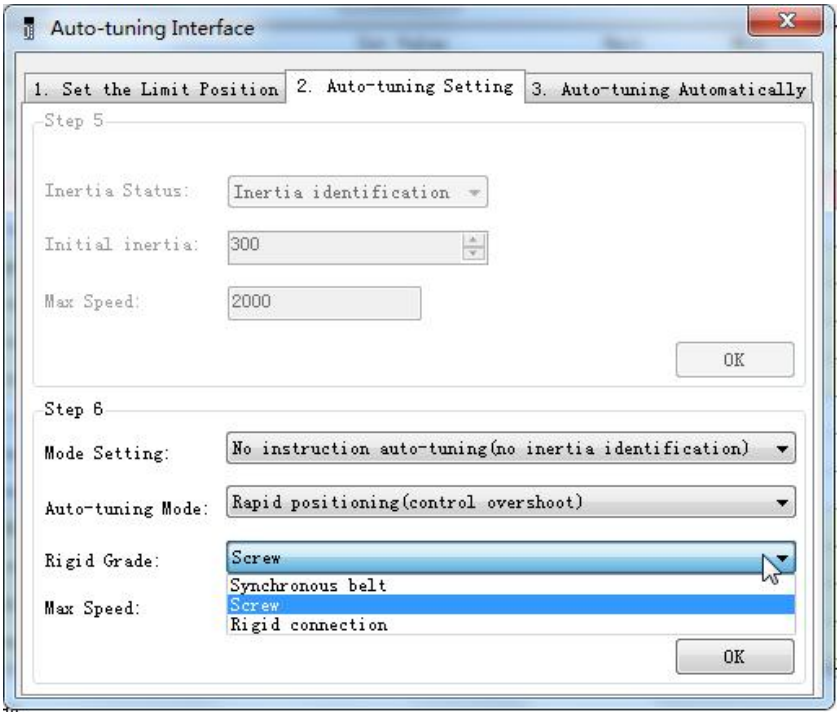
2. Select jog or manual setting to configure the trip of inertia identification.

3. Set the auto-tuning interface.



4. Click ok to start the inertia identification.

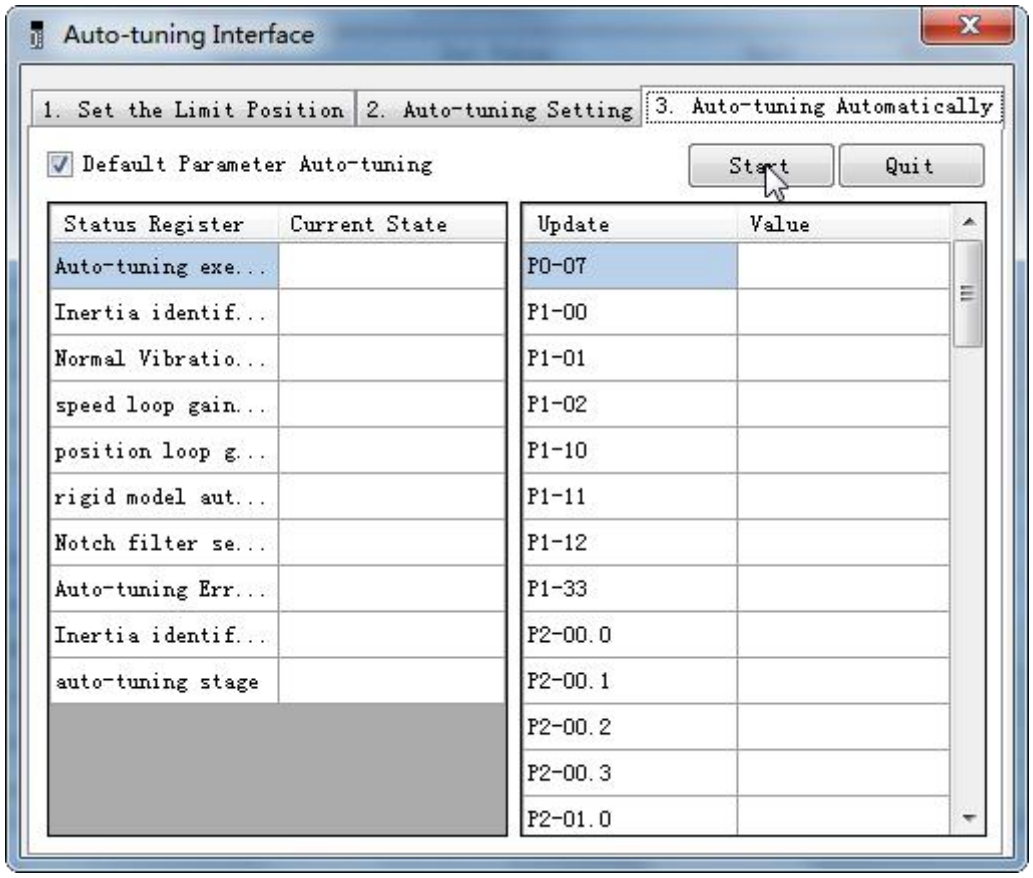
5. Configure the auto-tuning parameters.



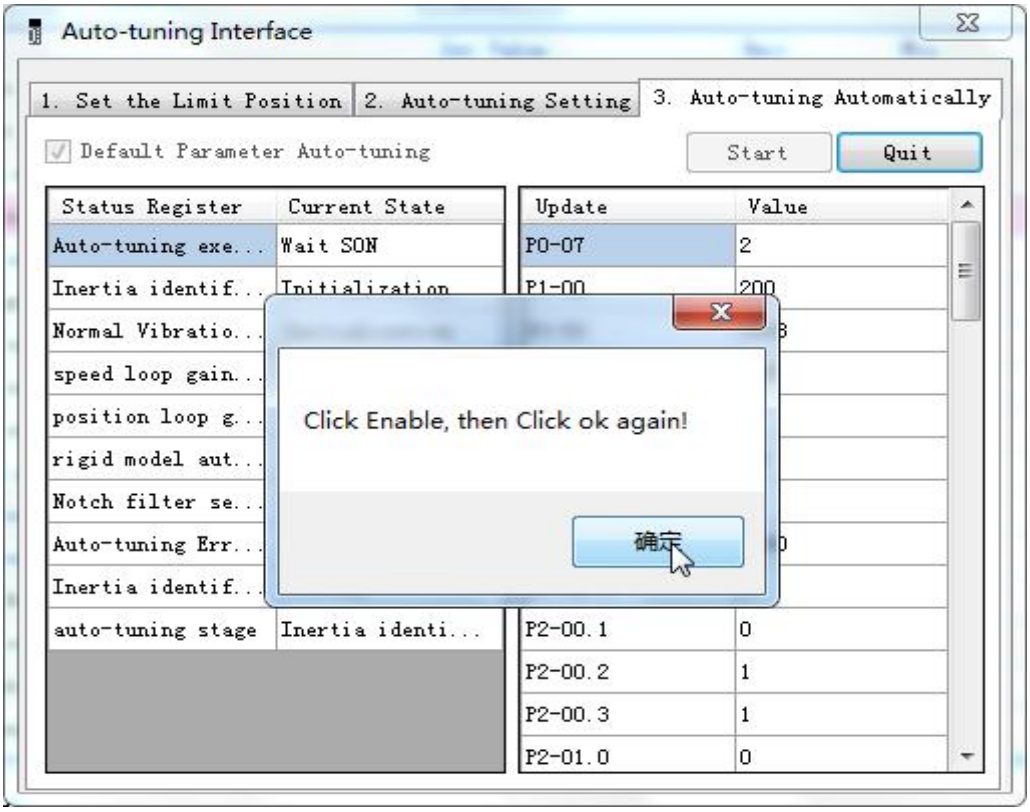
Auto-tuning mode	Description
Soft	Make a soft gain adjustment. Besides gain adjustment, notch filter is automatically adjusted.
Rapid positioning	Make special adjustment for positioning purpose. Besides gain adjustment, the model loop gain and notch filter are automatically adjusted.
Rapid positioning (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-tuning

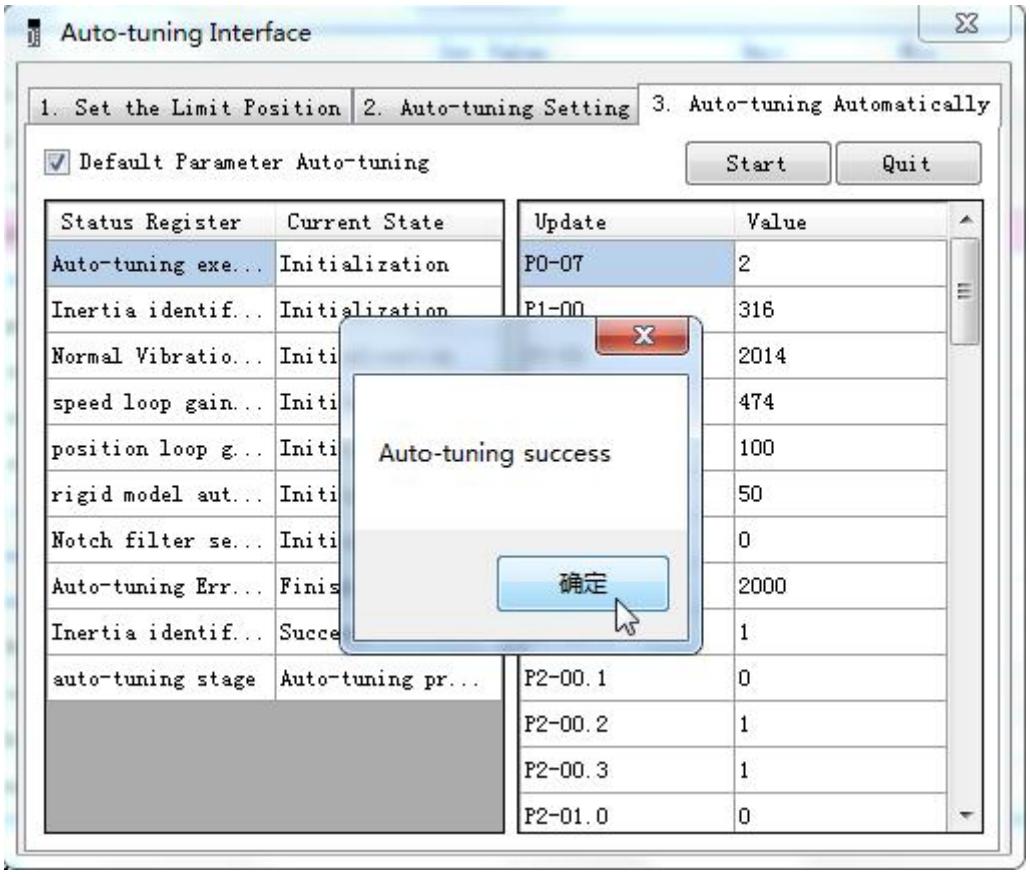


7. Enable the servo , then click ok.



8. The upper device starts to send pulses, wait the completion of auto-tuning.

9. Auto-tuning is finished, click ok.



10.4.6 Related parameters

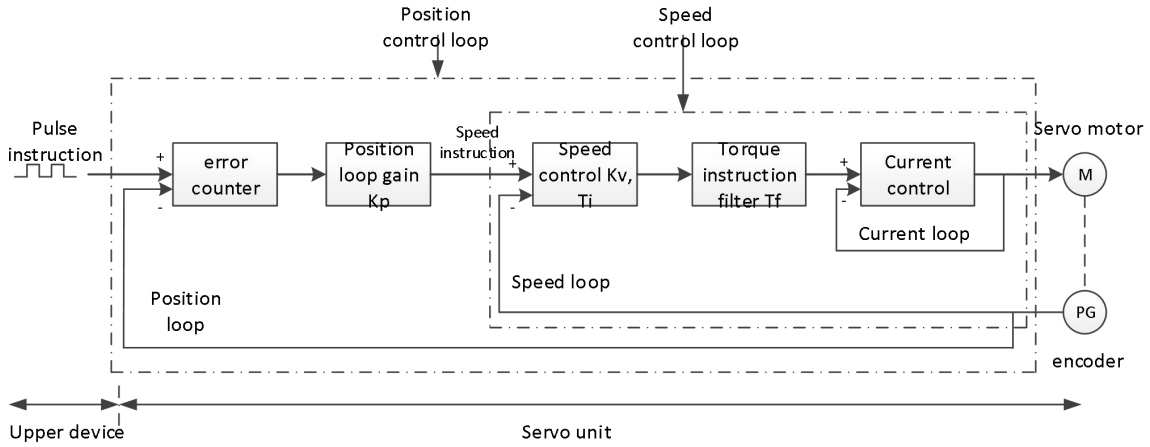
The following parameters may be modified during auto-tuning. Don't change them manually during auto-tuning.

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		

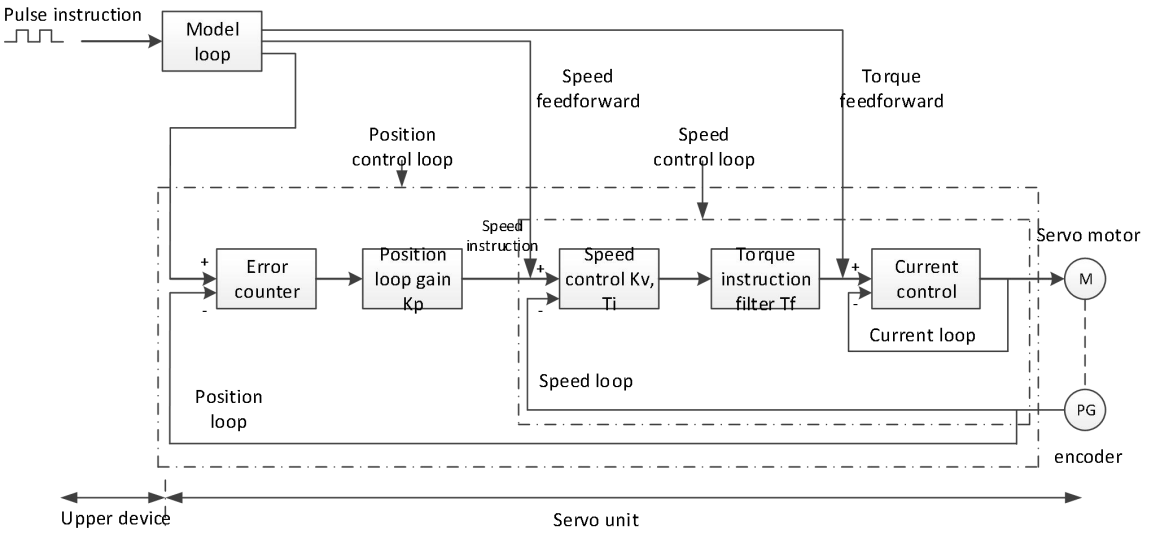
Note: P2-60~P2-63 are automatically modified in auto-tuning process. Users are not allowed to modify them manually. Manual modification may lead to the risk of system runaway.

10.5 Manual adjustment

10.5.1 Overview



Position control loop diagram (shut down the model loop)



Position control loop diagram (turn on the model loop)

Servo unit consists of three feedback loops (current loop, speed loop and position loop) from inside to outside. The more inner loop, the more responsive it is. Failure to comply with this principle will result in poor response or vibration. Among them, the current loop parameters are fixed values to ensure adequate responsiveness, and users don't need to adjust.

Please use manual adjustment in the following occasions:

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

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

10.5.3 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	Modify	Effective
P1-00	Speed loop gain	200	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	Modify	Effective
P1-01	Integral time constant of speed loop	3300	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	200	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	100	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	500	0.1Hz	10～20000	Anytime	Servo not run

10.6 Adaptive adjustment

10.6.1 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.

10.6.2 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.

10.6.3 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		Description	Default setting	Modify	Effective
P2-01	n.□□□0	Adaptive shutdown	n.□□□1	Servo bb	Re-power on
	n.□□□1	Adaptive Opening			

10.6.4 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		Description	Default setting	Modify	Effective
P2-03	n.0□□□	Adaptive small inertia mode	n.0□□□	Servo bb	Re-power on
	n.1□□□	Adaptive large inertia mode			

Parameter	Description	Default setting	Modify	Effective
P2-05	Adaptive speed loop gain	400[Note 1]	Servo bb	Re-power on
P2-10	Adaptive speed loop integral	500	Servo bb	Re-power on
P2-11	Adaptive position loop gain	100	Servo bb	Re-power on
P2-07	Adaptive inertia ratio	0	Servo bb	Re-power on
P2-08	Adaptive speed observer gain	60	Servo bb	Re-power on
P2-12	Adaptive stable max inertia ratio	30	Servo bb	Re-power on
P2-16	Adaptive motor rotor inertia coefficient	100	Servo bb	Re-power on
P2-19	Adaptive bandwidth	50[Note 2]	Anytime	At once
P6-05	Adaptive large inertia mode speed loop gain	200	Servo bb	Re-power on
P6-07	Adaptive large inertia mode inertia ratio	50	Servo bb	Re-power on
P6-08	Adaptive large inertia mode speed observer gain	40	Servo bb	Re-power on
P6-12	Adaptive large inertia mode max inertia ratio	50	Servo bb	Re-power on

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.

10.6.5 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 above	Within 5 times inertia	Adaptive small inertia mode (default parameters)
	5-10 times inertia	Set P2-08=50, P2-12=40
	10-20 times	Switch to adaptive large inertia mode or set P2-08=40, P2-12=50,

Motor flange	Inertia	Parameters
	inertia	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.

10.6.6 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 position loop gain coefficient	100	50～200	Adjust according to the need, increasing 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.

10.6.7 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

10.7 Vibration suppression

10.7.1 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't 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't be controlled properly.

10.7.2 Operation tools

Adjustment mode	Operation tools	Control mode	Operation steps	Limit
Adaptive mode	XinJeServo Mechanical Characteristic Analysis	Position mode	10.7.4 Vibration Suppression(Software)	All version software
Auto-tuning mode	Panel vibration suppression		10.7.3 Vibration Suppression(Panel)	Driver firmware requires version 3700 or higher
	XinJeServo Mechanical Characteristic Analysis		10.7.4 Vibration Suppression(Software)	All version software
Auto-tuning/adaptive mode	Panel vibration suppression		10.7.6 Vibration Suppression(easyFFT)	Driver firmware requires version 3730 or higher

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

10.7.3 Vibration suppression (Panel)

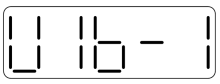
There are two modes of panel vibration suppression, mode 1(vib-1) and mode 2(vib-2).

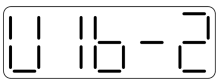
■ Difference between Two Kinds of Vibration Suppression

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.

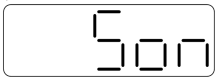
The operation steps:

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

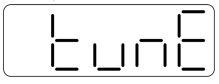


or


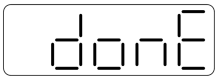
2.Short press ENTER, panel show Son and flashes, then need to enable manually



3. After enabling the servo, panel shows tune and flash, enter auto-tuning process.



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



5.Short press STA/ESC to exit.

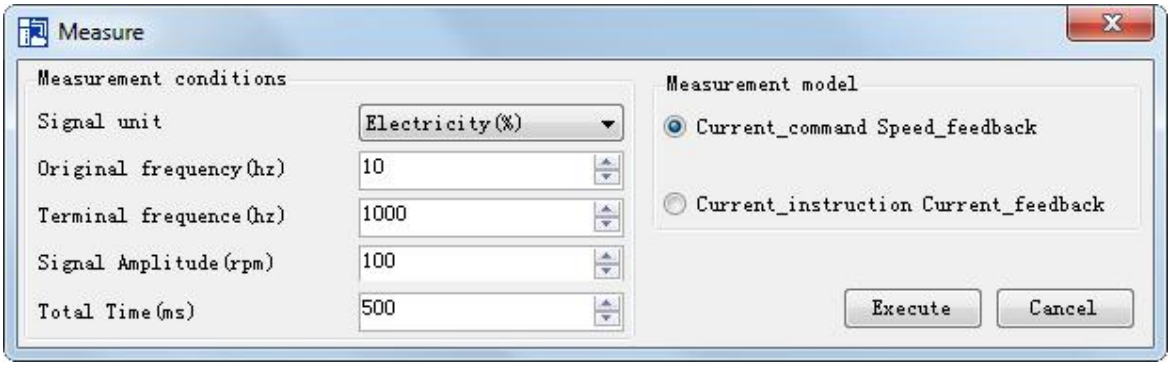
6.Vibration suppression parameters are automatically written into the second and first notches (the second notches are preferred when there is only one vibration point). The related parameters are detailed in 10.7.7 notch filter.

■ Fault alarm of panel in vibration suppression process

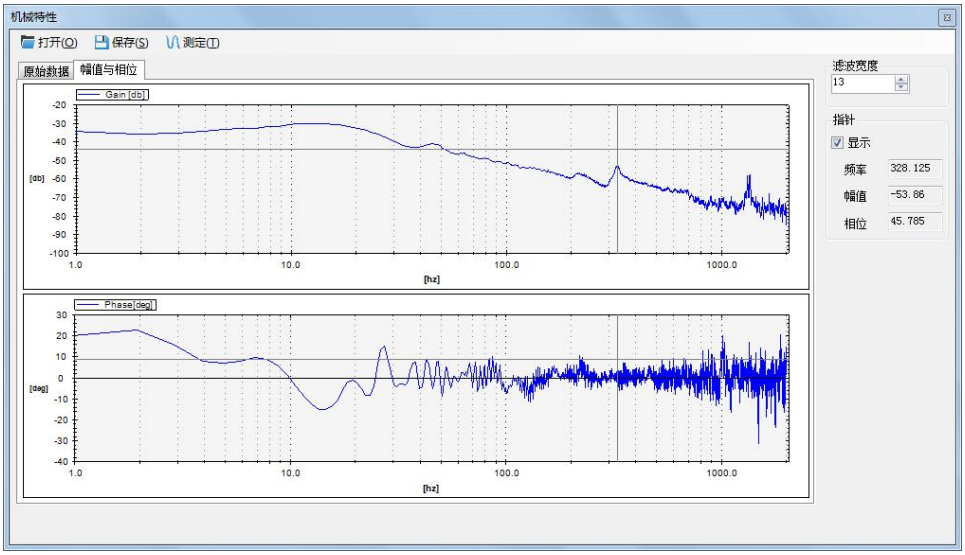
Error code	Description	Reasons
Err-1	Fail to search for optimal gain	Too large inertia ratio. Too weak rigidity of mechanism
Err-2	(1) Overrun/alarm occurs during auto-tuning (2) External instruction auto-tuning/Vibration Suppression Mode: Servo turns off the Enabler in auto-tuning process	Pls make sure 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	Pls auto-tune in position mode
Err-4	Not turn off the adaptive function	Pls 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

10.7.4 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

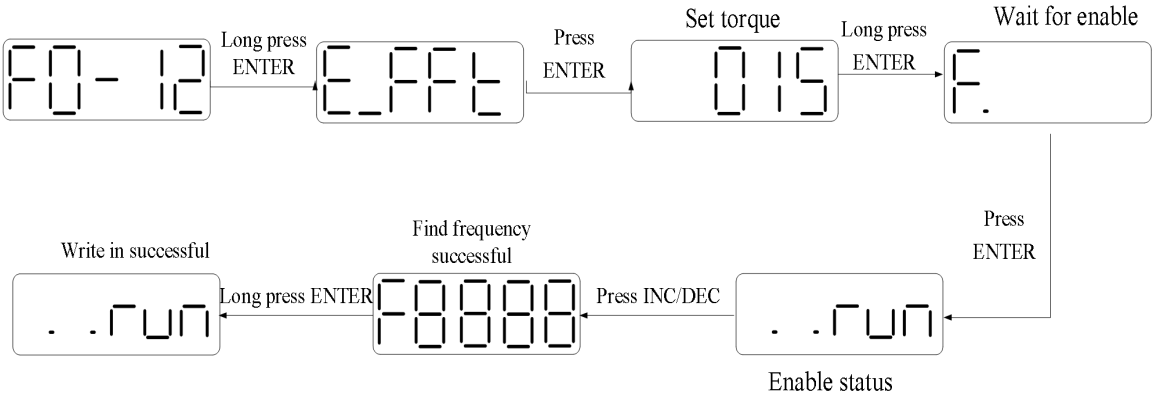
Note: In both adaptive and auto-tuning modes, if mechanical characteristic analysis is used, the notch can be set manually. If there are multiple resonance points, the third to fifth notch can be configured in turn.

10.7.5 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 10.7.7 notch filter.

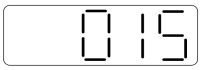
10.7.6 Vibration suppression (easy FFT)

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:



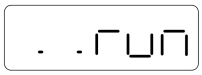
The operation steps are described as follows:
1. F0-12, long press【ENTER】to enter quick FFT function, it will show "E_FFt".

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.



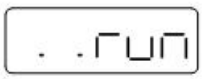
3. After setting the torque command, long press【ENTER】, enter "read to enable" status, it will show ‘F".

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----".

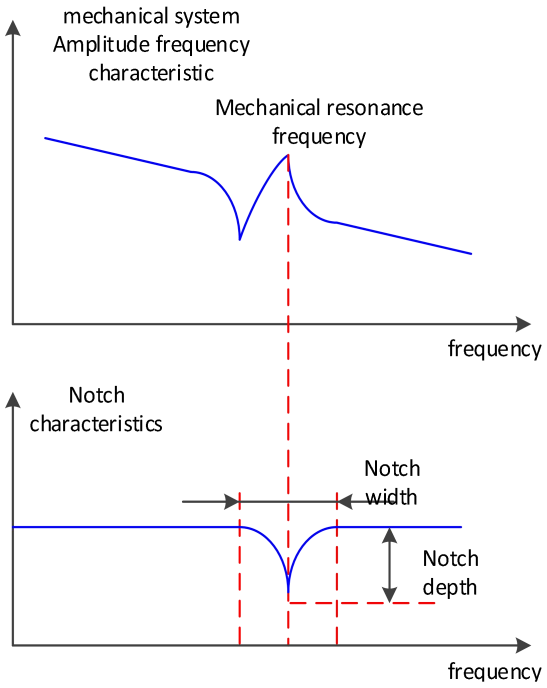
6. Whatever it shown "Fxxxx" or "F----", press【INC】,【DEC】 can find the resonance frequency again. If the resonance frequency is found, long press【ENTER】to set the resonance frequency in the notch filter of servo driver.



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

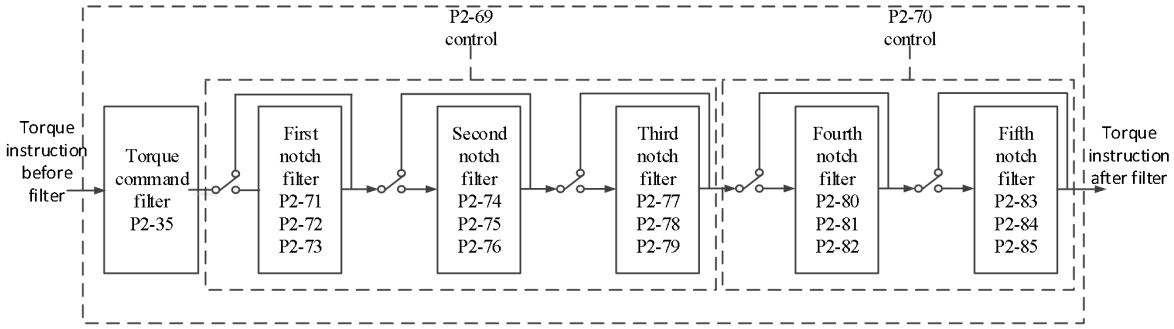
10.7.7 Notch filter

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:



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		Description	Default setting	Modify	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	Description	Default setting	Unit	Range	Modify	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

Parameter	Description	Default setting	Unit	Range	Modify	Effective
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.

10.8 Gain adjustment

10.8.1 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 is not 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 10.5 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		Description	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.

Auto-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.

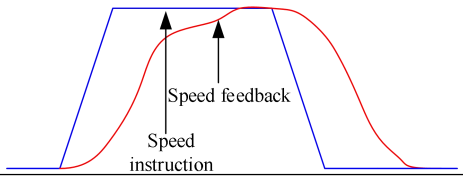
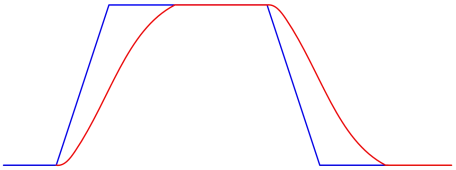
Parameter		Description	Default setting	Modify	Effective
P2-02	n.□□□1	Soft	n.□□□3	Any time	At once
	n.□□□2	Fast positioning			
	n.□□□3	fast positioning (control overshoot)			

Model loop function

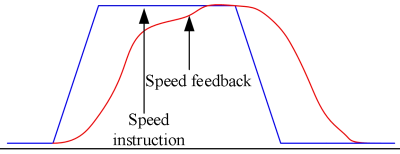
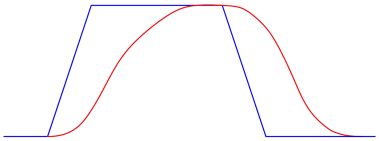
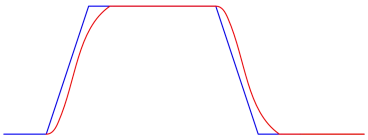
Parameter		Description	Default setting	Modify	Effective
P2-47	n.□□□0	Model loop turn off	n.□□□1	Any time	At once
	n.□□□1	Model loop turn on			

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.

10.8.2 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	Modify	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	Range	Modify	Effective
P2-41	Disturbance observer gain	85	%	0～100	Anytime	At once

10.8.3 Gain adjustment parameters

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P1-00	First speed loop gain	20P1：400 Others：200	0.1Hz	10~20000	Servo bb	At once
P1-01	Integral time constant of the	20P1：1650	0.01ms	15~51200	Servo bb	At once

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
	first velocity loop	Others：3300				
P1-02	First position loop gain	20P1：400 Others：200	0.1/s	10~20000	Servo bb	At once
P1-05	Second speed loop gain	20P1：400 Others：200	0.1Hz	10~20000	Servo bb	At once
P1-06	Second velocity loop integral constant	20P1：1650 Others：3300	0.01ms	15~51200	Servo bb	At once
P1-07	Second position loop gain	20P1：400 Others：200	0.1/s	10~20000	Servo bb	At once

10.8.4 Gain switch

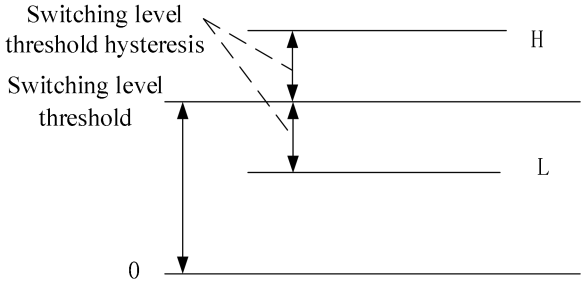
Note: The gain switching function is supported in firmware version 3770 and above.

Parameter		Meaning	Default setting	Modify	Effective
P1-14	n.□□□0	0-SI terminal switching gain is valid (the gain switching condition parameter is not 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 -Fixed to the first gain 6 - Large position deviation 7 - Position command 8 - Positioning completed 9 - High 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

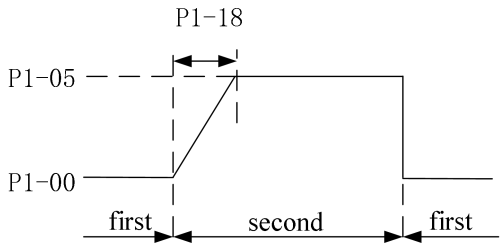
Note:

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

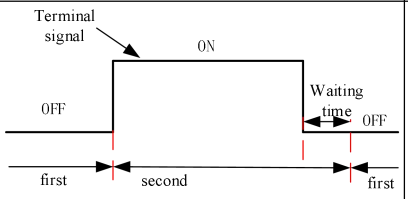
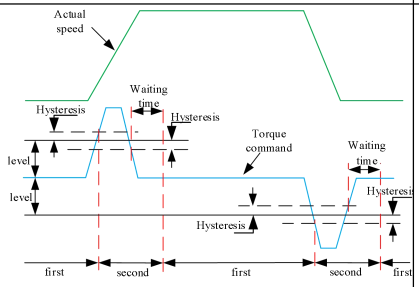
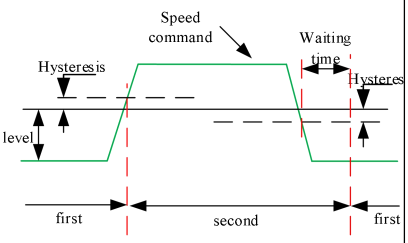
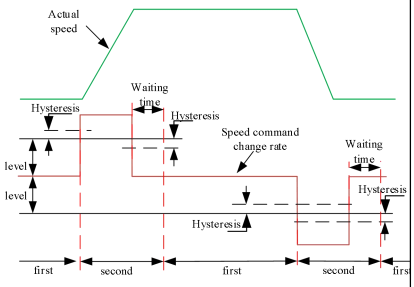
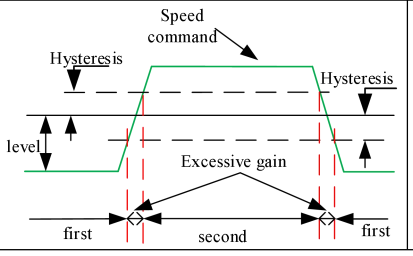
(2) The definition of gain switching level threshold hysteresis:

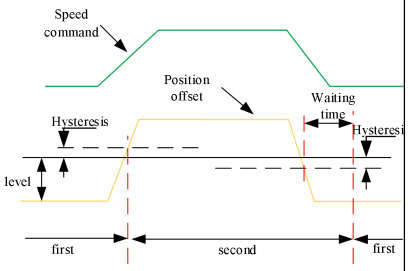
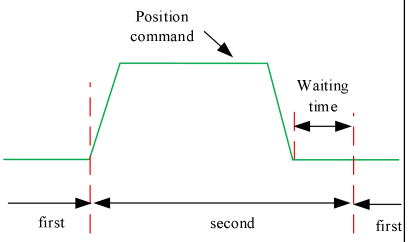
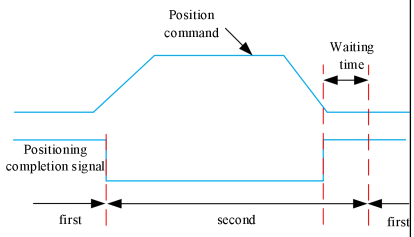
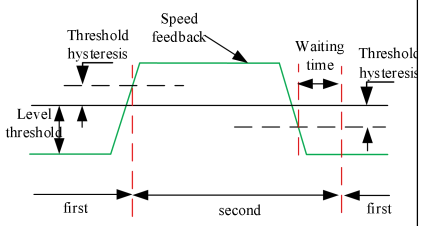


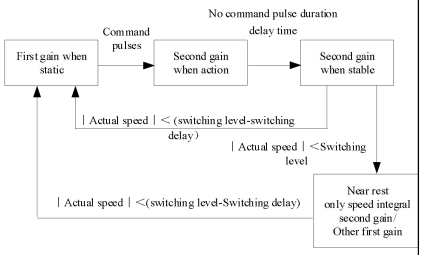
(3) The definition of position gain switching time:



(4) Gain switching conditions:

Gain switching condition				Parameter		
P1-14.1	Condition	Diagram	Notes	P1-15	P1-16	P1-17
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)
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	Invalid	Valid (rpm)	Valid (rpm)

Gain switching condition				Parameter		
			+ 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.			
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 is not 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 is not 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 P1-15, the first gain is returned. Note: it is necessary to set the positioning completion detection mode according to P5-01.	Valid	Invalid	Invalid
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	Valid	Valid (rpm)	Valid (rpm)

Gain switching condition				Parameter		
			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.			
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 is not 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)

10.9 Gain adjustment related solutions

10.9.1 Load shaking

The following causes cause load shaking:
1. The instruction is not smooth enough when the load inertia is too large.
Solutions:
(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
Solutions:
(1) Increase the gain parameters and rigidity to enhance the anti-disturbance ability.

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

10.9.2 Vibration

The following causes cause machine vibration:
(1) Vibration due to inappropriate servo gain
Solutions:
Reduce gain

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

10.9.3 Noise

In adaptive mode:
(1) Inappropriate servo gain
Solutions:
Reduce the adaptive control bandwidth (P2-19).

In auto-tuning mode:
(1) Inappropriate servo gain
Solutions:
Under the mode of fast adjustment, reduce the rigidity level.

Automatic Adjustment Mode: Reducing Model Loop Gain P2-49
(1) Noise due to mechanical resonance
Solutions:
Refer to 10.9.2 vibration.

11 Alarm

11.1 PROFINET related communication alarm

Alarm code	Reasons		Solutions
E-801	PLC stop	PLC in STOP state	Set PLC status to RUN
E-804	Network cable disconnected	1: Open circuit in the network cable. 2: Network cable not plugged in	1. Check whether there is a problem with the cable itself. 2. Check whether there is a problem with the wiring of the EtherCAT communication cable.
E-807	Alarm for synchronization loss error in isochronous synchronization mode	Abnormal heartbeat or disconnection during isochronous communication	1. Check if a shielded twisted pair communication cable with shielding function is used. 2. Check if the drive is well grounded. 3. Confirm if the communication line is connected.

11.2 Driver alarm

DS5 alarm code format is E-XX□,"XX"means main type, "□" means sub-type.

Type		Code	Explanation	Reasons	Solutions
EEEE	1	EEEE1	Communication error between panel and CPU	① The fluctuation of power supply voltage is large, and the low voltage leads to panel refresh failure. ② The panel program is damaged. ③Communication enters a dead cycle	① Stable power supply to ensure the stability of power supply voltage. ② Power off and power on again. If the alarm cannot be resolved, please contact the agent or manufacturer. ③ Unplug the communication terminal, and then run for confirmation
	2	EEEE2			
	3	EEEE3			
	4	EEEE4			
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
	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 the alarm occur repeatedly, 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.

Type		Code	Explanation	Reasons	Solutions
					② In P0-01=4 mode, setting P3-00 to 1 will trigger an alarm.
	3	E-023	Sampling channel setting error	Error setting of custom output trigger channel or data monitoring channel	Check if the setting parameters are correct.
	4	E-024	Parameter lost	Low voltage of power grid	① If it is a single-phase 220V power supply, please connect L1, L3. ② Immediately powering on after a power outage will trigger an alarm E-024. ③ Reset 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
03	0	E-030	Bus voltage U0-05 is higher than the actual preset threshold, 220V Power Supply (U0-05≥402V) 380V Power Supply (U0-05≥780V)	High voltage of power grid	Check the fluctuation of power grid, 220V driver normal voltage range 200V ~ 240V, 380V driver normal voltage range 360V ~ 420V. 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, (220V: bus voltage U0-05 = 392 discharge starts, U-05 = 377 discharge ends. 380V: U-05 = 750 discharge starts, U-05 = 720 discharge ends.) (2)Increase Acceleration and Deceleration Time (3) Reduce 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.
				Acceleration and deceleration time is too short	Increase Acceleration and Deceleration Time
				Hardware Fault of Driver Internal Sampling Circuit	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 the 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.
04	0	E-040	Bus voltage U0-05 is lower than the actual	Low voltage of power grid when normal power	(1) Check the fluctuation of power grid. The normal voltage range of

Type		Code	Explanation	Reasons	Solutions
			preset threshold. 220V power supply (U0-05 ≤ 150V) 380V power supply (U0-05 ≤ 300V)	on	220V driver is 200V~240V. If the voltage fluctuation is large, the voltage regulator is recommended. (2) Replace with larger capacity transformers
				Instantaneous power failure	Re-energize after voltage stabilization
				Hardware Fault of Driver Internal Sampling Circuit	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 < 220V + 10% (380V + 10%), then check the supply voltage. if the supply voltage is normal, then servo BB state, monitoring U0-05, multimeter measurement voltage * 1.414 > U0-05 (error within 10V), then the servo driver is faulty.
	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	① Motor above 11KW thermocouples are disconnected. ② Motor below 11KW false 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	Motor code not match	Check if the motor code (the number after the MOTOR CODE) on the drive U3-00 and motor label is consistent. If not, modify it to be consistent and then power on again

Type		Code	Explanation	Reasons	Solutions
			P3-21 and the maximum reverse speed is P3-22.	UVW wiring error	Check the motor UVW wiring and connect it in phase sequence
				Motor speed too fast	(1) The maximum speed limit value P3-21/P3-22 was reduced. (2) 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 exceeds the value of P3-21/P3-22, an alarm will occur.
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.
10	1	E-101	Position command mutation	Position difference every 6K cycle exceed the instruction difference alarm value set by P0-70	① Check and modify the program ② Set appropriate P0-70 values
11	0	E-110	External UVW Short Circuit Discovered in Self-Inspection	Not match the motor code	Check if the motor code (the number after the MOTOR CODE) on the drive U3-00 and motor label is consistent. If not, modify it to be consistent and then power on again.
				UVW wiring error	Check the motor UVW wiring and connect it 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	Increasing Acceleration and

Type		Code	Explanation	Reasons	Solutions
				instantaneous alarm	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).
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	Drive thermal power overload	Not match the motor code	Check if the driver U3-00 is identical with the motor code of the motor label (the number after MOTOR CODE), if not, please change to the same one, then power 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 U-00, whether it is running over speed.
				Mechanisms are impacted, suddenly weighted and distorted.	Eliminate mechanical distortion. Reduce load
				Motor action when motor brake is not 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 is not 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	Detection of servo wiring, the motor cable, encoder cable are

Type		Code	Explanation	Reasons	Solutions
				connection of motor cable to other shafts leads to incorrect wiring.	correctly connected to the corresponding shaft.
				Poor gain adjustment results in motor vibration, back and forth swing and abnormal noise.	Readjustgain parameters
				Driver or motor hardware failure	Do cross test on site or motor idle shaft test, F1-01 trial operation, F1-00 jog run can't rotate uniformly. Replace the new driver or motor.
16	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 is not 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 is not 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 1.4.1)
				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 deviation), 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

Type		Code	Explanation	Reasons	Solutions
					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.
				Received encoder data errors, and the number of errors exceeds the number of error retries of encoder registers P0-56	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	Encoder interfered, isolate interference source.
22	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 2.75V	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't be carried out, which will lead to the loss of the current position of the motor, it will alarm 222. Please set F0-00=1 to clear the alarm, it can be used normally. (2) The alarm can be shielded by using F0-79. 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 is not used for multi-turn absolute motor	① Please use encoder cable with battery box. ② Power off and power on again (the driver panel shall be completely off). If the alarm cannot be removed, please contact the agent or manufacturer
				Generally, it is the problem of the encoder itself, or the power supply of the encoder is unstable	
				Abnormal power on of	

Type		Code	Explanation	Reasons	Solutions
				main control chip of multi-turn absolute value servo encoder	
				ADC sampling is out of range, some resistance and capacitance devices have problems or the signal consistency of magnetic sensor is poor	
	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.
24	0	E-240	Timing error in fetching encoder position data	① The number of consecutive errors in encoder data update sequence is greater than the value in P0-68 ② CPU timer fluctuates	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	The received encoder data is incorrect, and the number of errors exceeds the value in the encoder error retry number registers P0-68.2~P0-68.3	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.
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. (3) The setting of braking torque is too small.	(1) Reduce inertia or use brake motor. (2) Increase the stop timeout time P0-30. (3) Increase braking torque P3-32.
26	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,	(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

Type		Code	Explanation	Reasons	Solutions
				which leads to the oscillation of positioning.	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	Fail to read motor parameters	Request to read EEPROM failed	On the premise that the driver and motor are matched and can be used together, read the alarm shielding position of motor parameters through P0-53, and set the motor code of P0-33 correctly.
	1	E-281	Error writing data to encoder EEPROM	Request to write EEPROM failed	On the premise that the driver and motor are matched and can be used together, read the alarm shielding position of motor parameters through P0-53, and set the motor code of P0-33 correctly.
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 and can be used together, read the alarm shielding position of motor parameters through P0-53, and set the motor code of P0-33 correctly
	2	E-312	Reading motor parameter is damaged	Parameter CRC verification failed	On the premise that the driver and motor are matched and can be used together, read the alarm shielding position of motor parameters through P0-53, and set the motor code of P0-33 correctly.
	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, 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	Read the motor code is 0	On the premise that the driver and

Type		Code	Explanation	Reasons	Solutions
			is read automatically, the motor parameter is 0, and the driver P0-33 ≠ 0		motor are matched and can be used together, read the alarm shielding position of motor parameters through P0-53, and set the motor code of P0-33 correctly.
	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 label. 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.

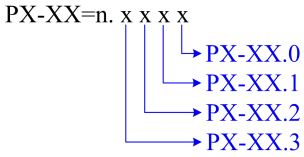
Appendix

Appendix 1. Group P parameters

Appendix 1.1 Functional parameters of group P

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 anytime and needs to be re powered to take effect.
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:



(1)P0-XX：

P0-XX	Function	Unit	Default value	Range	Effective	Suitable mode
P0-00	Driver mode 0-Common universal type 1-Profinet type	-	1	0～1	●	All
P0-01	P0-00=0：Common universal type 1-Internal Torque Mode 3-Internal speed Mode 5-Internal Location Mode	-	3	1～5	○	1|3|5|
P0-02	P0-00=1：Profinet type 1-Standard message 1 3-Standard message 3 102-Siemens message 102 105-Siemens message 105 111-Siemens message 111 750-Siemens message (Auxiliary message)	-	3	1～111	○	1|3|102|105|111
P0-03	Enabling mode: 0-not enable， 1-IO /SON input signal， 2-software Enable(panel/Modbus)Panel F1-05 Write 1. Modbus writes 1 to register 0x2105. Write 0 to cancel enable 3-Bus Enablation	-	3	0~3	○	All
P0-04	Rigidity grade	-	750W and below：15 Above 750W：10	0~63	△	All
P0-05	Rotation direction selection	-	0	0~1	●	All
P0-07	First inertia ratio	1%	500	0~50000	√	All
P0-11	Set the low number of pulses per turn ×1	-	0	0~9999	○	5|6|8
P0-12	Set the low number of pulses per turn ×10000	-	1	0~65535	○	5|6|8
P0-13	Electronic gear molecule	-	1	1~65535	√	5|6|8
P0-14	Electronic gear denominator	-	1	1~65535	○	5|6|8
P0-23	Pulse deviation limit	0.01 turn	2000	0~65535	√	5|6|8
P0-24	**Type selection of discharge**	-	0	0~1	○	All

P0-XX	Function	Unit	Default value	Range	Effective	Suitable mode
	resistance (version 3640 and before) 0: Built in 1: External **Power protection mode of discharge resistance** (version 3700 and later) 0 - Cumulative discharge time 1 - Average power mode 1 2-Average power mode 2					
P0-25	Power Value of Discharge Resistance	W	Related to driver power	0~65535	○	All
P0-26	Power Value of Discharge Resistance	Ω		1~500	○	All
P0-27	Servo shutdown the enable stop mode 0-Inertial operation stop 2-Deceleration stop	-	0	0, 2	○	All
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	0~3	○	All
P0-29	Servo alarm stop mode 0- Inertial Stop 2- Deceleration stop	-	2	0, 2	○	All
P0-30	Stop timeout time	1ms	20000	0~65535	○	All
P0-31	Slope stop deceleration time, OFF1 stop	1ms	200	0~5000	○	All
P0-32	Emergency stop deceleration time, OFF3 stop	1ms	10	0~3000	○	All
P0-33	Motor code setting	-		0~65535	●	All
P0-53	Automatic reading of motor parameter alarm shielding position 0- Don't block alarms 1- Shield not reading valid motor parameter alarm	-	0	0/1	●	All
P0-55	Open loop rotation speed	-	0	-6000~6000	○	All
P0-56	Encoder communication attempts	-	10	1~65535	○	All
P0-68.0~ P0-68.1 xx□□	Number of consecutive error alarms for encoding data update timing		0x05	0x01~0xFF	●	All
P0-68.2~ P0-68.3 □□xx	E-241 Alarm Filtering Times	-	0	0~0xFF	●	All
P0-69	Fan switch (P0-69.0) 0-Turn on the fan when the temperature is above 45 ℃, and turn off the fan when it is below 42 ℃ (hysteresis loop of 3 ℃) 1-Turn on the fan when enabled, and turn off the fan when enabled Large motor thermocouple wire breakage alarm shielding switch (P0-69.1) 0-Unshielded thermocouple wire	-	1	0/1	√	All

P0-XX	Function	Unit	Default value	Range	Effective	Suitable mode
	breakage alarm 1-Shield thermocouple wire breakage alarm					
P0-70	Pulse instruction deviation limit	0.01 circle	2000	0-65535	√	8
P0-74	Locked rotor alarm time	1ms	According to the model	0-65535	√	All
P0-75	Locked rotor alarm speed	1rpm	50	5~9999	√	All
P0-79	0-Absolute encoder single multi turn position switch (firmware versions after 20160304) 1-Used as an absolute value encoder 2-1-Used as an incremental encoder 2-As an absolute value encoder, ignore multi turn overflow alarms	-	1	0~2	●	All
P0-80	Motor thermal power protection method 0-Current protection 1-Average thermal power protection 2-Simulated thermal power protection	-	2	0~2	●	All
P0-92～P0-93	32 bit electronic gear ratio molecule P0-11 to P0-14 are valid when they are 0. P0-92*1 + P0-93 *10000	-	1	1~9999	○	5
			0	1~65535		
P0-94～P0-95	32-bit electronic gear ratio denominator P0-11 to P0-14 are valid when they are 0. P0-94*1 + P0-95 *10000	-	1	1~9999	○	5
			0	1~65535		

(2)Parameter P1 group

P1-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P1-00	First speed loop gain	0.1Hz	According to the model	10~20000	√	All
P1-01	First speed loop integration time constant	0.01ms	According to the model	15~51200	√	All
P1-02	First position loop gain	0.1/s	According to the model	10~20000	√	All
P1-05	Second speed loop gain	0.1Hz	200	10~20000	√	All
P1-06	Second speed loop integration time constant	0.01ms	3300	15~51200	√	All
P1-07	Second position loop gain	0.1/s	200	10~20000	√	All
P1-10	Speed feedforward gain	1%	0	0~300	√	5
P1-11	Speed feedforward filtering time	0.01ms	50	0~10000	√	5
P1-14.0	Gain switching function switch (Supported in versions 3770 and beyond)	-	0	0~2	√	All
P1-14.1	Selection of gain switching conditions (Supported in versions 3770 and beyond)	-	0	0~A	√	All
P1-15	Gain switching waiting time	-	5	0~1000	√	All
P1-16	Gain switching level threshold	-	50	0~20000	√	All
P1-17	Gain switching level hysteresis	-	30	0~20000	√	All
P1-18	Position loop gain switching time	-	3	0~1000	√	All

P1-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P1-22	Speed command filter selection 0-first-order low-pass filter 1-Moving average filter	-	0	0~1	○	3
P1-23	Speed command filtering time parameter	0.1ms	0	0~65535	○	3
P1-24	Position command acceleration/deceleration filtering time	0.1ms	0	0~65535	△	5
P1-25	Position command smoothing filtering time parameter	0.1ms	0	0~65535	△	5
P1-74	Encoder zero offset detection cycle	-	1000	0~65535	√	All
P1-75.0~1	Encoder zero offset detection threshold	-	0A	0~500	√	All
P1-75.2~3	Electric angle deviation detection filtering frequency	-	06	0~500	√	All

(3)Parameter P2 group

P2-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P2-00.0	Disturbance observer switch 0- Close 1- Open	-	0	0~1	○	All
P2-01.0	Adaptive mode switch 0- Close 1- Open	-	0	0~1	●	All
P2-01.1	Adaptive level 0-High response 1- Low noise	-	1	0~1	●	All
P2-02.0	Self tuning mode 1- Soft 2- Quick positioning 3- Quick positioning, control overshoot	-	3	1~3	√	All
P2-02.2	Load type (only valid during self-tuning process) 1-Synchronous belt 2-Lead screw 3-Rigid connection	-	2	1~3	√	All
P2-03.3	Adaptive load type 0-Small inertia mode 1-Large inertia mode	-	0	0~1	●	All
P2-05	Adaptive mode speed loop gain (standard)	0.1Hz	According to the model	1~65535	○	All
P2-07	Adaptive mode inertia ratio (standard)	%	0	0~10000	○	All
P2-08	Adaptive mode speed observer gain (standard)	Hz	According to the model	10~1000	○	All
P2-12	Adaptive mode maximum inertia ratio (standard)	-	30	1~10000	○	All
P2-15	Inertia identification and internal command self-tuning for maximum stroke	0.01r	100	1~3000	√	All
P2-17	Inertia identification and internal command self-tuning for maximum speed	-	0	0~65535	√	All
P2-18	Inertia identification starting inertia ratio	%	500	1~20000	√	All

P2-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P2-19	Adaptive mode bandwidth	%	According to the model	1~100	○	All
P2-35	Torque command filtering time constant 1	0.01ms	100	0~65535	√	All
P2-36	Torque command filtering time constant 2	0.01ms	100	0~65535	√	All
P2-41	Disturbance torque compensation coefficient (Non adaptive mode effective)	%	85	0~100	√	All
P2-47.0	Model ring switch 0- Close 1- Open	-	1	0~f	√	All
P2-49	Model loop gain	0.1Hz	According to the model	10~20000	√	3|5
P2-60.0	Active vibration suppression switch 0- Close 1- Open	-	0	0~1	√	3|5
P2-60.1	Active suppression self-tuning switch 0- Active vibration suppression is not configured during self tuning 1- Configure active vibration suppression during self tuning	-	1	0~1	√	3|5
P2-61	Active vibration suppression frequency	0.1Hz	10000	10~20000	√	All
P2-62	Active vibration suppression gain	%	100	1~1000	√	All
P2-63	Active vibration suppression damping	%	100	0~300	√	All
P2-64	Active vibration suppression frequency 1	-	0	-10000~10000	√	All
P2-65	Active vibration suppression frequency 2	-	0	-10000~10000	√	All
P2-69.0	Notch filter 1 switch	-	0	0~1	√	All
P2-69.1	Notch filter 2 switch	-	0	0~1	√	All
P2-69.3	Notch filter 3 switch	-	0	0~1	√	All
P2-70.0	Notch filter 4 switch	-	0	0~1	√	All
P2-70.1	Notch filter 5 switch	-	0	0~1	√	All
P2-71	First notch frequency	Hz	5000	50~5000	√	All
P2-72	First notch attenuation	0.1dB	70	50~1000	√	All
P2-73	First notch bandwidth	Hz	0	0~1000	√	All
P2-74	Second notch frequency	Hz	5000	50~5000	√	All
P2-75	Second notch attenuation	0.1dB	70	50~1000	√	All
P2-76	Second notch bandwidth	Hz	0	0~1000	√	All
P2-77	Third notch frequency	Hz	5000	50~5000	√	All
P2-78	Third notch attenuation	0.1dB	70	50~1000	√	All
P2-79	Third notch bandwidth	Hz	0	0~1000	√	All
P2-80	Fourth notch frequency	Hz	5000	50~5000	√	All
P2-81	Fourth notch attenuation	0.1dB	70	50~1000	√	All
P2-82	Fourth notch bandwidth	Hz	0	0~1000	√	All
P2-83	Fifth notch frequency	Hz	5000	50~5000	√	All
P2-84	Fifth notch attenuation	0.1dB	70	50~1000	√	All
P2-85	Fifth notch bandwidth	Hz	0	0~1000	√	All

(4)Speed control parameter P3 group

P3-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range

P3-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P3-05	Preset speed 1	rpm	0	-9999~9999	√	3
P3-06	Preset speed 2	rpm	0	-9999~9999	√	3
P3-07	Preset speed 3	rpm	0	-9999~9999	√	3
P3-09	Acceleration time	ms	0	0~65535	○	3
P3-10	Deceleration time	ms	0	0~65535	○	3
P3-12	Zero speed clamping mode	-	0	0~3	○	3
P3-13	Zero speed clamping speed	rpm	10	0~300	○	3
P3-14	Maximum forward speed command limit	rpm	4000	0~10000	○	All
P3-15	Reverse maximum speed command limit	rpm	4000	0~10000	○	All
P3-16	Internal forward speed limitation during torque control	rpm	2000	5~10000	√	1
P3-17	Internal reverse speed limitation during torque control	rpm	2000	5~10000	√	1
P3-18	Jog speed	rpm	100	0~1000	○	All
P3-19	Forward warning speed	rpm	3000	0~10000	○	All
P3-20	Reverse warning speed	rpm	3000	0~10000	○	All
P3-21	Forward alarm speed	rpm	4000	0~10000	○	All
P3-22	Reverse alarm speed	rpm	4000	0~10000	○	All
P3-28	Internal forward torque limit	%	300	0~1000	√	All
P3-29	Internal reverse torque limit	%	300	0~1000	√	All
P3-30	External forward torque limit	%	300	0~1000	√	All
P3-31	External reverse torque limit	%	300	0~1000	√	All
P3-32	Braking torque	1%	300	0~1000	√	All
P3-33	Preset torque	%	0	-1000~1000	√	1
P3-45	Moment mode switching delay	ms	40	0~9999	√	1

(5)Internal position parameter P4 group

P4-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P4-00.0	Number of Z-phase signals The number of Z-phase signals passed after leaving the limit switch (note: stop when the n+1st Z-phase signal arrives)	unit	2	0~f	○	5
P4-00.1	Whether the origin finding function is enabled or not 0- Not enabled 1- Enable	-	0	0~1	○	5
P4-00.2	Zero return overtravel prohibition 0- Not prohibited 1- Prohibition	-	0	0~1	○	5
P4-01	The speed of hitting the proximity switch	rpm	600	0~65535	○	5
P4-02	The speed of leaving the proximity switch	rpm	100	0~65535	○	5
P4-03.0	Internal position setting mode setting positioning mode 0-Relative positioning 1- Absolute positioning	-	0	0~1	○	5
P4-03.1	Internal position setting mode setting	-	0	0~5	○	5

P4-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
	step change mode 0-When the signal is ON, the step changes and can be cycled 1- Signal rising edge changing step, single step execution 2-Signal rising edge start, execute all in sequence without cycling 3-Communication setting segment number 4-/CHSTP bilateral edge trigger 5-Terminal/PREFA (P5-57),/PREFB (P5-58),/PREFC (P5-59) Select segment number, optional 1-3 segments					
P4-03.2	Internal position setting mode setting waiting mode 0- Waiting for positioning completion 1- Don't wait for positioning completion	-	0	0~1	○	5
P4-04	Number of effective segments	-	0	0~35	○	5
P4-10～ P4-11	First pulse	1pul	0	-327689999~ 327679999	√	5
P4-12	First segment speed	0.1rpm	0	0~65535	√	5
P4-13	First acceleration time	1ms	0	0~65535	√	5
P4-14	First deceleration time	1ms	0	0~65535	√	5
P4-16	Adjust time	1ms	0	0~65535	√	5
P4-10+(n-1)*7 ~ P4-16+(n-1)*7	Pulse parameters from the first to the 35th segments (n represents the number of position segments)	-	-	-	√	5
Note: ① Set the number of pulses=number of pulses (high bit) x 10000+number of pulses (low bit). ② 35 sections in total. The parameters of the 1st to 12th segments can be set through the panel, while the parameters of the 13th to 35th segments need to be written through communication (RS232 and RS485).						

(6)Signal parameter settings P5 group

P5-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P5-00	Positioning completion width/COIN	Instruction unit	11	1~65535	√	5
P5-01	Positioning completion detection mode	-	0	0~3	√	5
P5-02	Positioning completion retention time	ms	0	0~65535	√	5
P5-03	Rotation detection speed	rpm	50	0~10000	√	All
P5-04	Same speed detection speed	rpm	50	0~10000	√	All
P5-05	Arrival detection speed	rpm	1000	0~10000	√	All
P5-06	Positioning close to output width	Instruction unit	50	0~65535	√	5
P5-07	Servo OFF delay time	ms	500	0~65535	○	All
P5-08	Brake command output speed	rpm	30	20~10000	○	All
P5-09	Brake command waiting time	ms	500	0~65535	○	All
P5-10	Custom Output 1 Trigger Condition	-	0	0~ffff	√	All
P5-11	Set a value compared to the trigger condition for custom output 1	Related to triggering conditions	0	-9999~9999	√	All
P5-12	Choose custom output 1 method	-	0	0~3	√	All
P5-13	Set custom output 1 hysteresis loop	Related to	0	0~65535	√	All

P5-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
		triggering conditions				
P5-14	Custom output 2 trigger condition	-	0	0~ffff	√	All
P5-15	Set a value compared to the trigger condition for custom output 2	Related to triggering conditions	0	-9999~9999	√	All
P5-16	Choose custom output 2 method	-	0	0~3	√	All
P5-17	Set custom output 2 hysteresis	Related to triggering conditions	0	0~65535	√	All
P5-18	IO filtering time multiple	-	1	0~10000	√	All
P5-19	Z-phase output holding time	ms	2	1~65535	√	All
P5-20.0~1	/S-ON: Servo signal 00：Set the signal to always be "invalid". 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. 10：Set the signal to always be "valid". 11：Input reverse signal from SI1 terminal. 12：Input reverse signal from SI2 terminal. 13：Input reverse signal from SI3 terminal. 14：Input reverse signal from SI4 terminal.	-	0	0~ff	√	All
P5-20.2	SI terminal filtering time	ms	0	0~f	√	All
P5-21.0~1	/P-CON proportional action command	-	00	0~ff	√	All
P5-21.2	SI terminal filtering time	ms	0	0~f	√	All
P5-22.0~1	In non Profinet mode: /P-OT: Prohibit forward drive In Profinet mode: Control mode 6 (zero return mode), POT inhibit signal	-	0	0~ff	√	All
P5-22.2	SI terminal filtering time	ms	0	0~f	√	All
P5-23.0~1	In non Profinet mode: /N-OT: Prohibit reverse drive In Profinet mode: Control mode 6 (zero return mode), NOT inhibit signal	-	0	0~ff	√	All
P5-23.2	SI terminal filtering time	ms	0	0~f	√	All
P5-24.0~1	/ALM-RST: Alarm Clear	-	0	0~ff	√	All
P5-24.2	SI terminal filtering time	ms	0	0~f	√	All
P5-25.0~1	/P-CL: External torque limitation on the forward rotation side	-	00	0~ff	√	All
P5-25.2	SI terminal filtering time	ms	0	0~f	√	All
P5-26.0~1	/N-CL: External torque limitation on the reverse side	-	00	0~ff	√	All
P5-26.2	SI terminal filtering time	ms	0	0~f	√	All
P5-27.0~1	In non Profinet mode: /SPD-D: Internal speed direction selection in Profinet mode: Control mode 6 (zero return mode), Home origin signal	-	03	0~ff	√	1|3
P5-27.2	SI terminal filtering time	ms	0	0~f	√	1|3
P5-28.0~1	//SPD-A: Internal Setting Speed Selectiong	-	00	0~ff	√	3|5

P5-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P5-28.2	SI terminal filtering time	ms	0	0~f	√	3|5
P5-29.0~1	/SPD-B: Internal setting speed selection	-	00	0~ff	√	3|5
P5-29.2	SI terminal filtering time	ms	0	0~f	√	3|5
P5-30.0~1	/C-SEL: Control mode selection	-	00	0~ff	√	All
P5-30.2	SI terminal filtering time	ms	0	0~f	√	All
P5-31.0~1	/ZCLAMP: Zero clamping	-	00	0~ff	√	3
P5-31.2	SI terminal filtering time	ms	0	0~f	√	3
P5-32.0~1	/INHIBIT: Instruction pulse suppression	-	00	0~ff	√	5
P5-32.2	SI terminal filtering time	ms	0	0~f	√	5
P5-33.0~1	/G-SEL: Gain switching	-	00	0~ff	√	All
P5-33.2	SI terminal filtering time	ms	0	0~f	√	All
P5-34.0~1	/CLR: Pulse offset clearing	-	00	0~ff	√	5
P5-34.2	SI terminal filtering time	ms	0	0~f	√	5
P5-35.0~1	/CHGSTP: Internal position mode change signal	-	00	0~ff	√	5
P5-35.2	SI terminal filtering time	ms	0	0~f	√	5
P5-36.0~1	/I-SEL: Inertia ratio switching	-	00	0~ff	√	All
P5-36.2	SI terminal filtering time	ms	0	0~f	√	All
P5-37	/COIN_HD: Positioning completed and maintained 00：Not output to terminals. 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
P5-38	/COIN: Positioning end	-	0001	0~ffff	√	5
P5-39	/V-CMP: Same speed detection	-	0000	0~ffff	√	3
P5-40	/TGON: Rotation detection	-	0000	0~ffff	√	All
P5-41	/S-RDY: Ready	-	0000	0~ffff	√	All
P5-42	/CLT: Torque limit	-	0000	0~ffff	√	All
P5-43	/VLT: Speed limit detection	-	0000	0~ffff	√	1
P5-44	BK: Brake interlock	-	0000	0~ffff	○	All
P5-45	/WARN: Warning	-	0000	0~ffff	√	All
P5-46	/NEAR: Nearing	-	0000	0~ffff	√	5
P5-47	/ALM: Alarm	-	0002	0~ffff	√	All
P5-48	/Z: Encoder Z-phase signal output	-	0000	0~ffff	√	All
P5-50	/MRUN: Internal position mode motion start signal	-	0000	0~ffff	√	5
P5-51	/V-RDY: Speed reached	-	0000	0~ffff	√	3
P5-52	/USER1: Custom Output 1	-	0000	0~ffff	√	All
P5-53	/USER2: Custom Output 2	-	0000	0~ffff	√	All
P5-54	Return to origin completion signal	-	0000	0~ffff	√	5
P5-57	/PREFA: Internal position selection signal A	-	0	※1	√	5
P5-58	/PREFB: Internal position selection signal B	-	0	※1	√	5
P5-59	/PREFC: Internal position selection signal C	-	0	※1	√	5
P5-61.0~1	/TRAJ-START: Motion start trigger signal	-	00	0~ff	√	5
P5-70	/SRDY: Output condition selection 0: After the driver initialization is completed, this terminal conducts	-	0	0~1	√	All

P5-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
	1: This terminal will only conduct after being enabled					

(7)Signal parameter settings P6 group (some parameters reserved)

P6-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P6-05	Adaptive mode speed loop gain (large inertia)	0.1Hz	200	1~65535	○	1|3|5
P6-07	Adaptive mode inertia ratio (large inertia)	%	50	0~10000	○	1|3|5
P6-08	Adaptive mode speed observer gain (large inertia)	Hz	40	10~1000	○	1|3|5
P6-12	Adaptive mode maximum inertia ratio (large inertia)	-	50	1~10000	○	1|3|5

(8)Communication parameter settings P7 group (currently not supporting 485 communication)

P7-XX	Function description	Unit	Factory value	Setting range	Take effect time	Apply range
P7-00	RS485 station number	-	1	0~100	○	All
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 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	Baud rate	06	0~16	○	All

P7-XX	Function description	Unit
P7-01.2	RS485 stop bit 0:2 bits 2: 1 digit	Stop bit
P7-01.3	RS485 checksum 0: No verification 1: Odd check 2: Parity check	Check bit
P7-02	RS485 communication protocol 1: Modbus Rtu protocol 2: Xnet Bus protocol 3: Read Xnet bus torque	-
P7-03	Xnet synchronous sampling time	1ms
P7-04	Xnet slave data	-
P7-05	Number of Xnet Slaves	-
P7-06	Communication timeout retry count	Time
P7-07	Bus instruction refresh cycle	1us
P7-08	Position deviation compensation threshold	-
P7-09	Number of compensation times for position deviation	-

P7-XX	Name	Unit	Factory value	Setting range	Effective timing
P7-10	RS232 station number	-	1	0~100	○

P7-XX	Name	Unit	Factory value	Setting range	Effective timing
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 16：6M	Baud rate	06	0~16	○
P7-11.2	RS232 stop bit 0:2 bits 2: 1 digit	Stop bit	2	0~2	○
P7-11.3	RS232 checksum 0: No verification 1: Odd check 2: Parity check	Check bit	2	0~2	○

(9)Parameter P8 group

P8-XX	Name	Unit	Factory value	Setting range	Effective timing	Applicable mode
P8-25	Panel display selection	-	0	0~2	▲	All

(10)Parameter PA group

PA-XX	Name	Unit	Factory value	Setting range	Applicable mode
PA-00	Epos maximum speed low bit	1000[LU/min]	0	0~9999	Bus
PA-01	Epos maximum speed high bit * 10000	1000[LU/min]	4	0~9999	Bus
PA-02	Epos maximum acceleration low bit	1000[LU/s^2]	3000	0~9999	Bus
PA-03	Epos maximum acceleration high position * 10000	1000[LU/s^2]	0	0~9999	Bus
PA-04	Epos maximum deceleration low position	1000[LU/s^2]	3000	0~9999	Bus
PA-05	Epos maximum deceleration high position * 10000	1000[LU/s^2]	0	0~9999	Bus
PA-06	Epos slope deceleration low position	1000[LU/s^2]	100	0~9999	Bus
PA-07	Epos slope deceleration high position * 10000	1000[LU/s^2]	0	0~9999	Bus
PA-08	Epos deviation threshold low bit	1LU	0	0~9999	Bus
PA-09	Epos deviation threshold high bit * 10000	1LU	3	0~30000	Bus
PA-10	Epos deviation threshold arrival time	ms	0	0~32767	Bus
PA-11	Epos positioning reaches the low bit of	1LU	11	0~9999	Bus

PA-XX	Name	Unit	Factory value	Setting range	Applicable mode
	the threshold				
PA-12	Epos positioning reaches high threshold * 10000	1LU	0	0~30000	Bus
PA-13	Epos positioning arrival time	ms	0	0~32767	Bus
PA-14	JOG1 jog speed low position	1000[LU/min]	-300	-9999~9999	Bus
PA-15	JOG1 Jog Speed High * 10000	1000[LU/min]	0	-200~200	Bus
PA-16	JOG2 jog speed low position	1000[LU/min]	300	-9999~9999	Bus
PA-17	JOG2 Jog Speed High * 10000	1000[LU/min]	0	-200~200	Bus
PA-18	JOG2 Jog Speed High * 10000	0x4000-100%	16384	0~32767	Bus
PA-19	Origin restoration type	-	0	0~35	Bus
PA-20	Origin reset, high speed, low position	1000[LU/min]	5000	0~9999	Bus
PA-21	Origin reset high-speed high bit * 10000	1000[LU/min]	0	0~400	Bus
PA-22	Origin reset low speed low position	1000[LU/min]	300	0~9999	Bus
PA-23	Origin reset low speed high position * 10000	1000[LU/min]	0	0~400	Bus
PA-24	Origin reset acceleration/deceleration ratio	0x4000-100%	16384	0~32767	Bus
PA-25	Origin reset offset type	-	0	0~1	Bus
PA-26	Origin reset offset low bit	1LU	0	-9999~9999	Bus
PA-27	Origin reset offset high bit * 10000	1LU	0	-9999~9999	Bus
PA-28	Origin reset timeout	ms	32767	0~32767	Bus
PA-29	Finding Z Numbers for Origin Restoration	-	1	0~100	Bus
PA-30	Z-phase positioning completion time delay	ms	100	0~1000	Bus
PA-31	Return to original mode switch signal source	-	1	1~2	Bus
PA-32	JOG1 running stroke low position	LU	1000	0~9999	Bus
PA-33	JOG1 running stroke high position * 10000	LU	0	0~200	Bus
PA-34	JOG2 running stroke low position	LU	1000	0~9999	Bus
PA-35	JOG2 running stroke high position * 10000	LU	0	0~200	Bus

Appendix 1.2 Functional parameters of group F

Function code	Function
F0-00	Clear alarm
F0-01	Restore factory
F0-02	Clear position deviation
F1-00	Jog
F1-01	Test run
F1-02	Current sampling zero calibration
F1-05	Panel enable
F1-06	Absolute encoder clear number of turns

Appendix 1.3 U group monitoring parameters

U0-XX

Monitoring number	Content	Unit
U0-00	Current speed of servo motor	Rpm
U0-01	Input speed command	Rpm
U0-02	Torque command	%Rated

Monitoring number	Content		Unit
U0-03	Mechanical angle		1°
U0-04	Electrical angle		1°
U0-05	Bus voltage		V
U0-06	IPM temperature		0.1℃
U0-07	Torque feedback		%Rated
U0-08	Pulse deviation value	(-9999～9999)*1	Command pulse
U0-09		(-65535～65535)*10000	
U0-10	Encoder feedback value	(0000～9999)*1	Encoder pulse
U0-11		(0000～65535)*10000	
U0-12	Input instruction pulse count	(-9999～9999)*1	Command pulse
U0-13		(-65535～65535)*10000	
U0-14	Position feedback	(-9999～9999)*1	Command pulse
U0-15		(-65535～65535)*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		(0000～65535)*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 instruction unit
U0-50	Speed feedforward		rpm
U0-51	Torque feedforward		%Rated
U0-52	Instantaneous bus capacitance power		1W
U0-53	Average bus capacitance power		1W
U0-55	Instantaneous regenerative braking discharge power		1W
U0-56	Average regenerative braking discharge power		1W
U0-57	Absolute encoder current position feedback low 32 bits		Encoder position
U0-58			
U0-59	Absolute value encoder current position feedback high by 32 bits		Encoder position
U0-60			
U0-89	Position instruction end flag		
U0-91	Absolute number of motor turns for multiple turns		
U0-98	High power motor temperature		0.1℃

U1-XX

Monitoring number	Content	Unit
U1-00	Current alarm code	
U1-01	Current warning code	
U1-02	U-phase current at the time of alarm occurrence	0.01A
U1-03	V-phase current at the time of alarm occurrence	0.01A
U1-04	Bus voltage at the time of alarm occurrence	V
U1-05	IGBT temperature at the time of alarm occurrence	0.1℃
U1-06	Torque current at the time of alarm occurrence	0.01A
U1-07	Excitation current at the time of alarm occurrence	A
U1-08	Position deviation at the time of alarm occurrence	Command Pulse

Monitoring number	Content	Unit
U1-09	Speed value at the time of alarm occurrence	rpm
U1-10	The time of alarm occurrence in seconds (low 16 bits), accumulated from the first power on for seconds	s
U1-11	The time of alarm occurrence in seconds (high 16 bits), accumulated from the first power on for seconds	s
U1-12	The number of errors in this operation is calculated from the time of power on	
U1-13	The number of warnings for this operation is calculated from the time of power on	
U1-14	Total number of historical alarms	
U1-15	Total number of historical warnings	
U1-16	Last 2nd alarm code	
U1-17	Last 3rd alarm code	
U1-18	Last 4th alarm code	
U1-19	Last 5th alarm code	
U1-20	Last 6th alarm code	
U1-21	The second recent warning code	
U1-22	Last 3rd warning code	
U1-23	Last 4th warning code	
U1-24	Last 5th warning code	
U1-25	Last 6th warning code	

U2-XX

Monitoring number	Content		Unit
U2-00	Power on frequency		-
U2-01	Series		-
U2-02	Model (low 16 bits)		-
U2-03	Model (high 16 bits)		-
U2-04	Factory date: Year		-
U2-05	Factory date: Month		-
U2-06	Factory date: Day		-
U2-07	Firmware version		-
U2-08	Hardware version		-
U2-09	Total running time (from the first power on)		Hour
U2-10	Total running time (from the first power on)		Minute
U2-11	Total running time (from the first power on)		Second
U2-12	This operation time (starting from this power on)		Hour
U2-13	This operation time (starting from this power on)		Minute
U2-14	This operation time (starting from this power on)		Second
U2-15	Average output power (average power during the enabling process from the first activation)		1W
U2-16	Average heating power (the average power during the activation process starting from the first activation)		1W
U2-17	Average bus capacitor filtering power (average power during the power on period from the first power on)		1W
U2-18	Accumulated number of motor turns	(0000～9999)*1	Circle
U2-19		(0000～9999)*10000	Circle
U2-20	Equipment serial number: low 16 bits		
U2-21	Equipment serial number: upper 16 digits		
U2-22	Firmware generation date: Year		
U2-23	Firmware generation date: Month/Day		
U2-24	Firmware generation time: Hours/Minutes		

U3-XX

Monitoring number	Content	Unit
U3-00	Drive the motor code for automatic reading (including thermal power	-

	parameters)	
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

Monitoring number	Content	Unit
U4-10	Resonance frequency detected by fast FFT	Hz
U4-16	Accumulated value of continuous overload operation for thermal power protection	-
U4-17	Accumulated value of instantaneous overload operation for thermal power protection	-

U5-XX

Monitoring number	Content	Unit
U5-00	Current Profinet communication main message	-
U5-01	Current Profinet communication assistance message	-

Appendix 2. Analysis of Common Usage Problems

Q1: What is the situation when the panel displays bb and run?

1. In BB standby mode, if not enabled, the motor is in an unpowered state.
2. Run status, enable, and the motor is in a powered on state.

Q2: How to view/set parameters?

Reference 4.2.

Q3: How to change the enable state parameter?

P5-20, set to 0000 enable not effective, set to 0010 power on enable, no need to power off again, effective immediately. The default is 0001, and an external high-level signal needs to be input from SI1, SI1 connected to low level,+24 connected to high level(5.2.2 Servo enable setting).

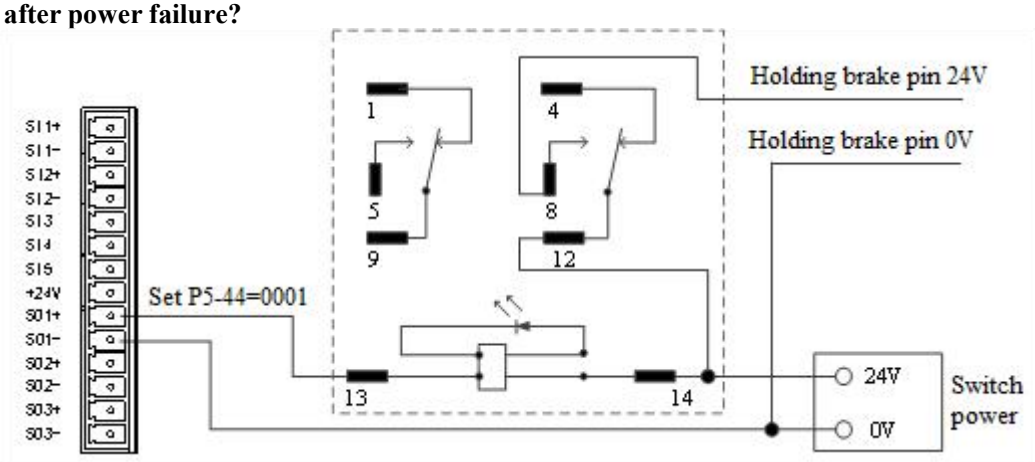
Q4: How to restore initialization?

1. P5-20, set to 0000 to disable, F0-01=1.

Q5: What are the current drivers that support bus mode?

1. The DS5E series supports Xnet communication - up to 20 axes.
2. DS5C supports EtherCAT communication - up to 32 axes.
3. DS5P supports Profinet communication - up to 32 axes.

Q6: How should the brake motor be wired? How to modify the parameters if there is slight sliding of the brake motor after power failure?



1. P5-44 defines the terminal of the brake output signal, as shown in the above figure, using SO1 to control the brake, that is, P5-44=0001.
2. Extend the servo OFF delay time P5-07. By default, 500ms can be appropriately extended. Set the holding brake command waiting time P5-09 to 0 to respond.

Q7: The initial direction is not 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 powering on. (Only applicable to modes 2, 4, 6, 7). If it is the internal speed mode (Mode 3), the positive and negative values of the speed setting can be changed.

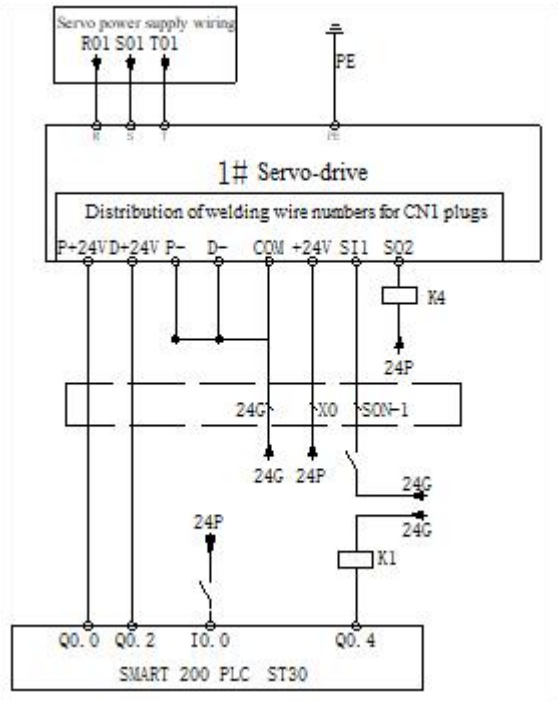
Q8: How do the two operating modes switch between each other?

Both P0-01 main mode and P0-02 sub mode are set to the required mode, with P5-30=0002 and SI2 defined as the mode switching terminals, when there is no signal coming from the SI2 terminal, operate according to the set mode in main mode P0-01, when there is a signal input at the SI2 end, operate according to the set mode in submode P0-02.

Note: The SI2 terminal signal needs to be a normally ON signal in order to switch.

Q9: What is the connection method between PLC and servo?

1. NPN low-level output type PLC: Y0 pulse connected to P -, Y1 direction connected to D -,+24V connected to P+24, D+24. (Taking XinJe PLC as an example)



Q10: What are the external connection methods and parameter settings for regenerative resistors?

1. There are P+, D, and C terminals on the servo interface, and there is a short connector connected between P+and D (using a built-in resistor), when the specifications of the built-in resistor are not sufficient, it needs to be replaced with an external resistor. The specifications of the external regenerative resistor can be found in 1.4 Selection of regenerative resistance.

①P+, D, C interfaces: Remove the short connector between P+and D, and connect the external regeneration resistor to P+, C.

②P+, PB interface models: Connect the external regeneration resistor to P+, PB.

2. P0-24 doesn't need to be set, P0-25=power value, P0-26=resistance value.

Q11: What is the service life of tank chains?

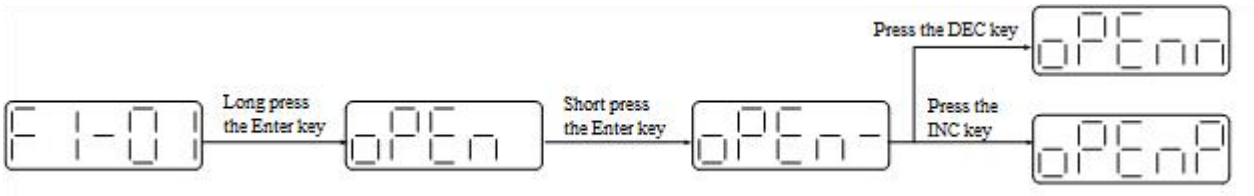
The bending resistance is 5 million times and the bending radius is 50mm.

Appendix 3. General debugging steps

1. Motor idle shaft, preliminary debugging

A. Connect the cables correctly, paying attention to the one-to-one connection of U, V, W, and PE terminals, and the phase sequence cannot be crossed.

B. Open loop trial operation: The trial operation mainly checks the power line and encoder feedback line to determine whether 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, the power should be immediately disconnected and the wiring should be rechecked.



C. Jogging test run: Enter parameter F1-00.

Short press the Enter key to enable the motor. In the enabled state, press INC forward jog operation and DEC reverse jog operation. Press STATUS/ESC, end enable and exit jog mode to enter serial number switching mode. The four states displayed during jogging are as follows:

State	Panel display	State	Panel display
Idle display	JoG-	Forward rotation display	JoG-P
Enable display	JoG--	Reverse display	JoG-n

2. Integrating the motor with the machinery for debugging

A. Observe the direction of the machine head operation. If it is opposite to the actual need, turn off the servo, set parameter P0-05 to 1, and then power on again to make the changes effective.

B. During operation, observe the smoothness and responsiveness of the operation, and adjust the servo control parameters appropriately.

Appendix 4. Common mode parameters of servo

Appendix 4.1 Basic general parameters

Basic general parameters	
Parameter	Abstract
P0-03 enable mode P5-20 servo ON signal/S-ON	Enabling method selection, usually P0-03 defaults, P5-20 sets n.0010 to enable as soon as power is applied
P0-04 Rigidity level	Adjusting servo gain in self-tuning fast adjustment mode
P0-05 Definition of rotation direction	Determine the direction of the motor, usually defaulting to 0/1
P0-25 Discharge resistor power value P0-26 Discharge resistance value	Set external regeneration resistor specifications to ensure 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 the source and limit value of servo torque limit. The default unit is the percentage ratio 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 holding brake motor adopts servo SO terminal to control the setting parameters of the holding brake
P5-47 Alarm output/ALM	Set alarm function through SO terminal output, default SO2 terminal output dynamic closing signal
P7-00 RS485 station number P7-01 Communication configuration P7-02 RS485 communication protocol	Communication settings related parameters

Appendix 4.2 Common parameters of internal position mode

Common parameters of internal position mode	
Parameter	Abstract
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 1st to 35th segment position parameter settings	The control methods for internal position mode are given, including step changing mode, positioning mode, and adjustment time Configuration of pulse displacement, speed, acceleration and deceleration time at each segment position
P5-35 Step change signal/GHGSTP P5-32 Pause current segment signal/INHIBIT P5-31 Skip current segment number/Z-CLAMP	Common terminal function allocation
P4-00 The number of Z-phase signals passed after leaving the limit switch P4-01 The speed of hitting the proximity switch P4-02 The speed of leaving the proximity switch P5-28 Find the reference origin/SPD-A on the forward rotation side in position mode P5-29 Reverse rotation to find reference origin/SPD-B in position mode	Internal position return to origin setting parameters
F2-09 35 Arbitrary setting of segment positions	Number of communication settings segments

Appendix 4.3 Common parameters for internal torque control

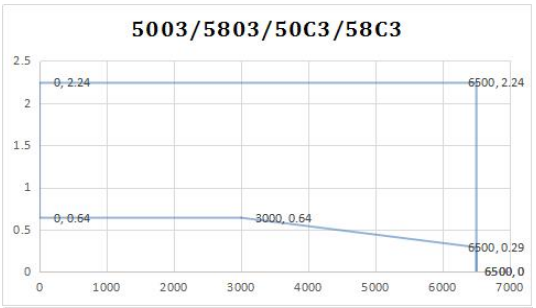
Internal torque control	
Parameter	Abstract
P0-01 Control mode selection	Set to 1: Internal torque mode
P3-33 Internal torque command given	The given value is the percentage ratio of the rated torque
P3-16 Internal forward speed limitation during torque control P3-17 Internal reverse speed limitation during torque control P3-14 Forward maximum speed limit (MAX speed)	Speed limit in torque mode

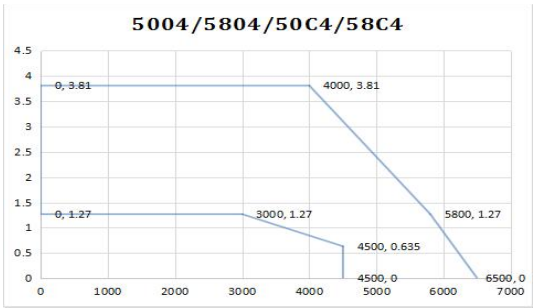
P3-15 Reverse maximum speed limit (MAX speed)	
P5-27 Speed direction switching/SPD-D	Reverse direction, default to n.0000. If a commutation is given through the SI2 terminal, P5-27 can be set to n.0002

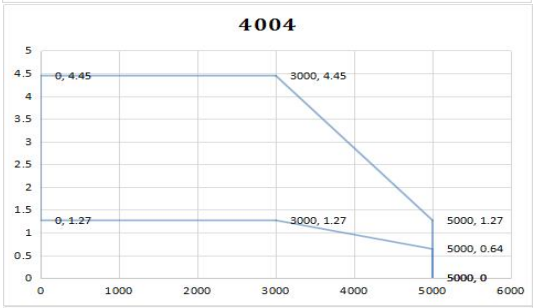
Appendix 4.4 Common parameters for internal speed control

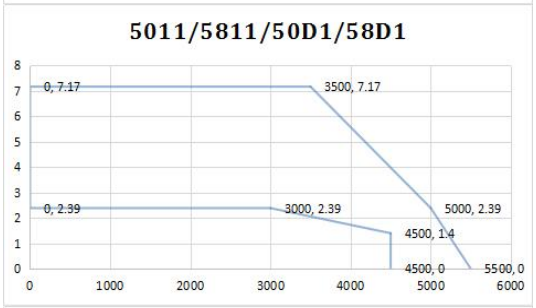
Internal speed control	
Parameter	Abstract
P0-01 Control mode selection	Set to 3: Internal speed control mode
P3-05 Internal setting speed 1 P3-06 Internal setting speed 2 P3-07 Internal setting speed 3	Internal 3-speed speed speed value setting, in rpm
P5-28 Internal speed selection/SPD-A P5-29 Internal speed selection/SPD-B	The combination of terminals determines the corresponding segment speed
P5-27 Internal speed direction selection/SPD-D	Reverse direction, default to n.0000. If a commutation is given through the 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

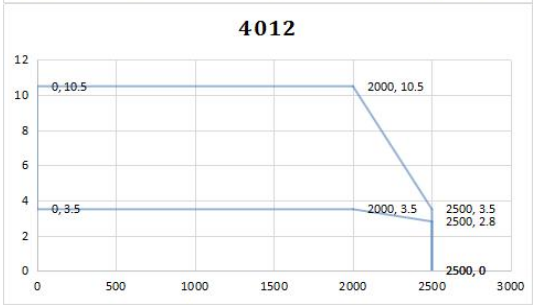
Appendix 5. Torque speed characteristic curve

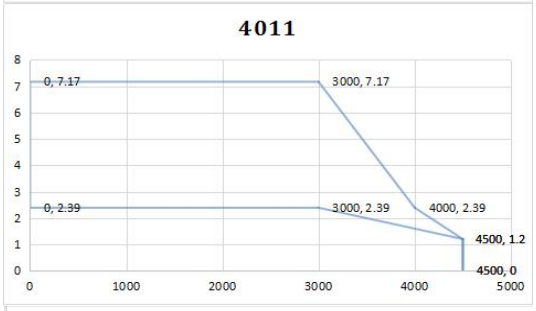


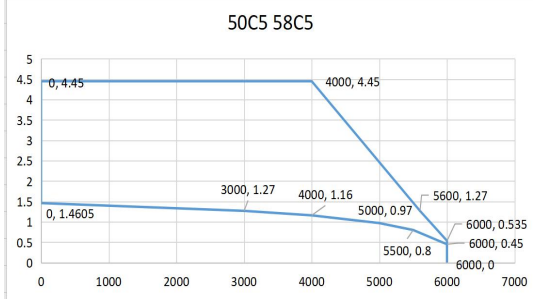


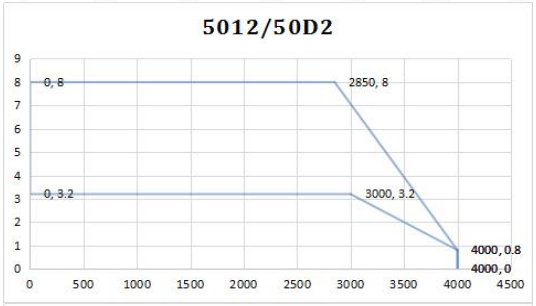


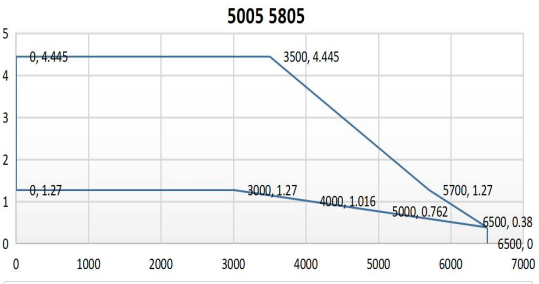


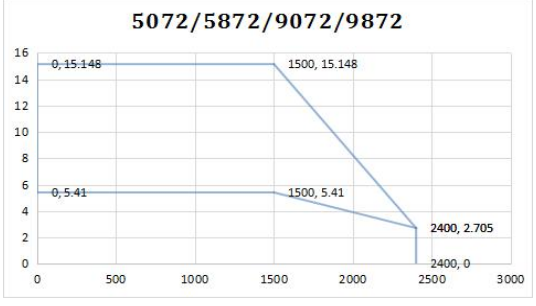








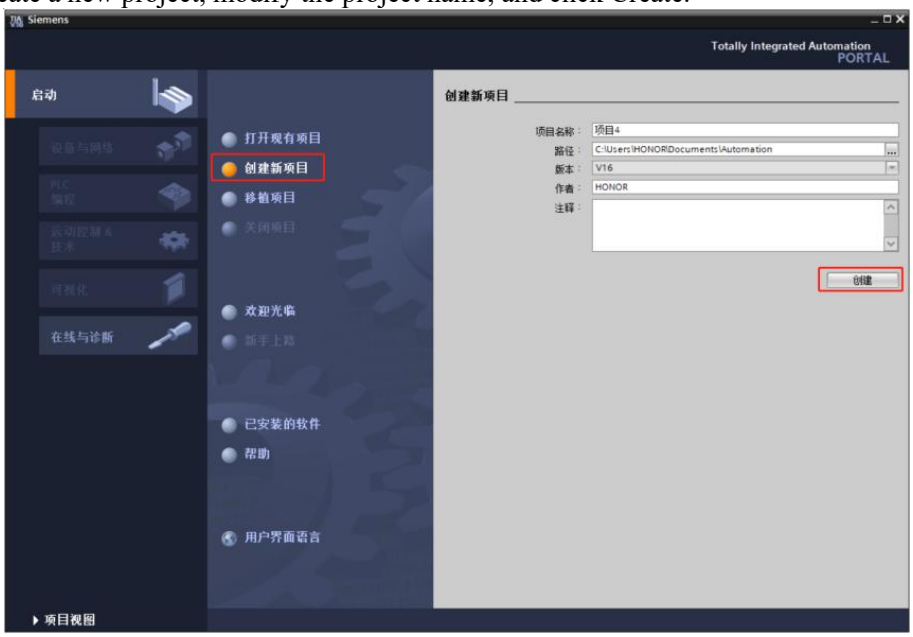




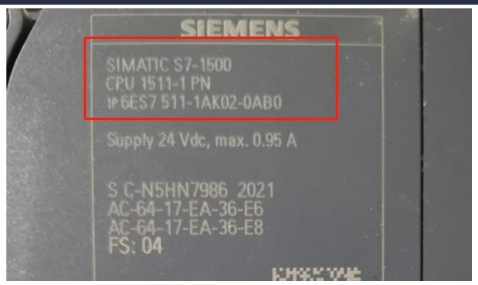
Appendix 6. Use cases of message 111

1. New project

1) Select to create a new project, modify the project name, and click Create.



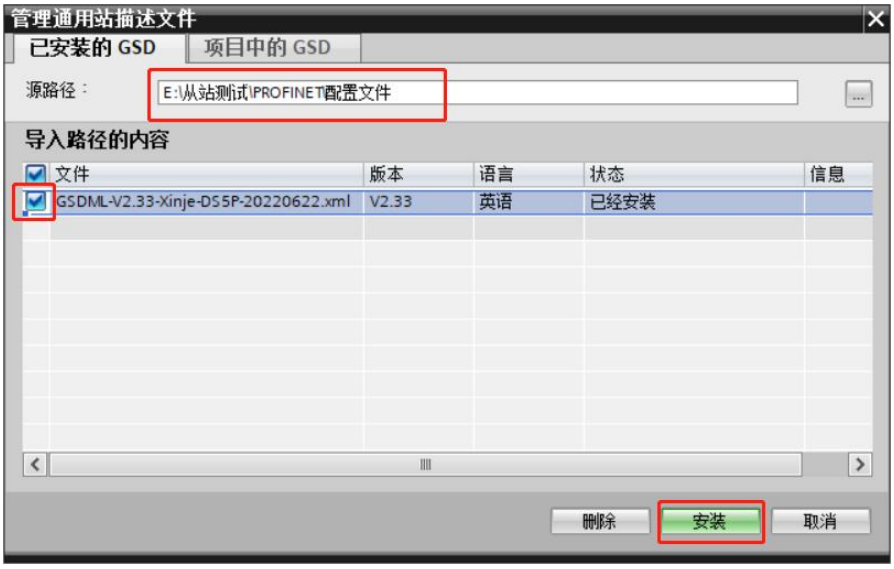
2) Select devices and networks, add new devices and controllers, and select corresponding devices based on PLC model and order number.



2. Install GSD files

1) In the "Options" menu, select the command "Manage general station description files (GSD)".
2) On the "Installed GSDs" tab, select the storage directory for the GSD files.
3) Select one or more files from the list of displayed GSD files.
4) Click the "Install" button. Installing the selected GSD file.
5) To create an installation log file, click the "Save log file" button.
6) All issues that occurred during installation can be tracked through log files.

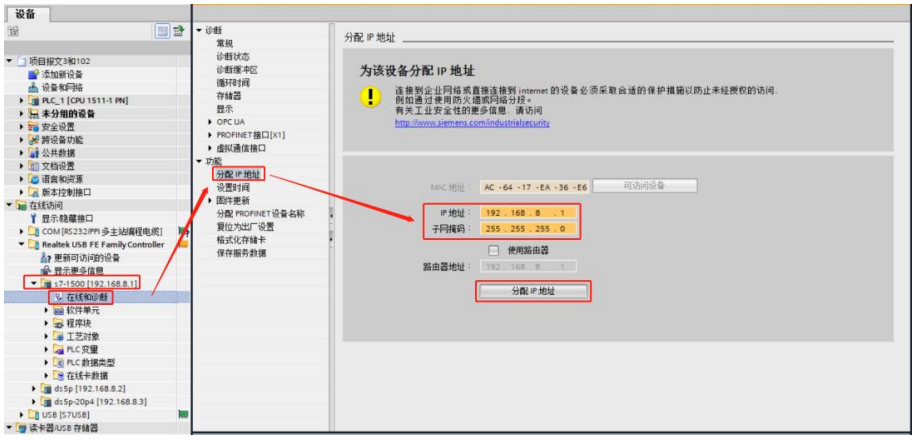
7) Click "Close". The system will notify that IO devices from the installed GSD file will be entered into the hardware directory. This process may take a few seconds.



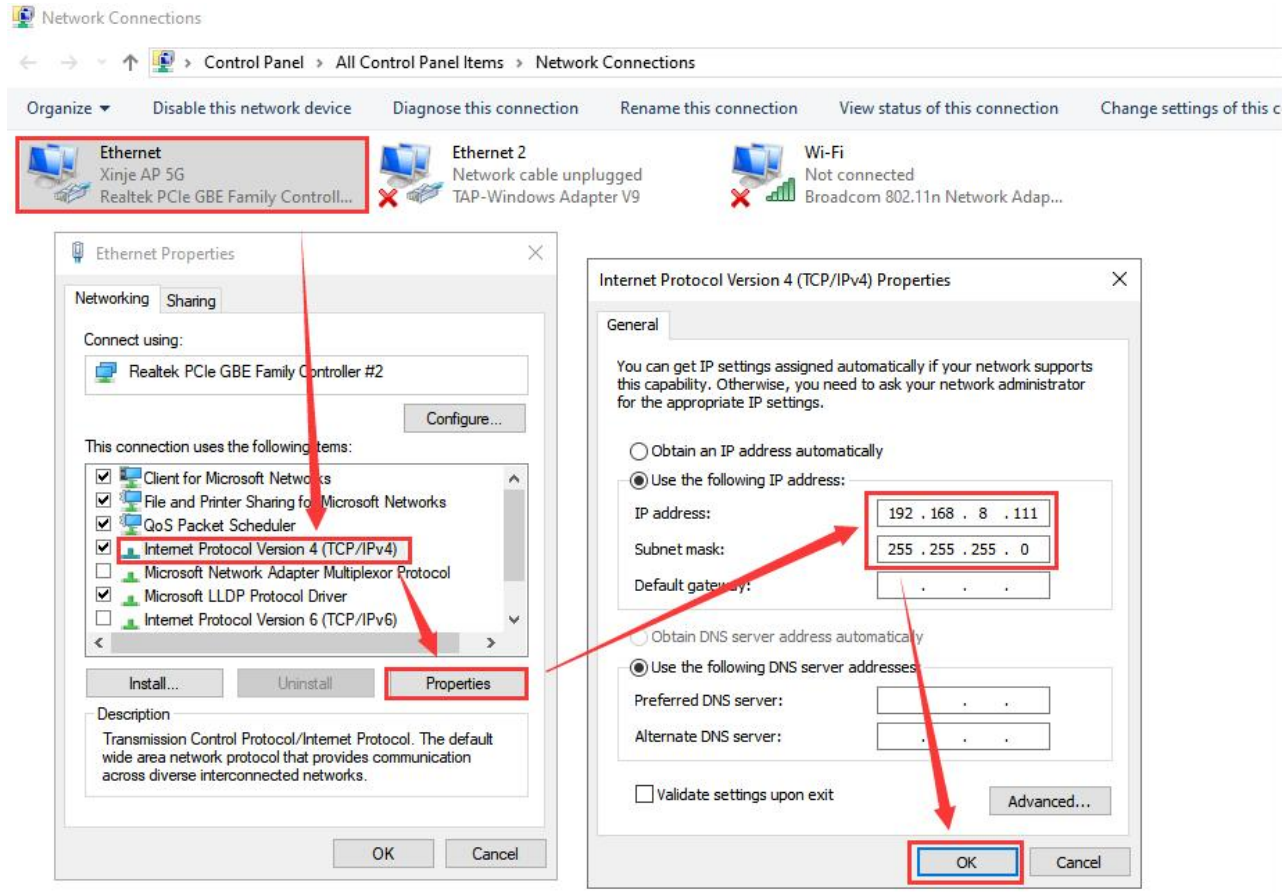
3. Assign device IP address and device name

Step 1: Choose online access, Step 2: Select the Ethernet adapter that connects the computer to the PLC, Step 3: Click to update accessible devices, accessible devices are shown in step 4 of the figure (with assigned IP address and device name).

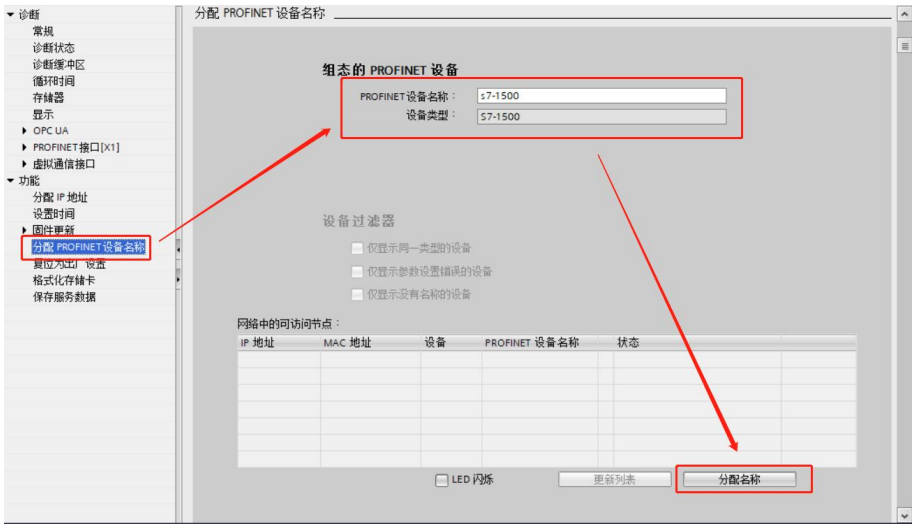
Assign device IP addresses.



After confirming the device IP address, Ethernet devices also need to be in the same network segment.

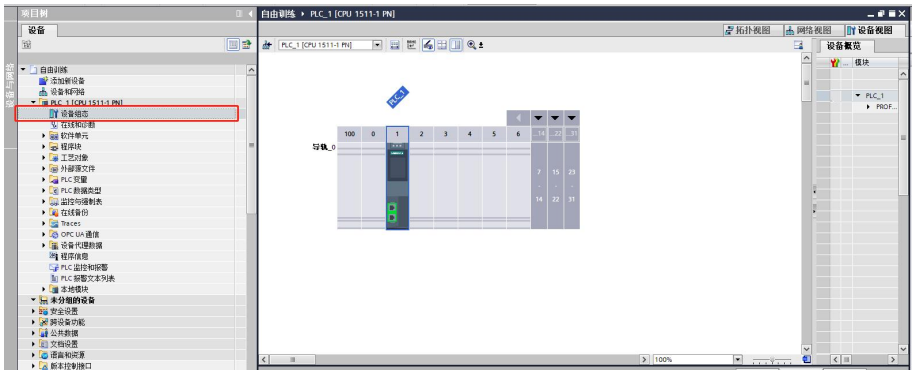


Assign device names.

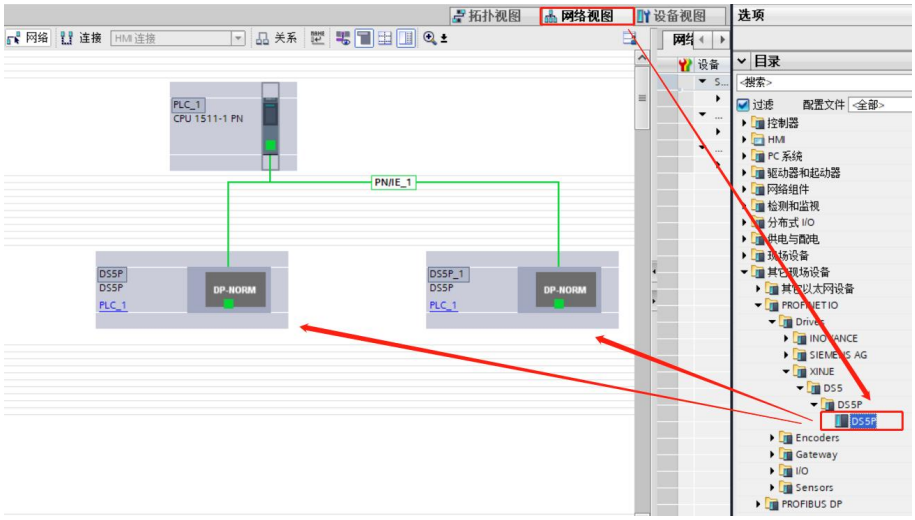


Note: After assigning device names to the slave station, they are sorted by device name, not by physical wiring.

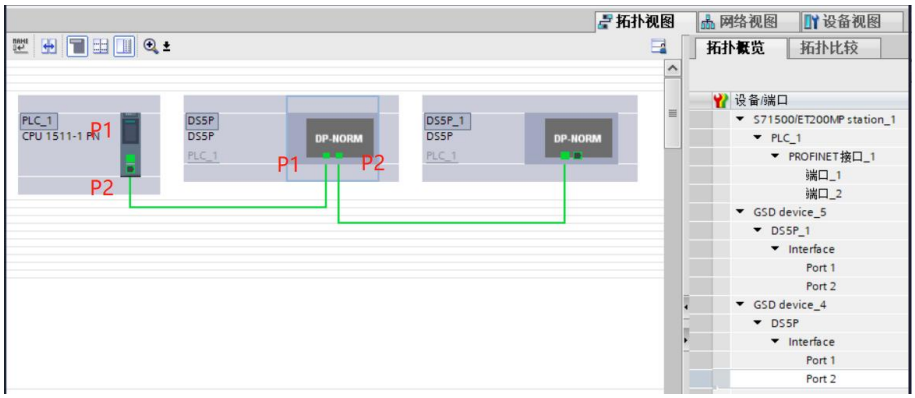
4. Add slave devices under device configuration.



Open the network view, add devices, and create a network connection to the PLC.



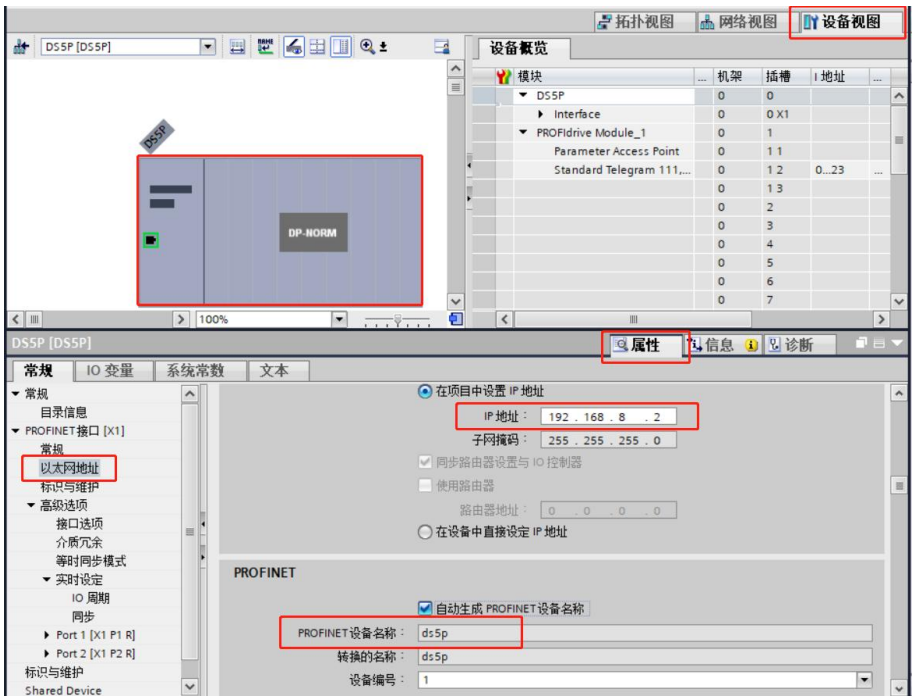
Open the topology view and connect the network ports. In this case, the PLC network port P1 corresponds to the servo network port P1：



Note: The topology view connection should be consistent with the physical network cable connection, otherwise an error will be reported.

5. Set IP address and device name

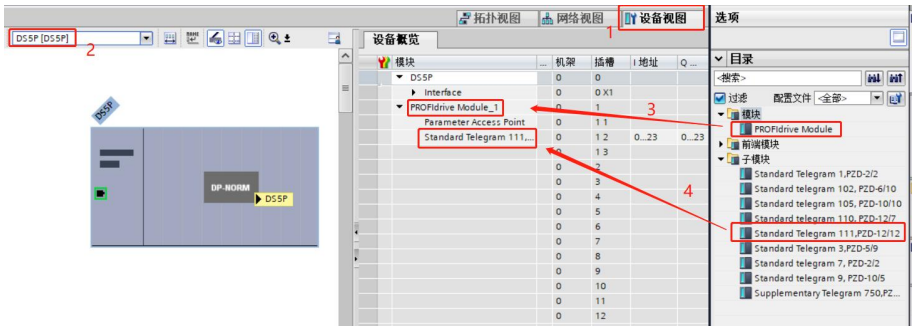
Device view, select device, properties, Ethernet address, set IP address and device name. Ensure that these are consistent with online access.



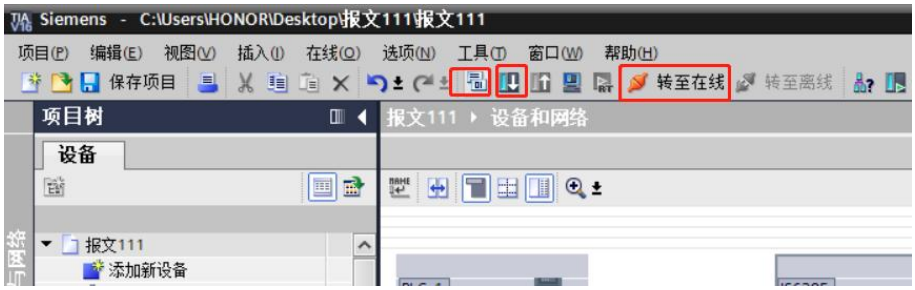
Note: The IP address and device name in the device view should be consistent with the IP address and device name assigned for online access. Inconsistencies will result in an error message. When multiple devices are connected, the device name and address are uncertain. The device name and IP address can be determined through online access to a single device via PLC.

6. Add message

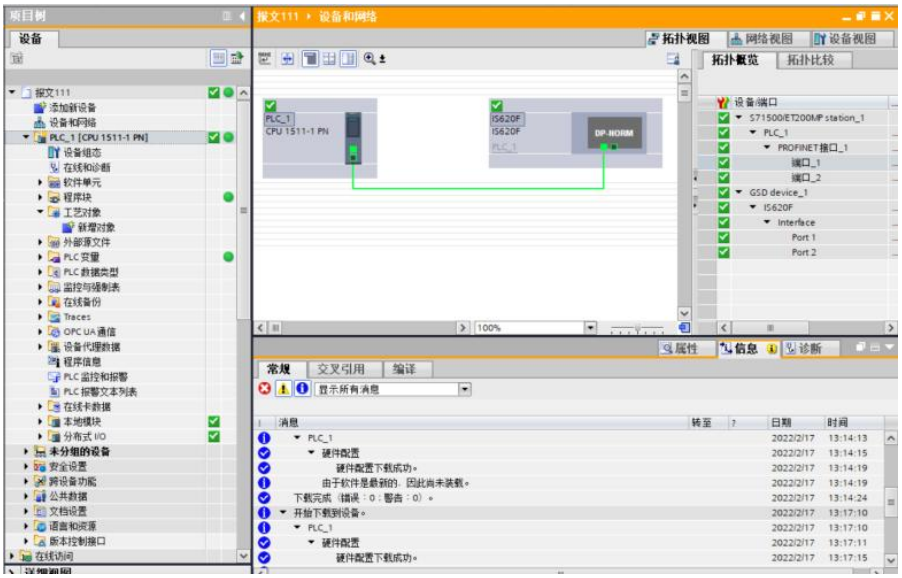
Select the slave station in the device view, add the message, first add the module, and then select to add the message in the submodule.



7. Compile and download, then go online.

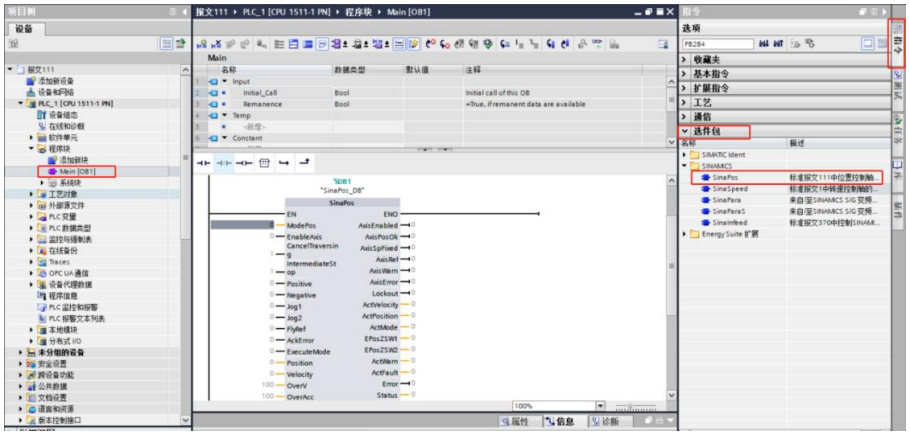


The normal network connection is shown in the following figure:

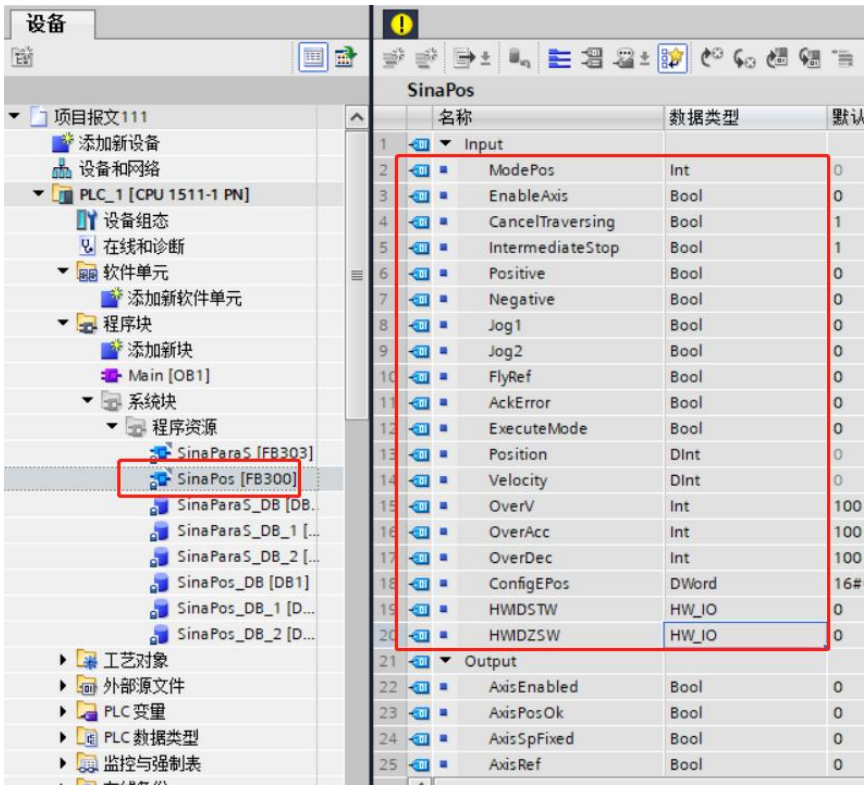


8. Edit programs

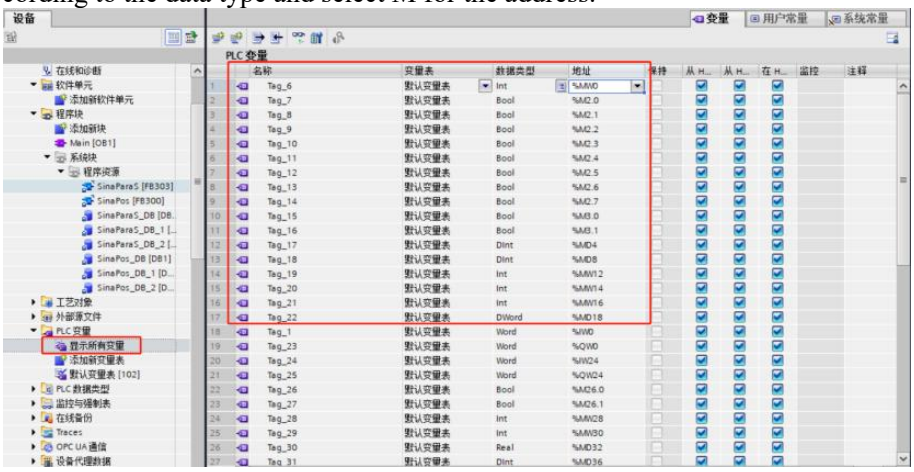
Program block, add SinaPos.



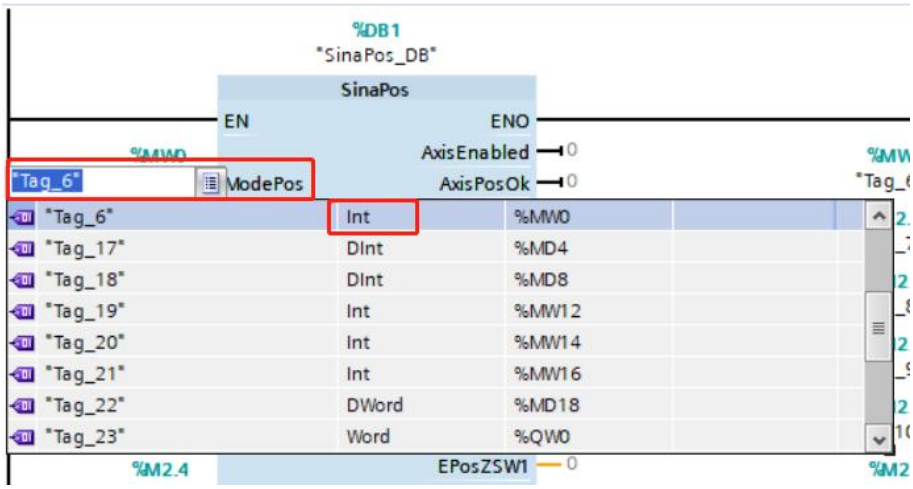
Viewing Function Block Data Types in System Blocks



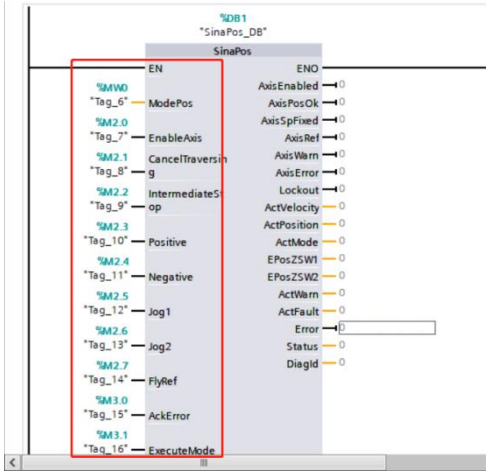
Add variables according to the data type and select M for the address.



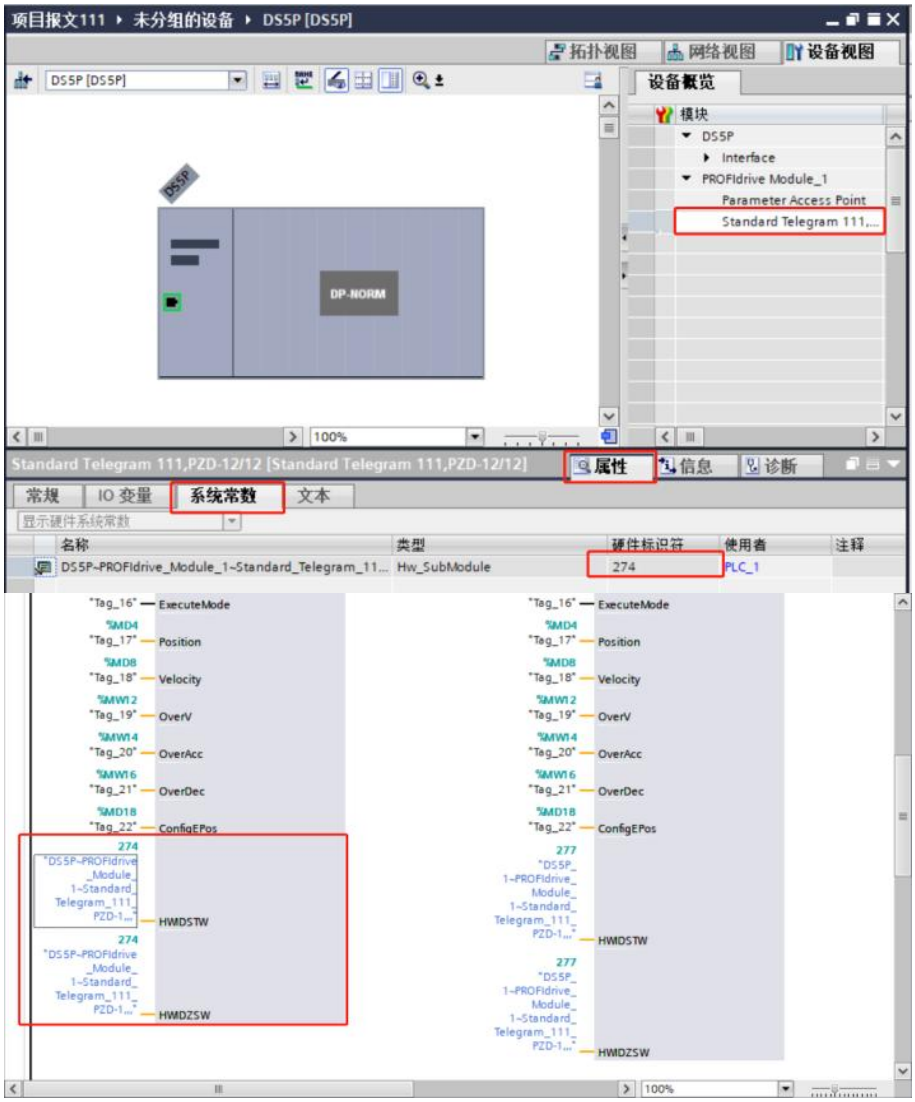
Add corresponding variables to the function block based on the data type.



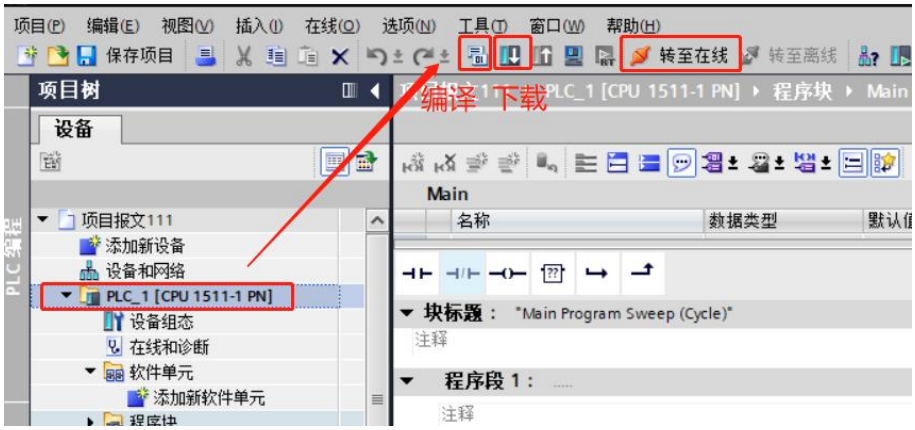
As shown in the following figure:



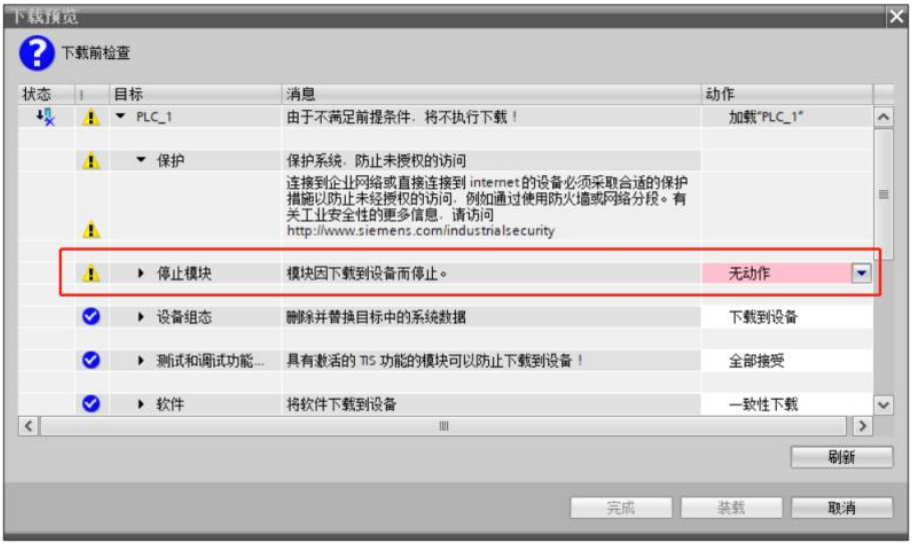
For the assignment of HWI DSTW and HWI DSZW pins in the function block, you can double-click DS5P in the device view, after selecting the 111 message, right-click on Properties and then find the hardware identifier in the system constant.



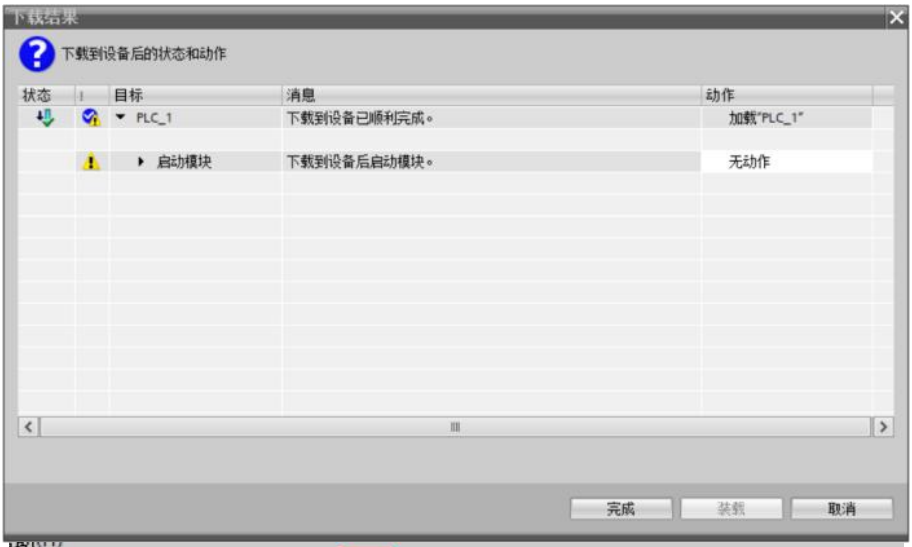
Compile, download, and go online:

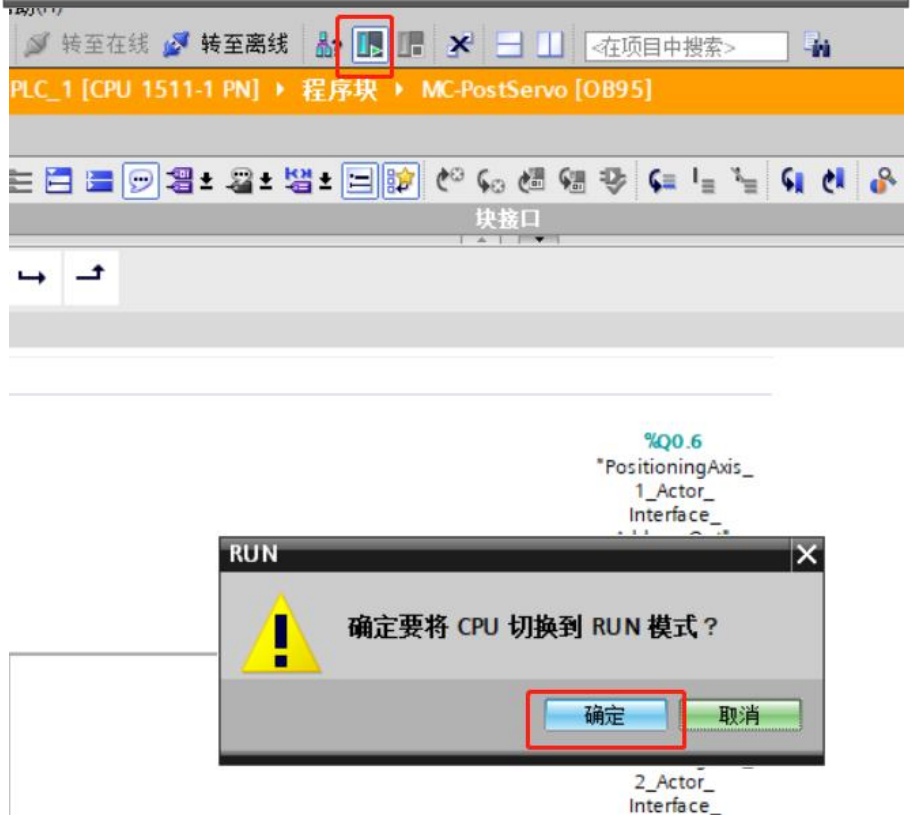


When a download message pops up, the CPU needs to be stopped before proceeding with the operation.



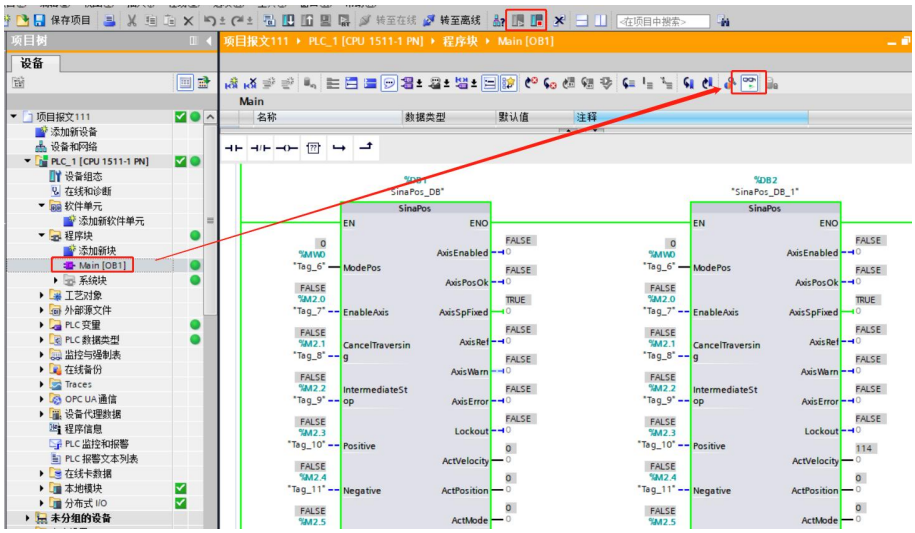
After downloading, it is necessary to switch back to RUN.





9. Debug

Select the program block, open Main, and enable monitoring (It is necessary to confirm that the PLC is in the RUN state).

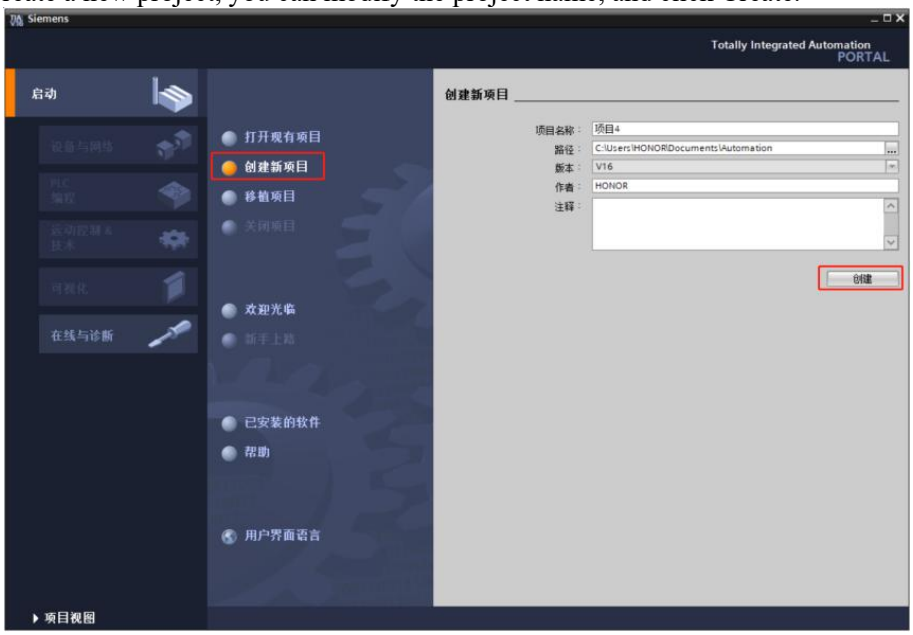


Taking Mode 1 relative operation as an example, the following parameters need to be set. (Related parameters can be viewed 6.3.2 FB284 Function Block Pin Introduction)
ConfigEPOS=3, must be set to 3, otherwise the function block will not take effect.
ModePos=1, 1 is the relative motion mode.
EnableAxis=ON, ON is enabled.
CancelTransing=ON, don't reject activated running tasks. (Set OFF to stop and cancel the current running task)
IntermediateStop=ON,don't stop running tasks in the middle. (Set OFF to pause, set ON to continue running the current task)
Position=1000000, set 10000 positions.
Velocity=3000, 300rpm.
OverV=100, the speed multiplier is 100%, generally default to 100.
OverAcc=100, acceleration multiplier of 100%, generally default to 100.
OverDec=100, acceleration multiplier of 100%, generally default to 100.
ExecuteMode=ON, set ON to trigger motion.

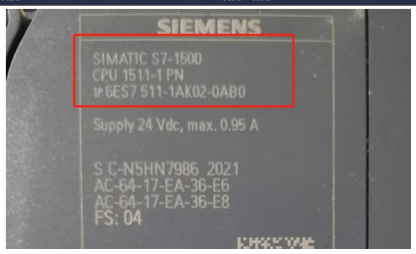
Appendix 7. Use Cases for Message 3/102

1. New project

1) Choose to create a new project, you can modify the project name, and click Create.

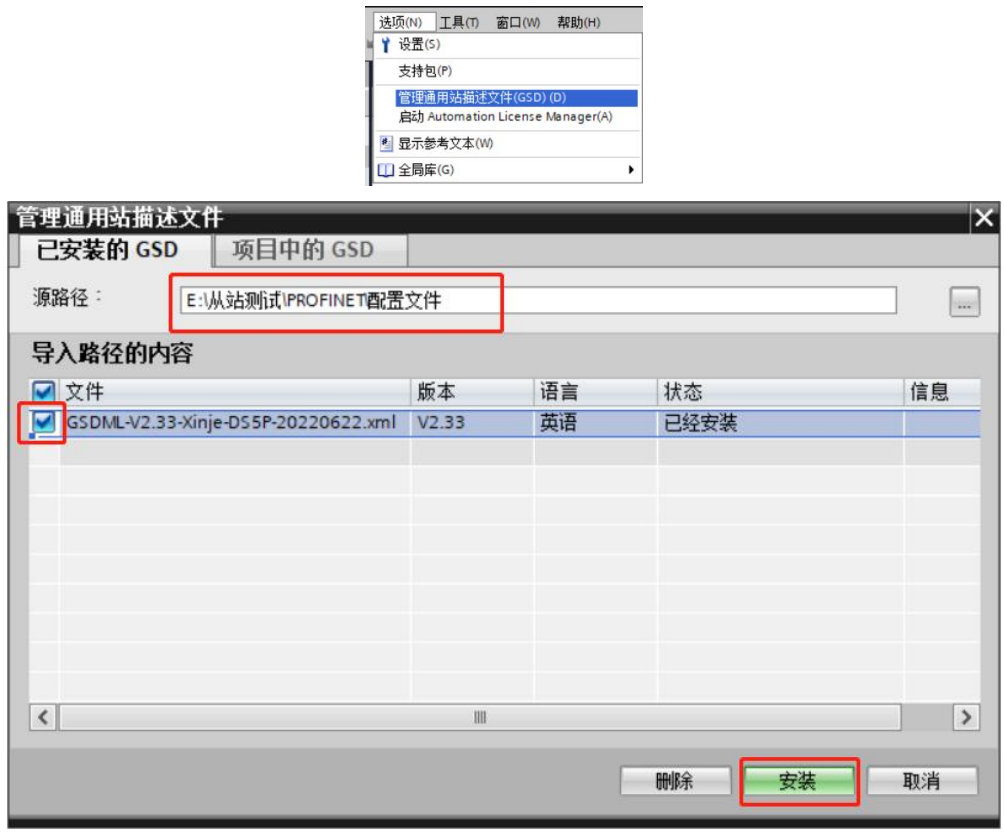


2) Select devices and networks, add new devices and controllers, and select corresponding devices based on PLC model and order number.



2. Install GSD files

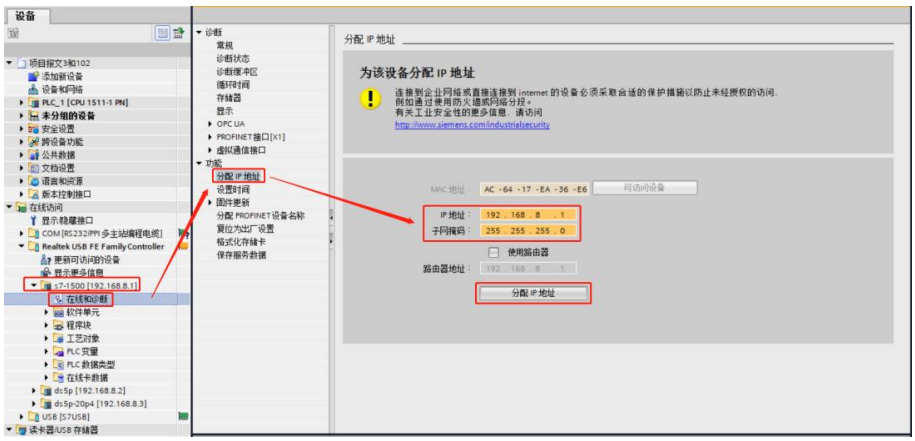
1) In the "Options" menu, select the command "Manage generic station description files (GSD)".
2) On the "Installed GSDs" tab, select the storage directory for the GSD files.
3) Select one or more files from the list of displayed GSD files.
4) Click the "Install" button. Installing the selected GSD file.
5) To create an installation log file, click the "Save Log File" button.
6) All issues that occurred during installation can be tracked through log files.
7) Click "Close". The system will notify that IO devices from the installed GSD file will be entered into the hardware directory. This process may take a few seconds.



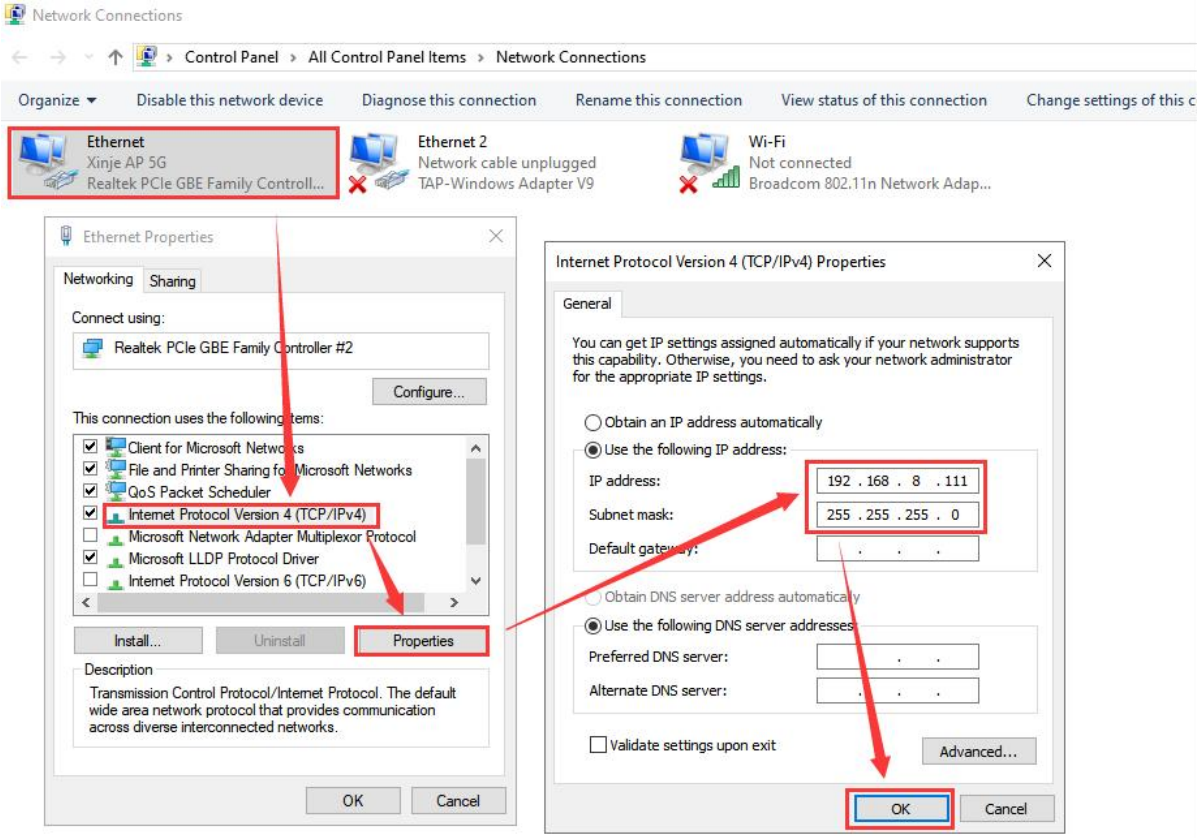
3. Assign device IP address and device name

Step 1: Choose online access, Step 2: Select the Ethernet adapter that connects the computer to the PLC, Step 3: Click to update accessible devices, accessible devices as shown in step 4 of the figure (assigned IP address and device name).

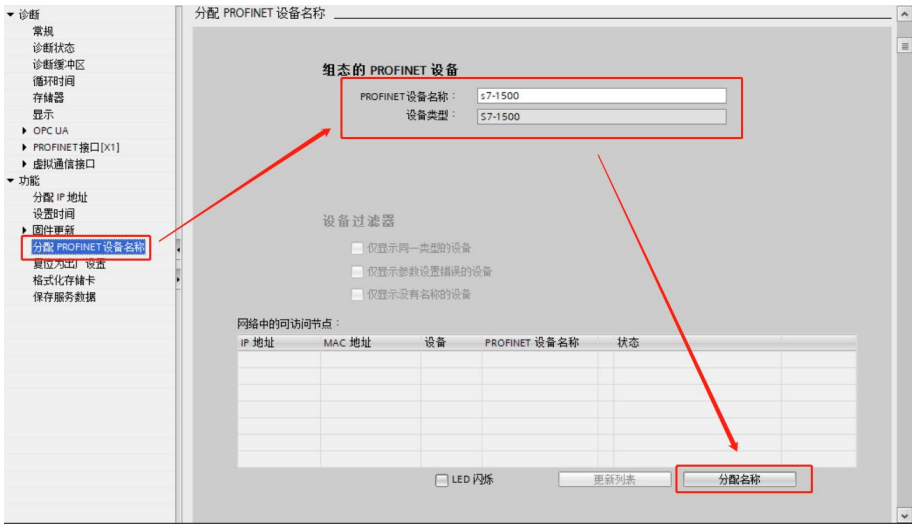
Assign device IP addresses.



After confirming the device IP address, Ethernet devices also need to be in the same network segment.

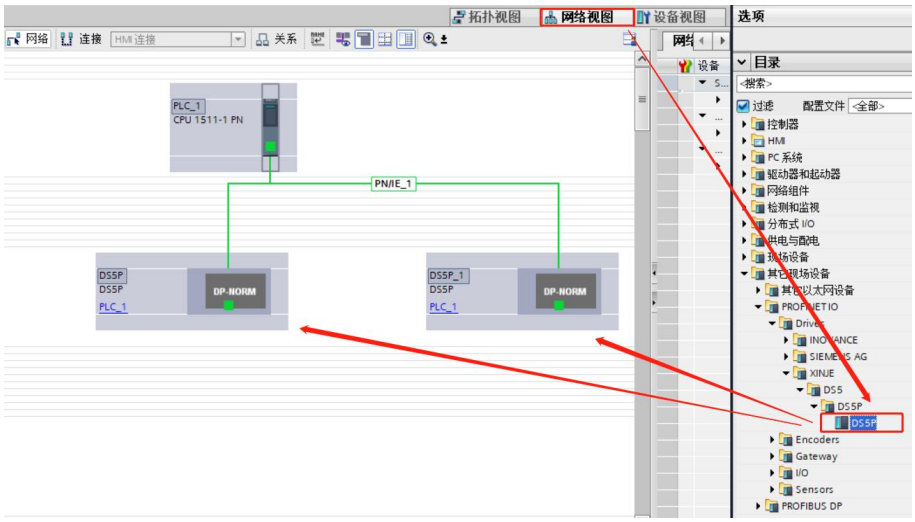


Assign device name.

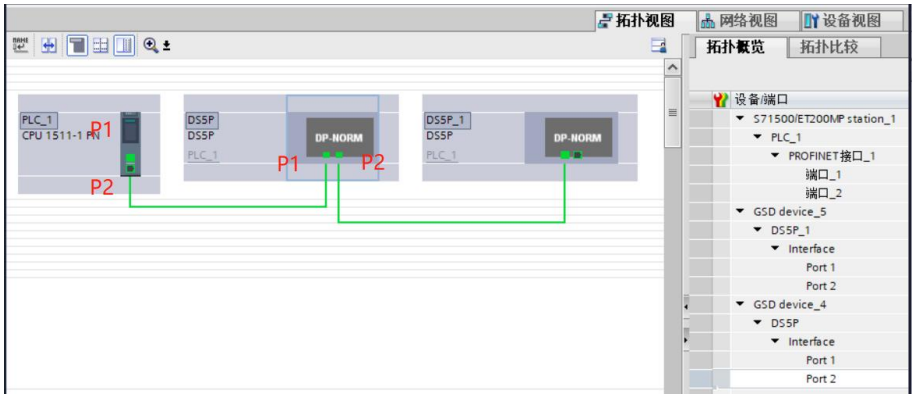


Note: After assigning device names to the slave station, they are sorted by device name, not by physical wiring.

4. Add slave devices to the network view and create a network connection with the PLC.



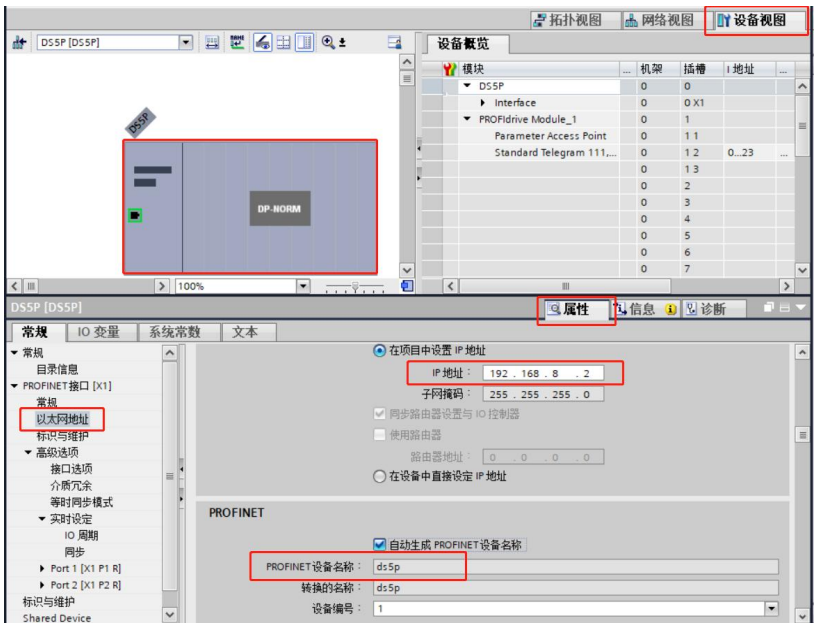
Open the topology view and connect the network ports. In this case, the PLC network port P1 corresponds to the servo network port P1.



Note: The topology view connection should be consistent with the physical network cable connection, otherwise an error will be reported.

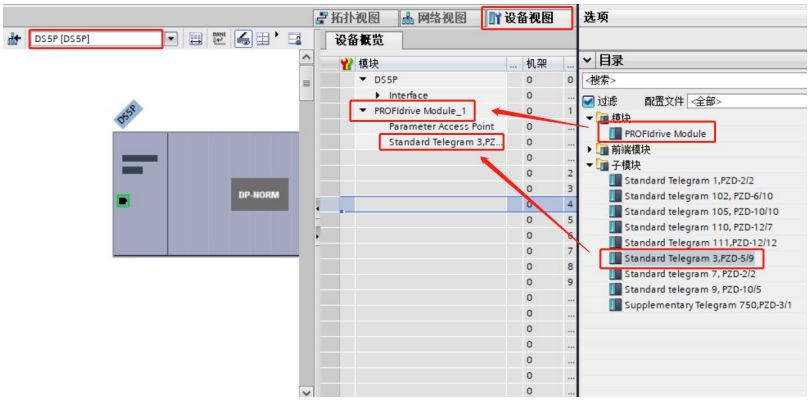
5. Set IP address and device name

Device view, select device, properties, Ethernet address, set IP address and device name. Ensure that these are consistent with online access.



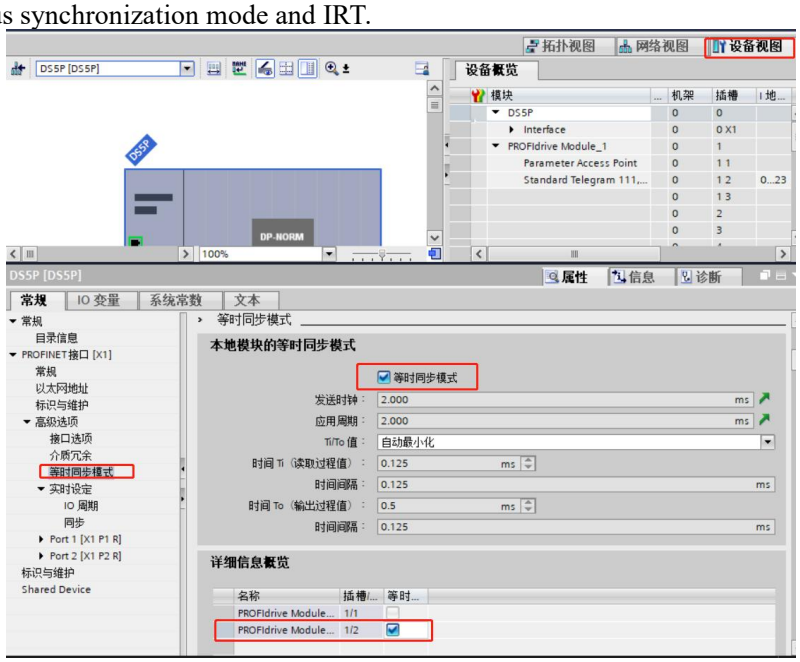
Note： The IP address and device name in the device view should be consistent with the IP address and device name assigned for online access. Inconsistencies will result in an error message. When multiple devices are connected, the device name and address are uncertain. The device name and IP address can be determined through online access to a single device via PLC.

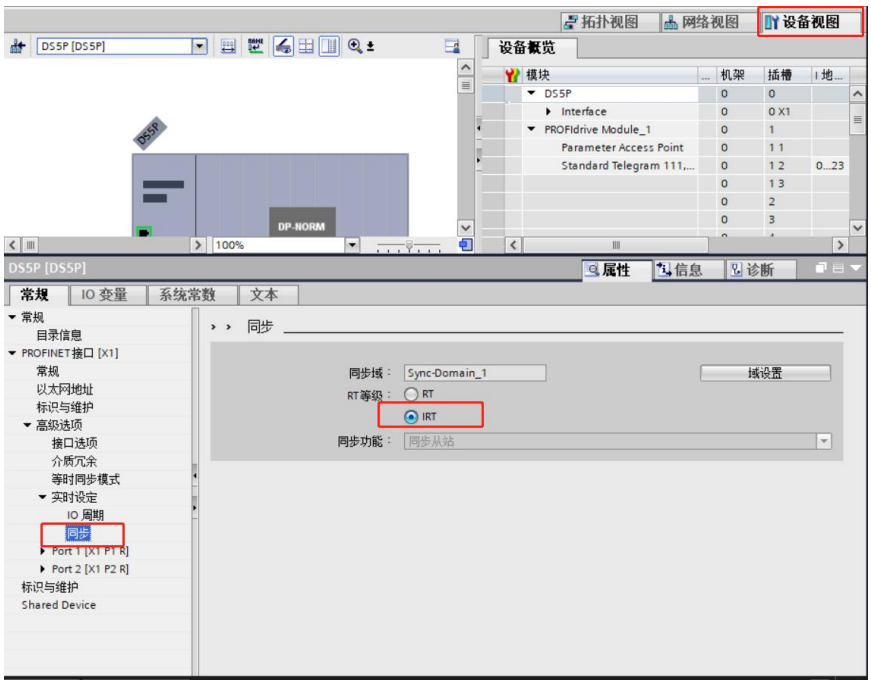
6. Add message



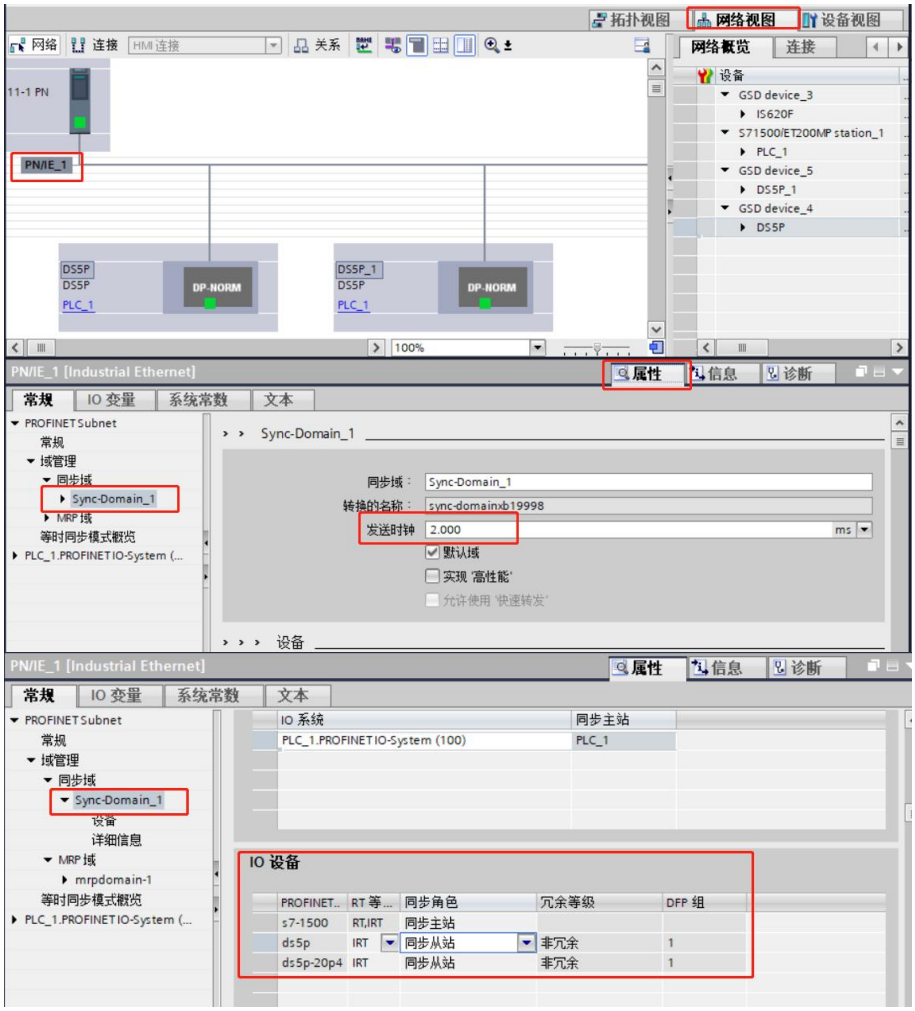
7. Configure IRT

Check the isochronous synchronization mode and IRT.



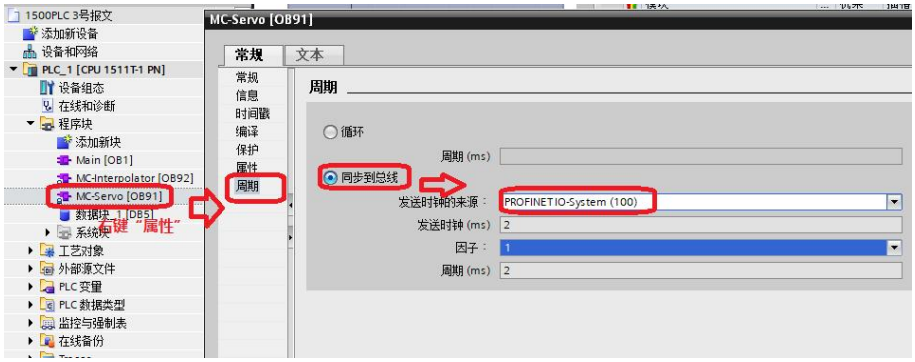


Modify synchronization time: Configure Profinet IRT communication in the network view, please note that the current communication time for DS5P is at least 1ms.



Right click on OB91 and select "Synchronize with Bus Options".

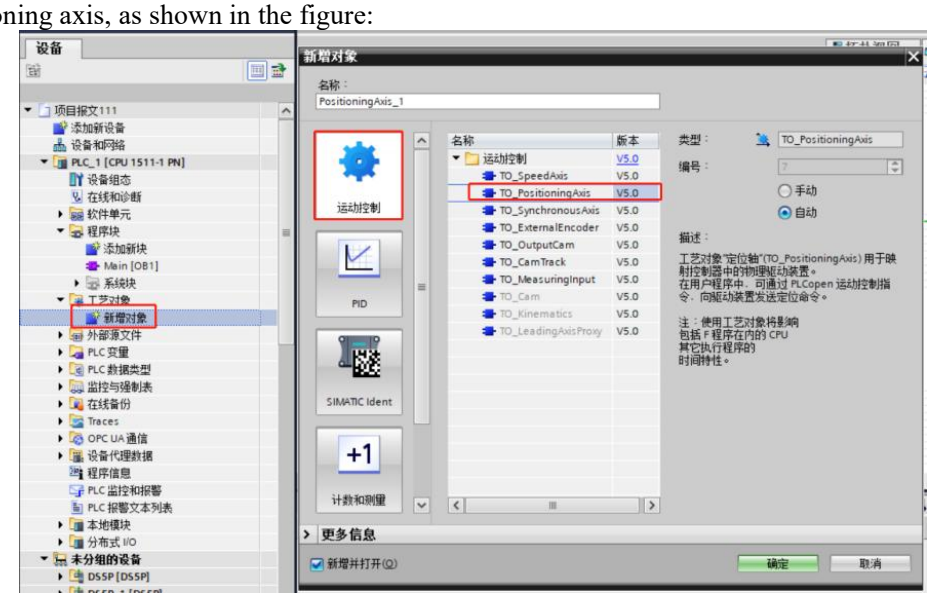
Note: If the CPU performance is low, it is necessary to consider adjusting the Factor parameter to 4 or 8 to reduce the CPU load.



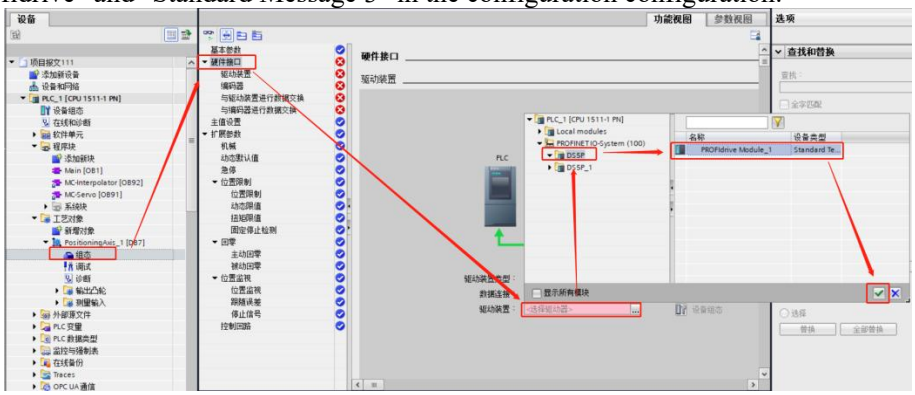
At this point, the IRT configuration is complete.

8. Add process object

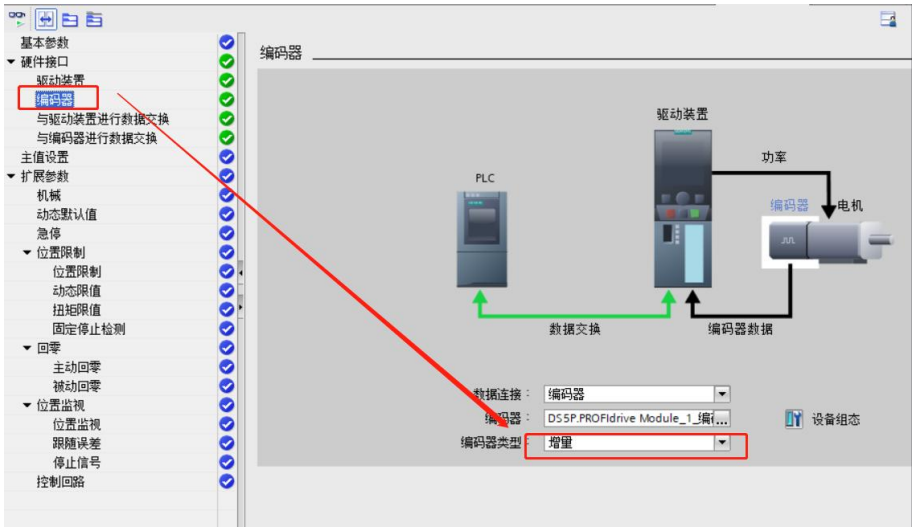
Add the positioning axis, as shown in the figure:



Then select "Profidrive" and "Standard Message 3" in the configuration configuration.



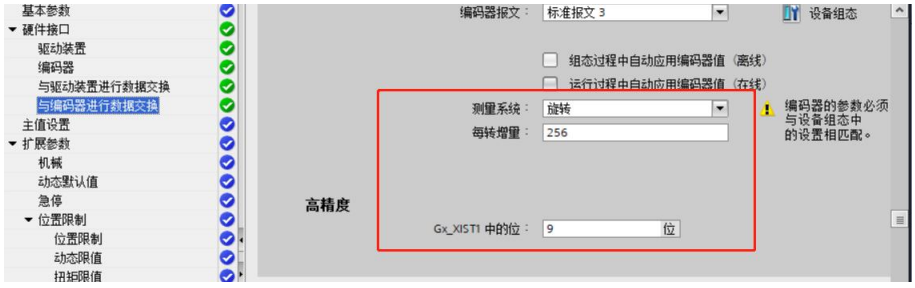
Next, select the encoder type, if P0-79=1 (incremental position mode), select "incremental" as the encoder type.



If P0-79=0 or 2 (absolute position linear mode), select "Loop Absolute Encoder" as the encoder type.

For the reference speed of the motor, the maximum speed and reference torque can't be checked with "Automatically apply drive values during operation", need to manually set according to drive parameters. The reference speed is the rated speed of the motor, and the maximum speed is.

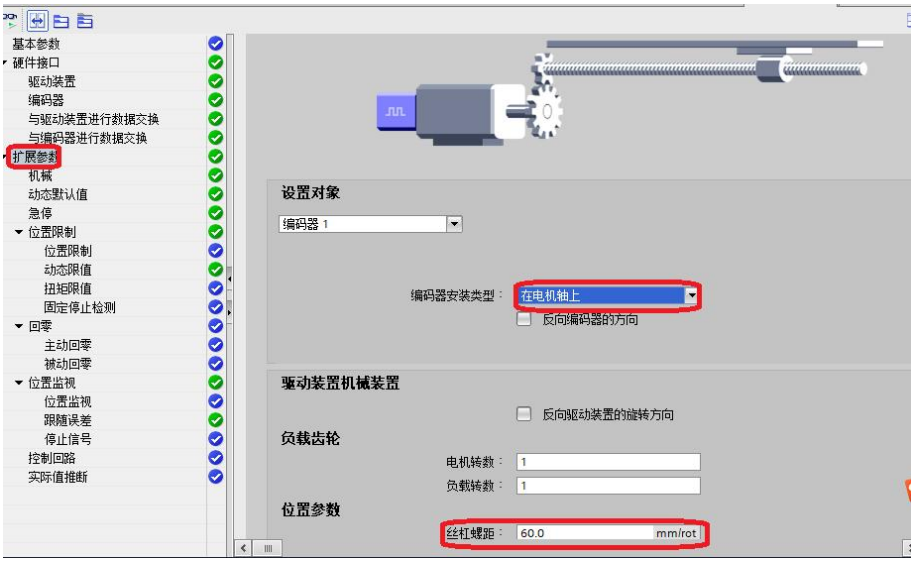
For the "Data exchange with encoder" section, if "Automatically apply encoder values during runtime" is not checked, the following configuration needs to be followed: If P0-79=1 (incremental position mode) and the encoder type is selected as "incremental", the following configuration is required.



If P0-79=0 or 2 (absolute position linear mode), if the encoder type is selected as "Loop Absolute Encoder", the following configuration is required.

Note: 17 bit motor (CS/CM), set increment per revolution=256, number of revolutions=128, the bit in Gx_XIST1 is 9, and the bit in Gx_XIST2 is 9. 23 bit motor (TL), set increment per revolution=16384, number of revolutions=128, the bit in Gx_XIST1 is 9, and the bit in Gx_XIST2 is 9.

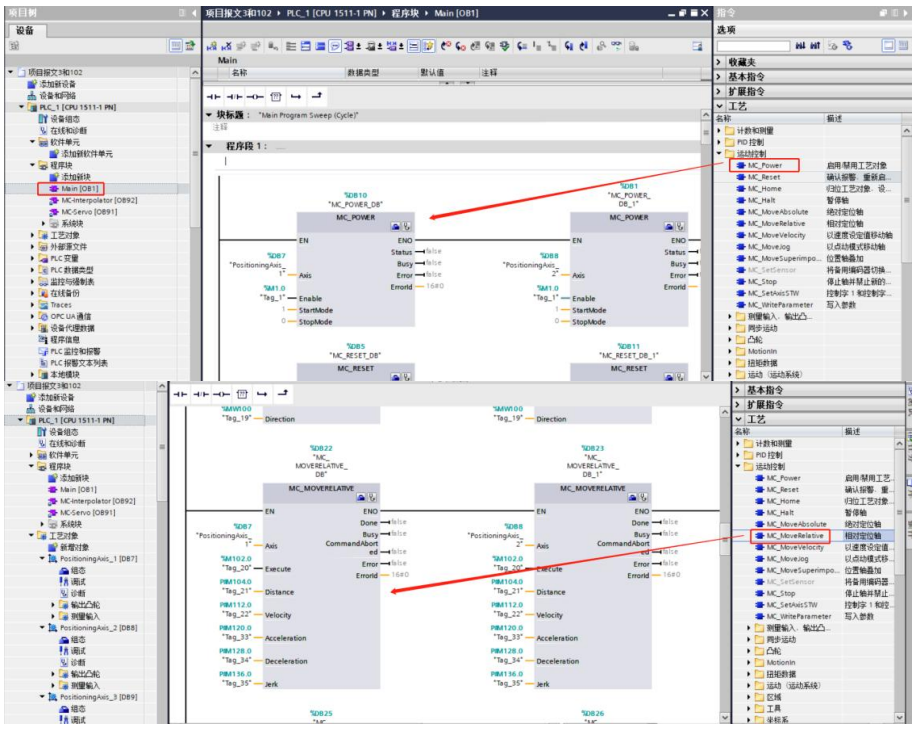
Next, proceed with the expansion parameter settings, select the encoder installation type as "on the motor shaft", and set the position parameters:



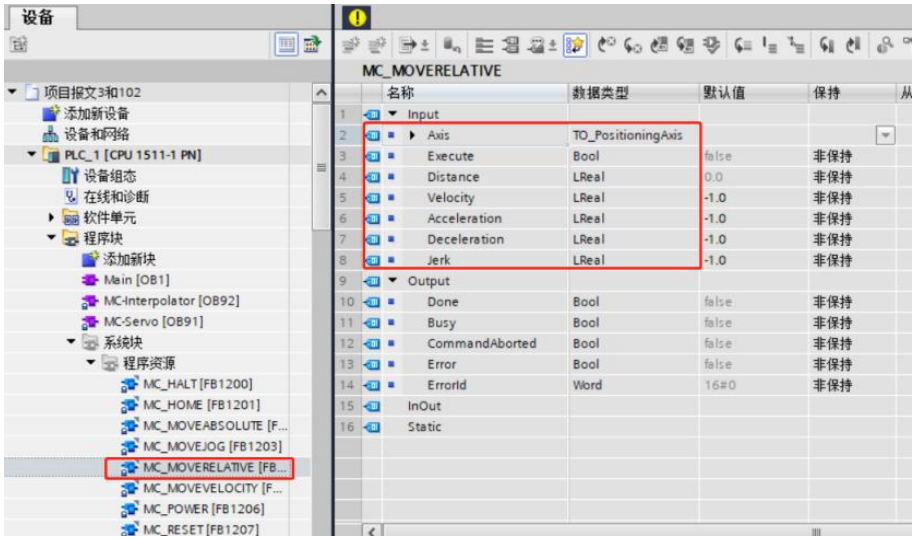
The "Enable Follow Error Monitoring" option can be turned off, if checked and the following error is set to be small, the upper computer is prone to reporting errors when enabling operation.

9. Programming

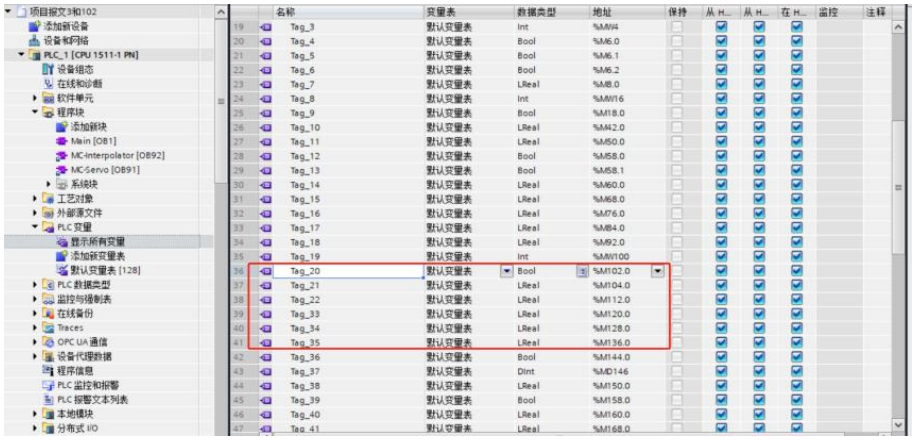
Instruction AXIS needs to be associated with process object "PositioningAxis_1".



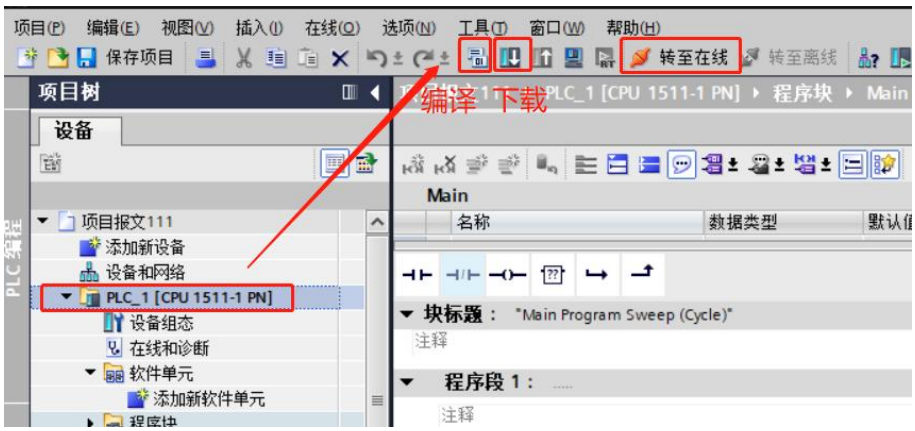
In the system block, function block data types can be viewed;



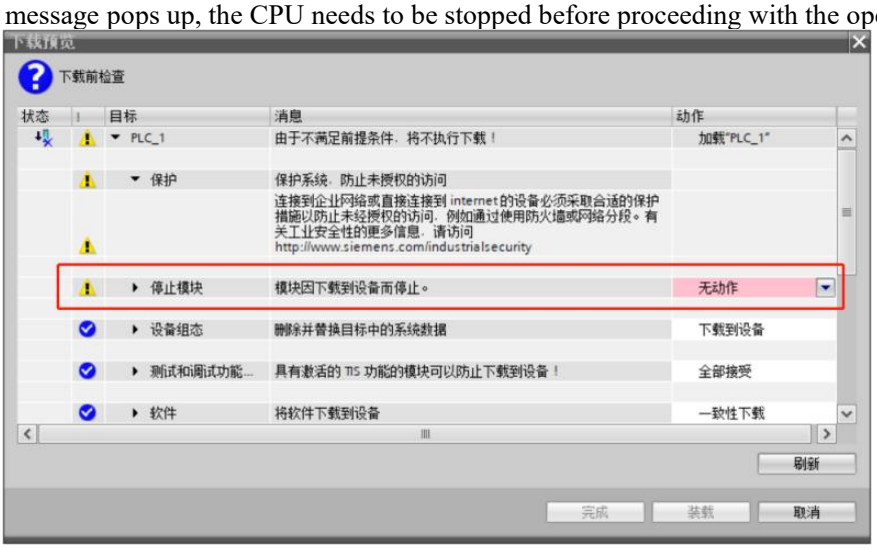
Add variables based on data type and select M for address.



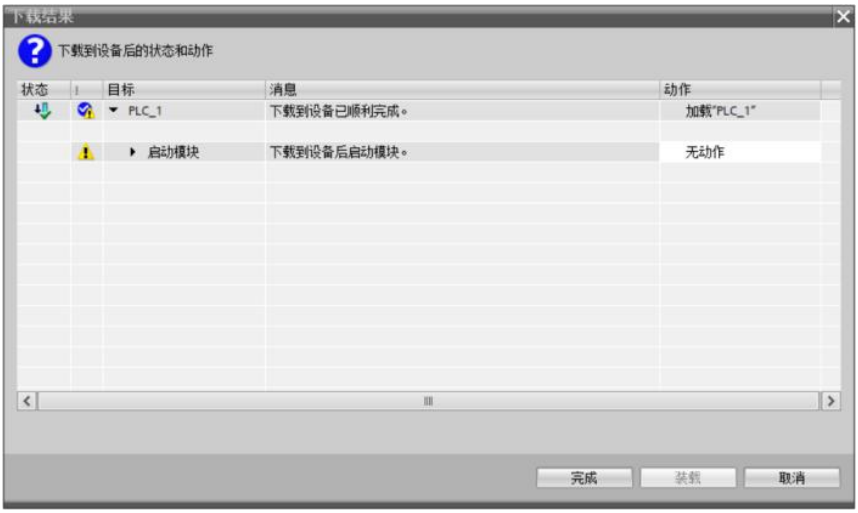
Compile, download, and go online.

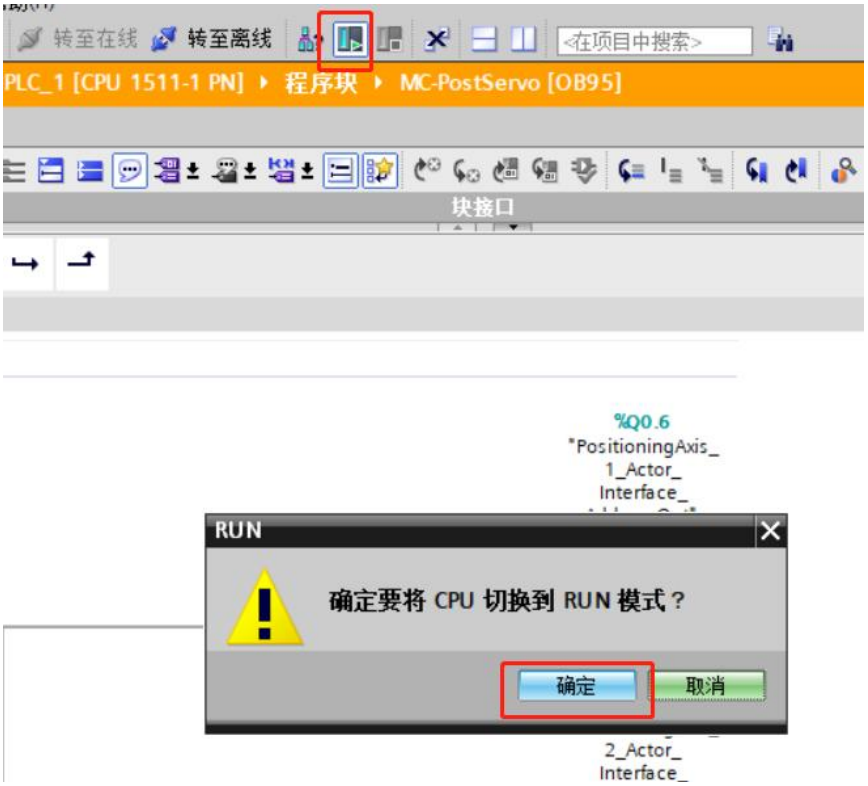


When a download message pops up, the CPU needs to be stopped before proceeding with the operation.



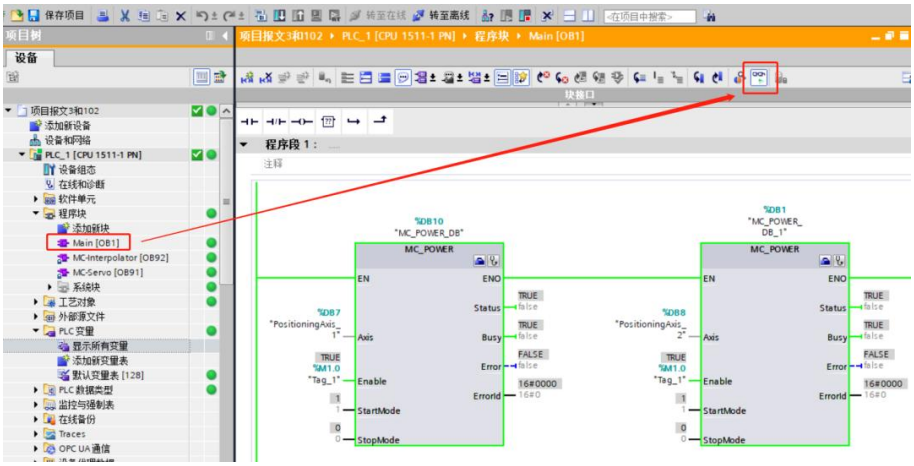
After downloading, you need to switch back to RUN.



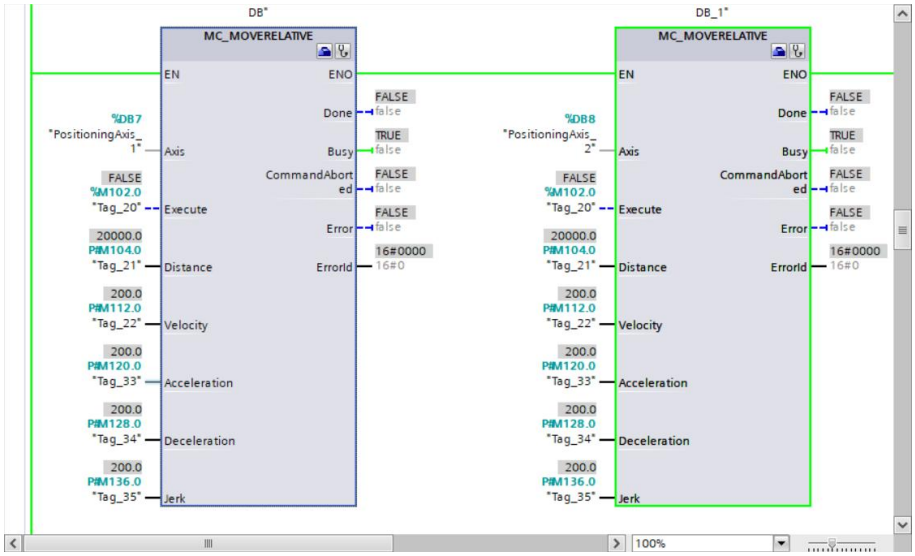


10. Debug

Select the program block, open Main, and enable monitoring. (It is necessary to confirm that the PLC is in the RUN state).



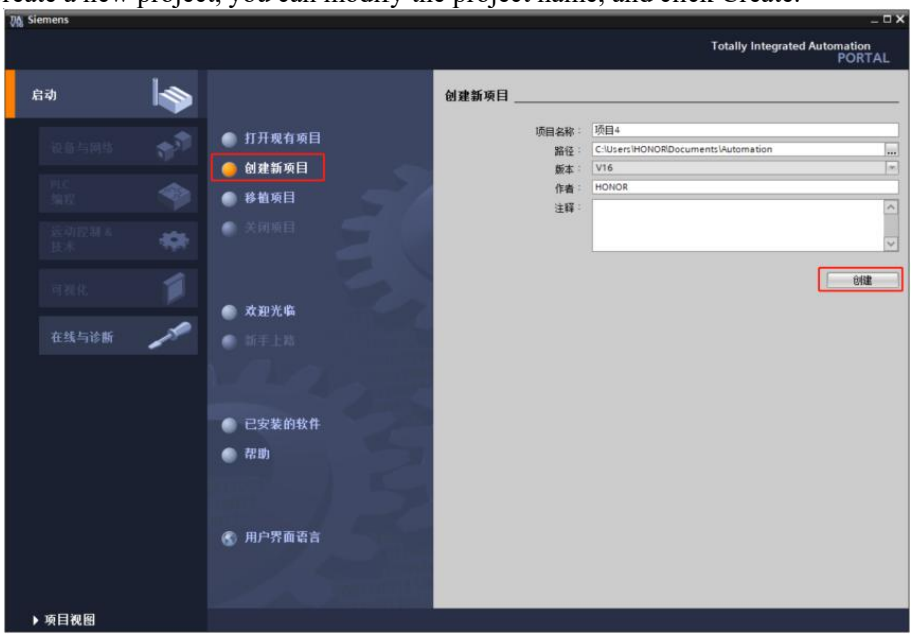
Enable=1.
MC_MOVERELATIVE relative positioning instruction.
According to the given data in the following figure, Execute=1 triggers the motion.


DB"
MC_MOVERELATIVE
EN
ENO
%DB7
"PositioningAxis_1"
Axis
FALSE
%M102.0
"Tag_20"
Execute
20000.0
P#M104.0
"Tag_21"
Distance
200.0
P#M112.0
"Tag_22"
Velocity
200.0
P#M120.0
"Tag_33"
Acceleration
200.0
P#M128.0
"Tag_34"
Deceleration
200.0
P#M136.0
"Tag_35"
Jerk
Done
Busy
CommandAborted
Error
ErrorId
FALSE
false
TRUE
false
16#0000
16#0
DB_1"
MC_MOVERELATIVE
%DB8
"PositioningAxis_2"
100%

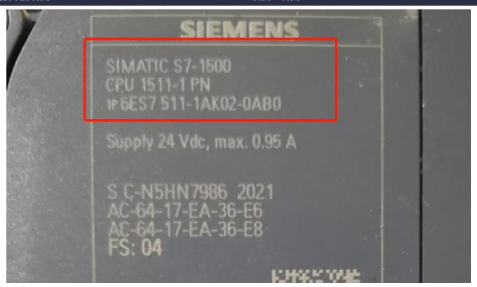
Appendix 8. Use Cases of Message 105+750

1. New project

1) Choose to create a new project, you can modify the project name, and click Create.



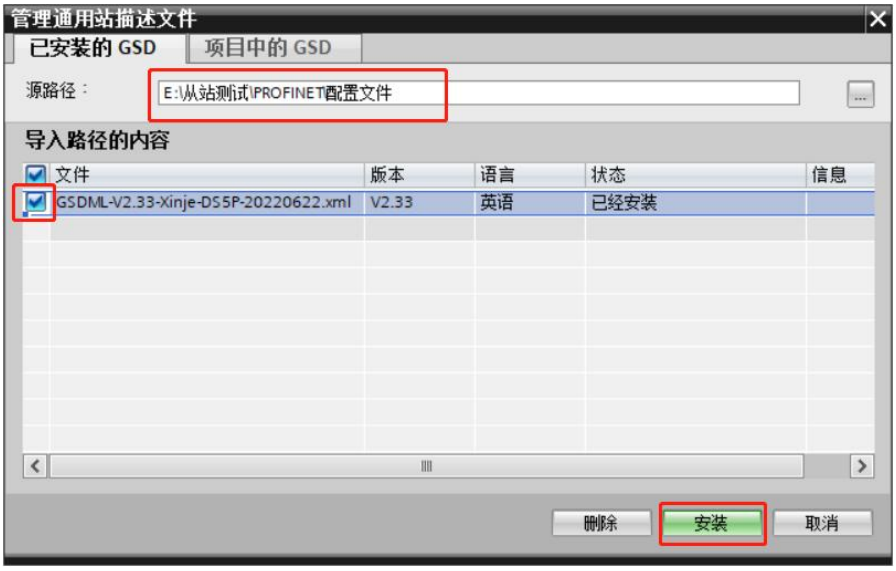
2) Select devices and networks, add new devices, controllers, select the corresponding equipment based on the PLC model and order number.



2. Install GSD files

1) In the "Options" menu, select the command "Manage generic station description files (GSD)".
2) On the "Installed GSDs" tab, select the storage directory for the GSD files.
3) Select one or more files from the list of displayed GSD files.
4) Click on the Install button. Installing selected GSD files.
5) To create an installation log file, click the "Save Log File" button.
6) All issues that occurred during installation can be tracked through log files.

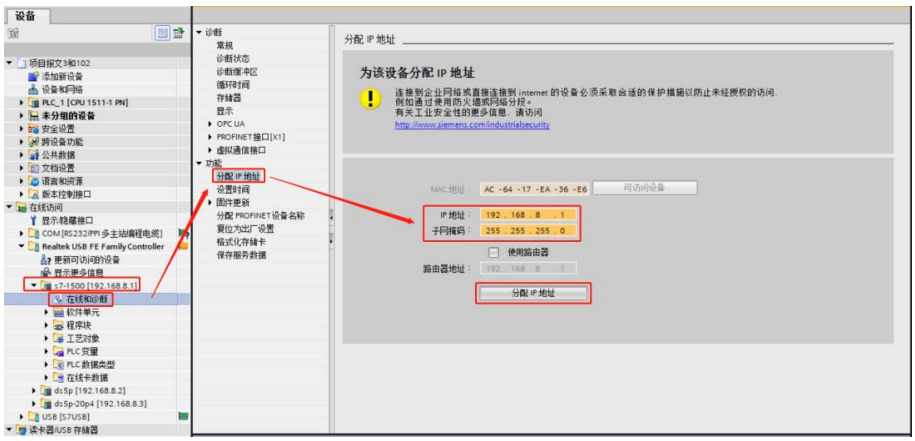
7) Click "Close". The system will notify that IO devices from the installed GSD file will be input into the hardware directory. This process may take a few seconds.



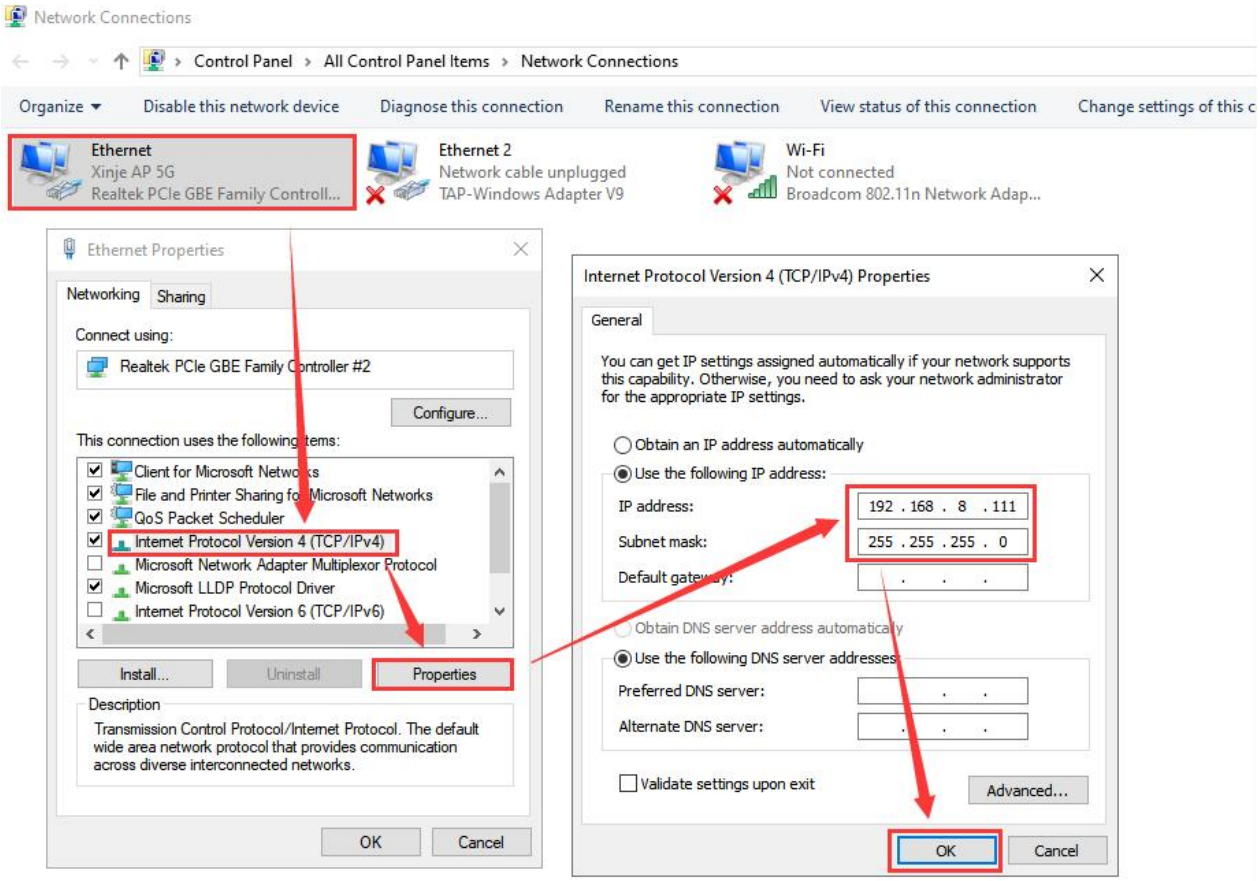
3. Assign device IP address and device name

Step 1: Choose online access, Step 2: Choose the Ethernet adapter that connects the computer to the PLC, Step 3: Click to update accessible devices, accessible devices are shown in step 4 of the figure (assigned IP address and device name):

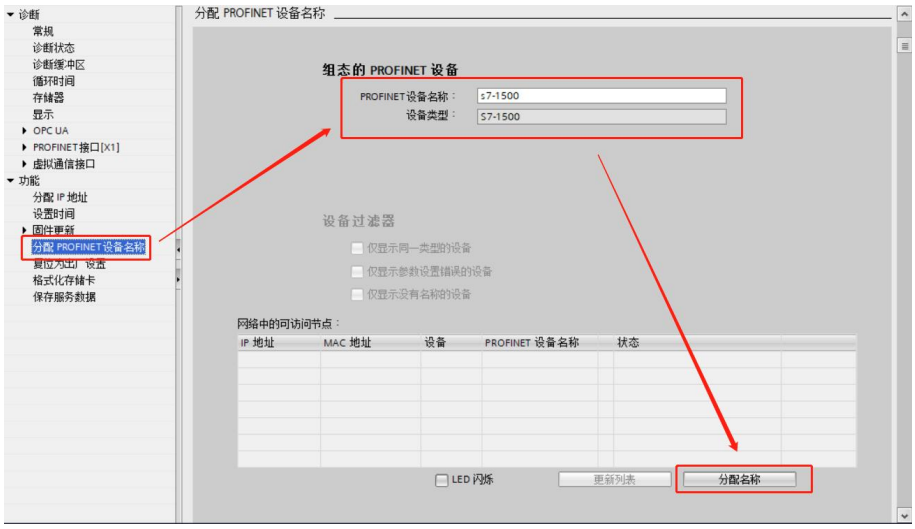
Assign device IP address.



After determining the device IP address, Ethernet devices also need to be in the same network segment.

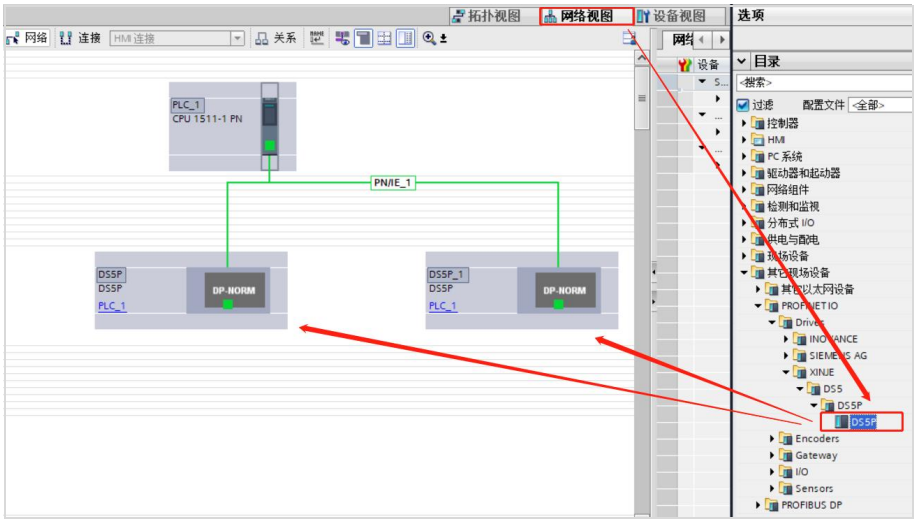


Assign device name:

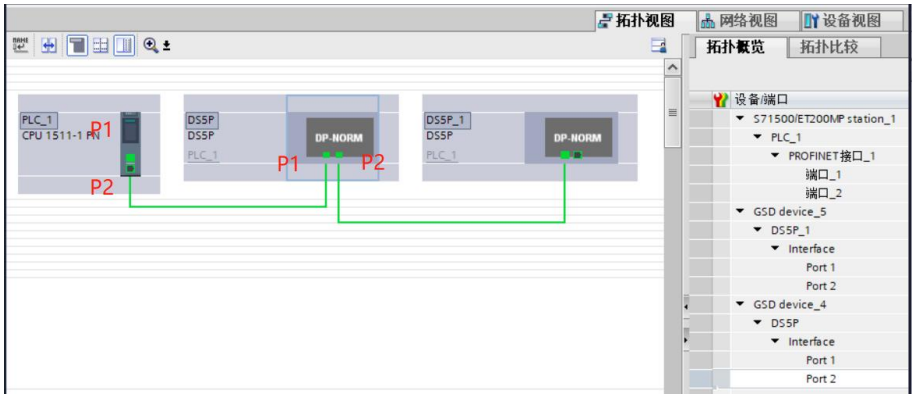


Note: After assigning device names to the slave station, they are sorted by device name, not by physical wiring.

4. Add a slave device to the network view and create a network connection with the PLC.



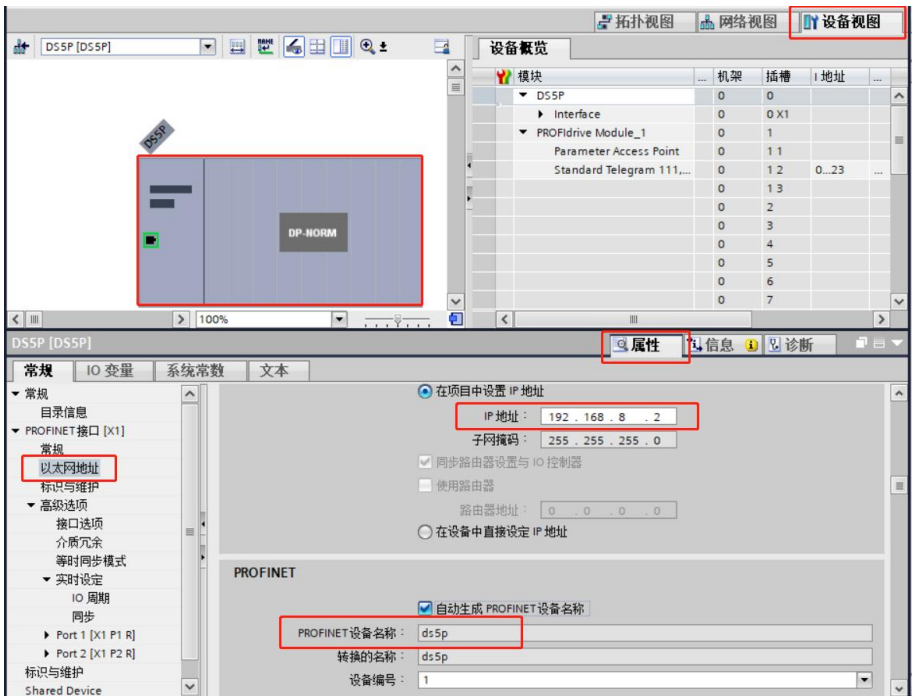
Open the topology view and connect the network ports. In this case, the PLC network port P1 corresponds to the servo network port P1.



Note: The topology view connection should be consistent with the physical network cable connection, otherwise an error will be reported.

5. Set IP address and device name

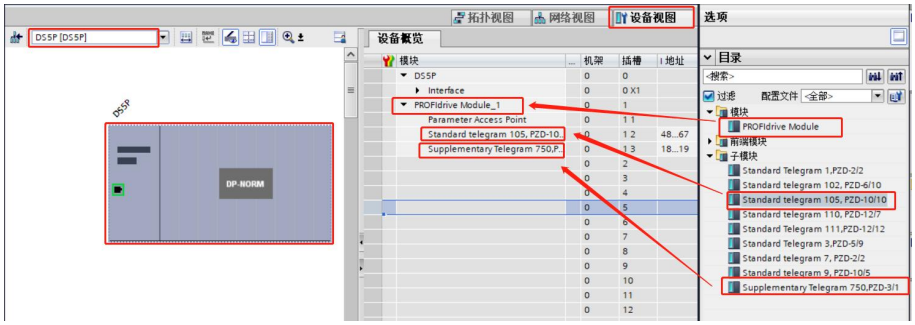
Device view, select device, properties, Ethernet address, set IP address and device name. Ensure consistency with online access:



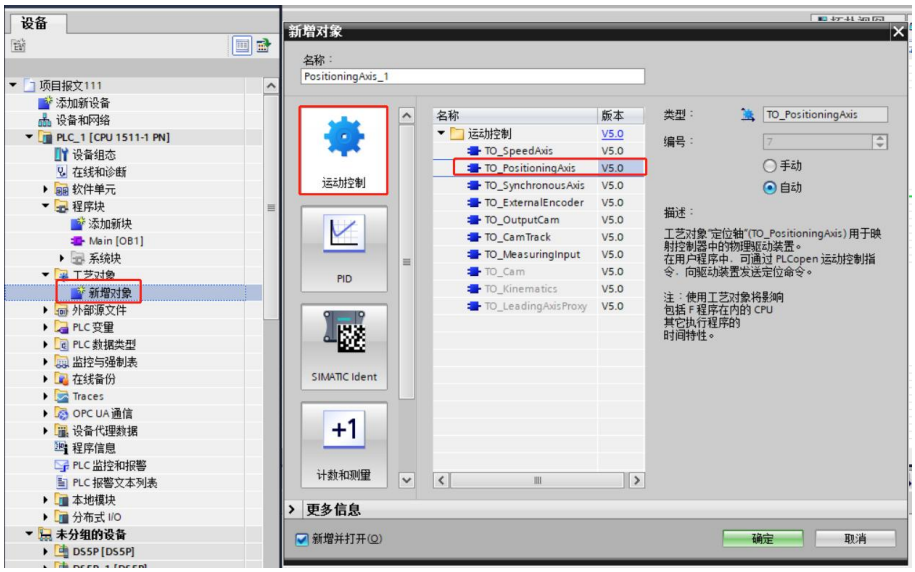
Note： The IP address and device name in the device view should be consistent with the IP address and device name assigned for online access. Inconsistencies will result in an error message. When multiple devices are connected, the device name and address are uncertain. The device name and IP address can be determined through online access to a single device via PLC.

6. Add message

Install the GSD file for DS5P in TIA Portal software, then configure 105 and 750 messages in the "Device View", which are used for axis motion control, additional 750 messages for additional torque setting and torque limiting.

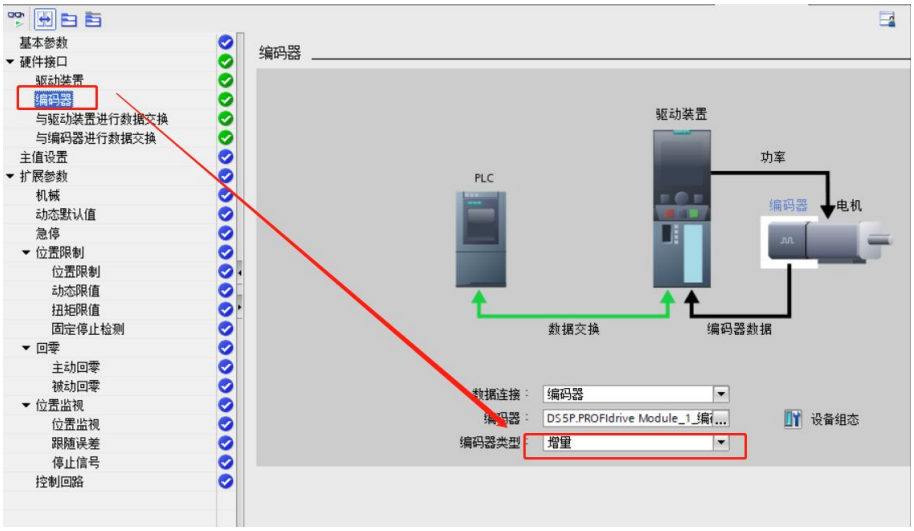


Create a new process object and configure the axis to be in linear mode.



Select 105 message in the "Drive device".

Next, select the encoder type, if P0-79=1 (incremental position mode), select "Incremental" as the encoder type.

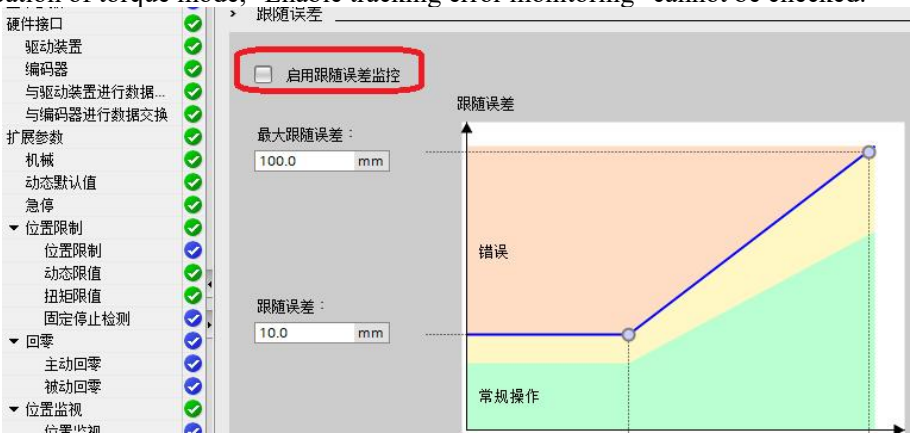


If P0-79=0 or 2 (absolute position linear mode), select "Cyclic absolute encoder" as the encoder type.

For the reference speed, maximum speed, and reference torque of the motor, the option of "automatic application of drive values during operation" can't be selected. It needs to be manually set according to the driver parameters. The reference speed is the rated speed of the motor, corresponding to servo parameter U3-05 (unit: rpm). The maximum speed corresponds to the servo parameter U3-06 (unit: rpm, due to limitations in Botu software, values greater than 6000 are set to 6000). The reference torque (in N ` m) is set to three times the rated torque of the motor, rated torque corresponds to servo parameter U3-12 (unit: 10mN ` m).

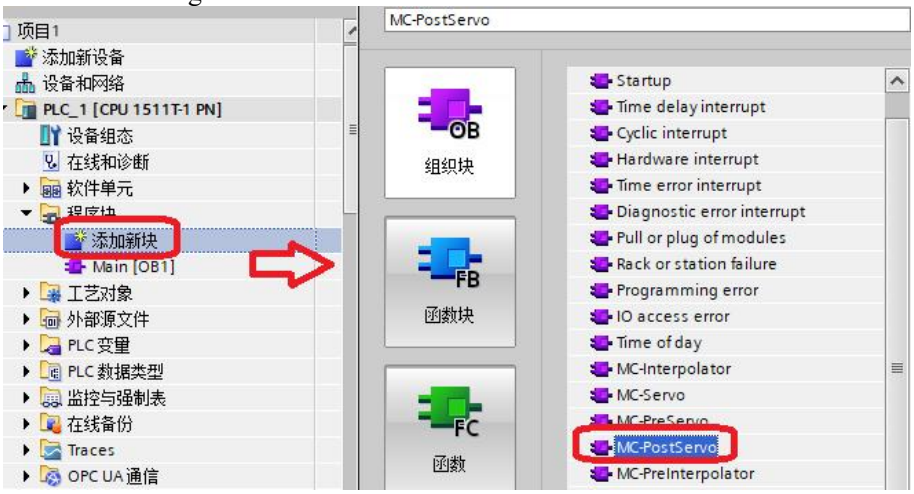
Additional data addition 750.

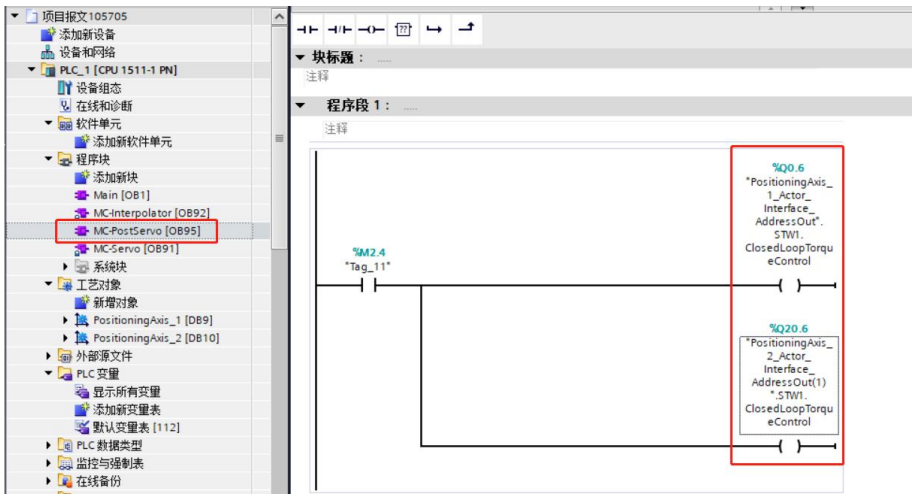
Due to the application of torque mode, "Enable tracking error monitoring" cannot be checked.



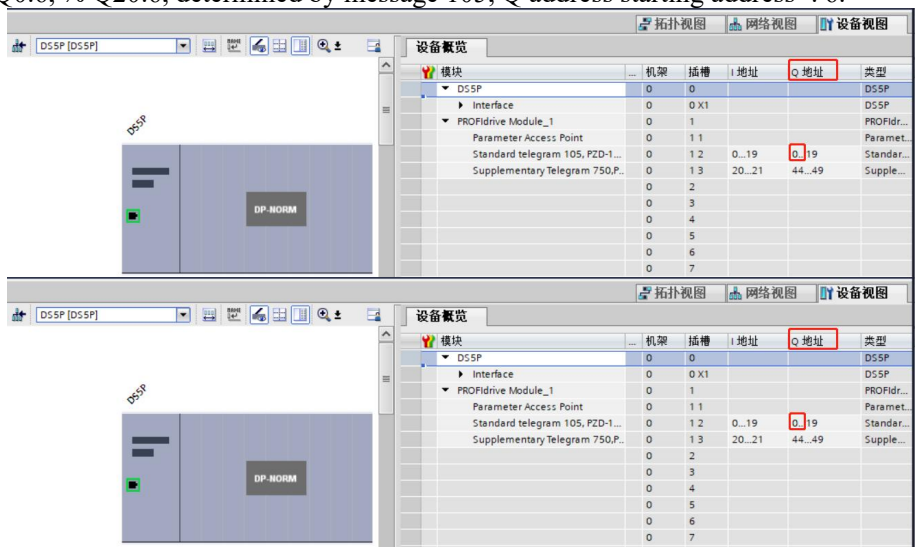
7. Edit programs

Add the MC-PostServo function block to the program block and enable closed-loop torque control mode in this function block, as shown in the figure.

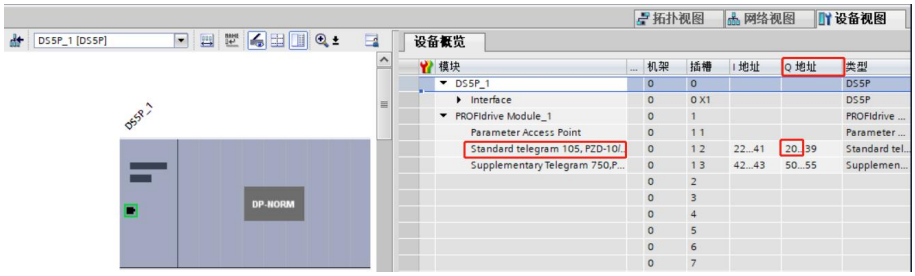




Output coils % Q0.6, % Q20.6, determined by message 105, Q address starting address+. 6.

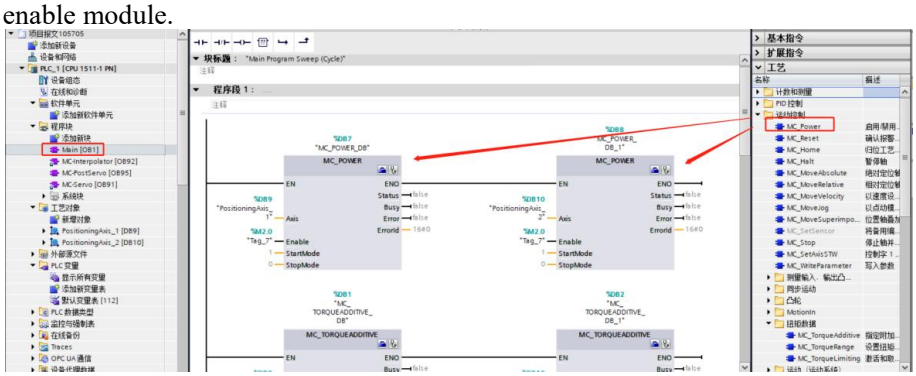


Axis 1 message 750 address area

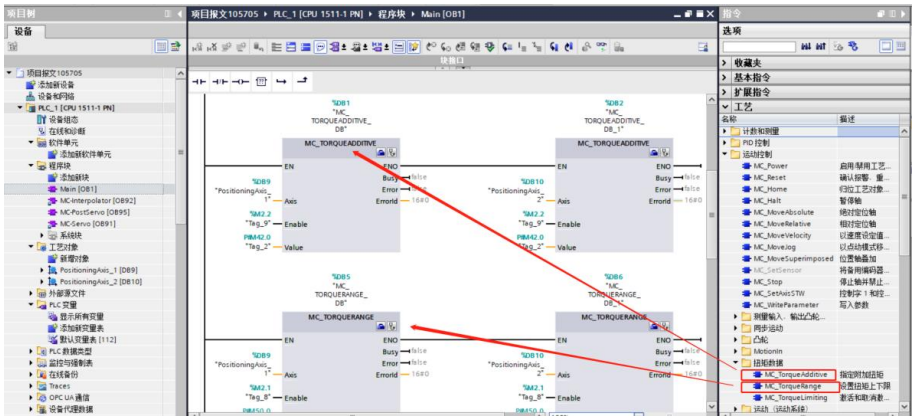


Axis 2 message 750 address area

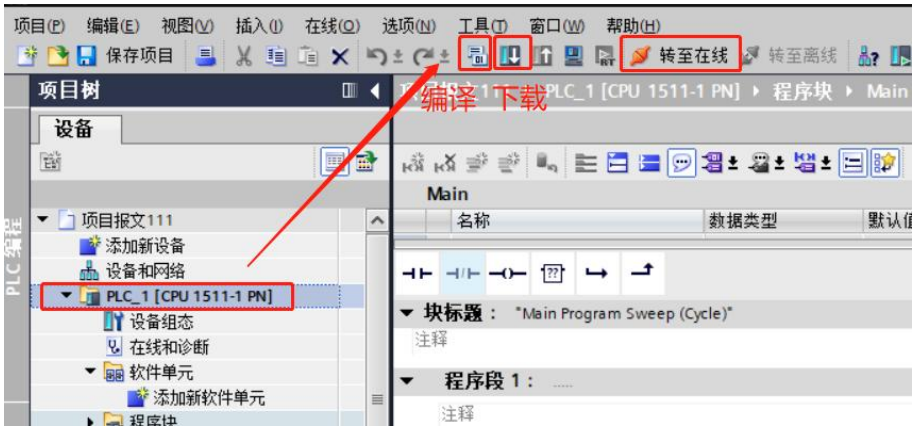
Add MC-Power enable module.



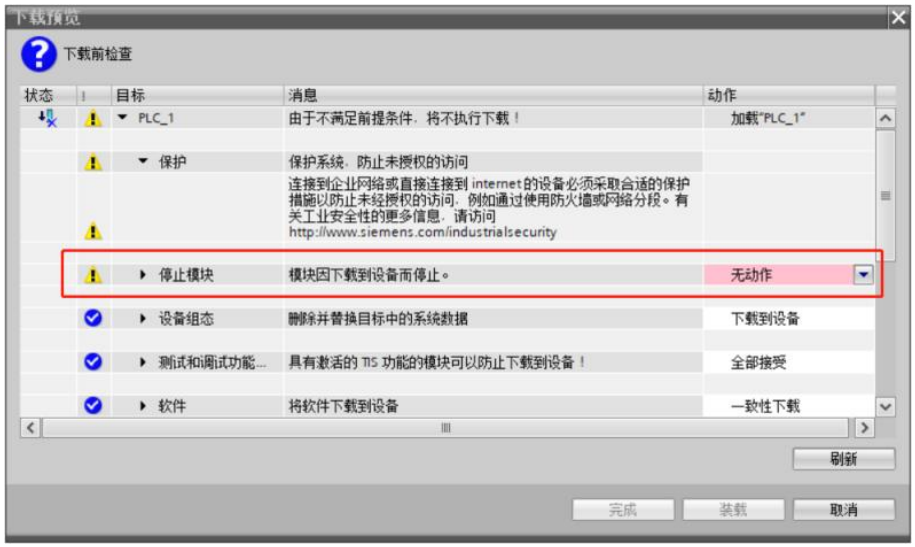
Add MC-TorqueAdditive and MC-TorqueRange function blocks.



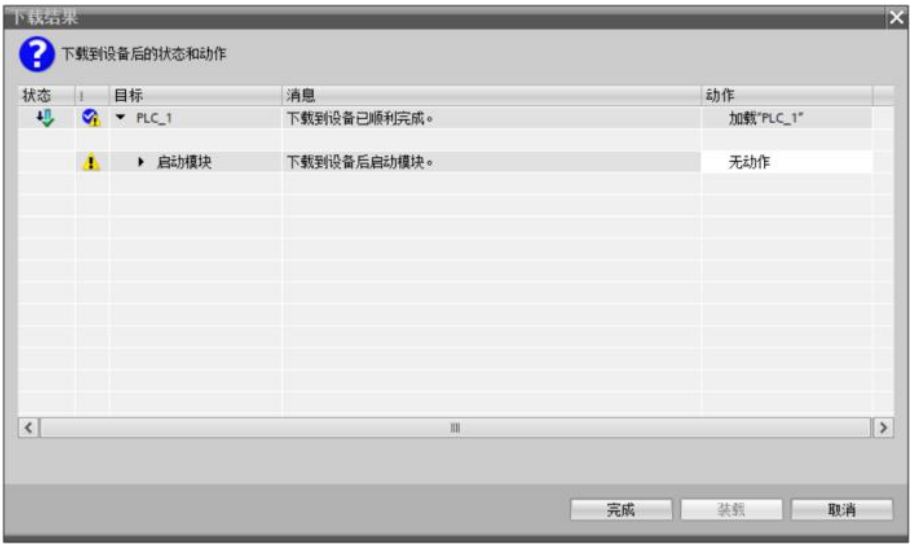
After writing, compile, download, and go online.

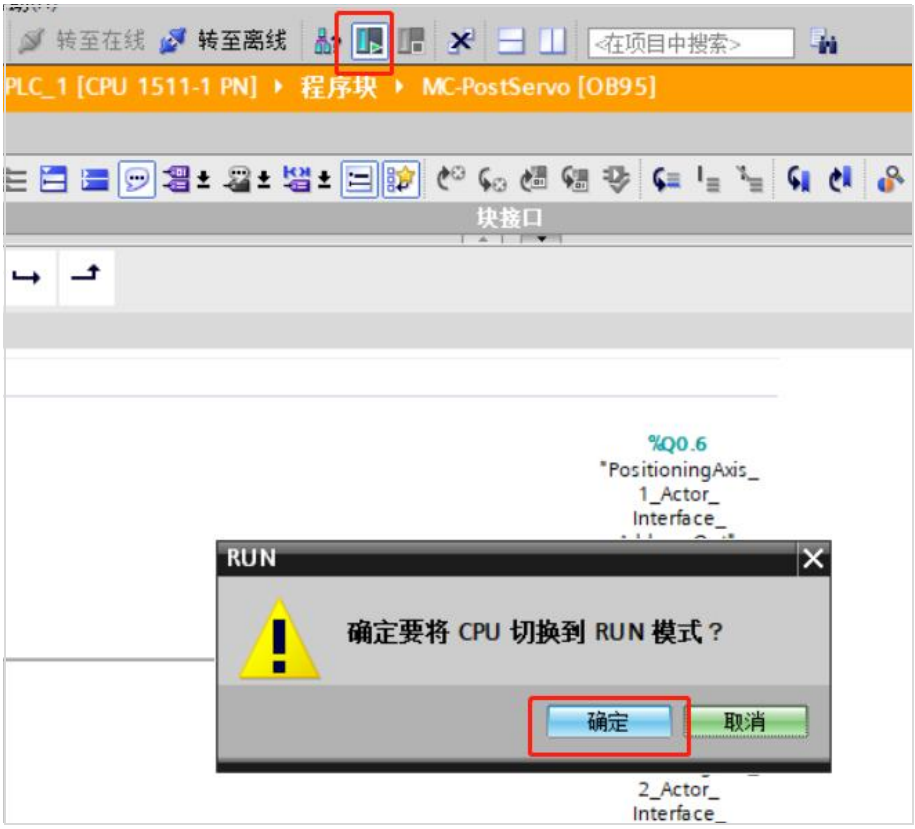


The following message appears during download, the CPU needs to be stopped before proceeding with the operation.



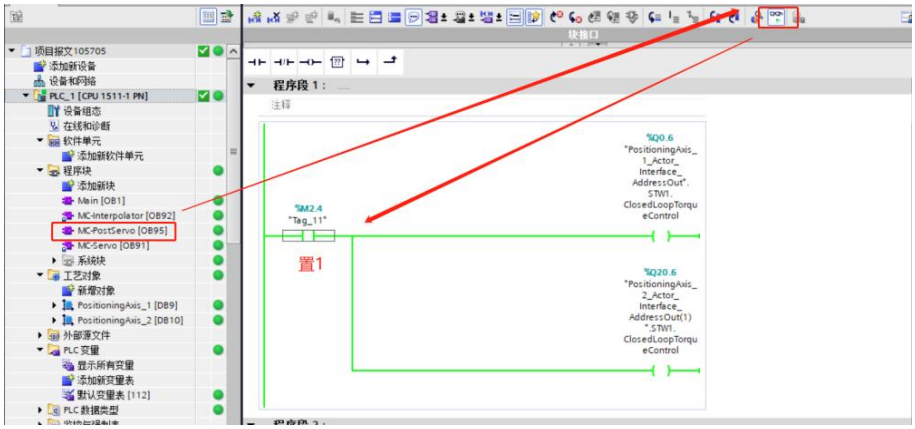
After downloading, need to switch back to RUN.



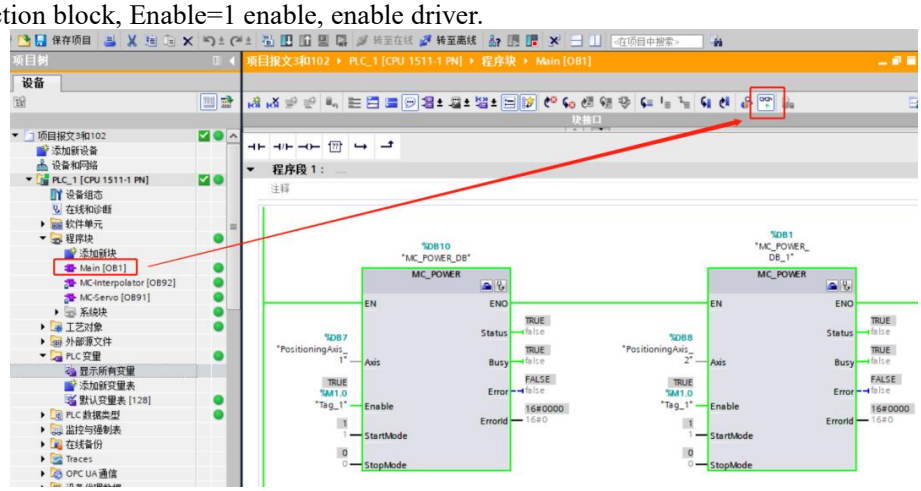


8. Debug

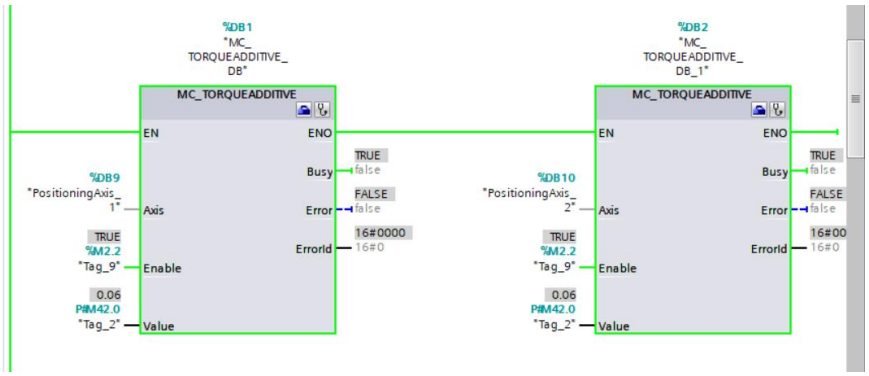
Select the program block, open MC PostServo, and enable monitoring. Set M2.4 to 1.



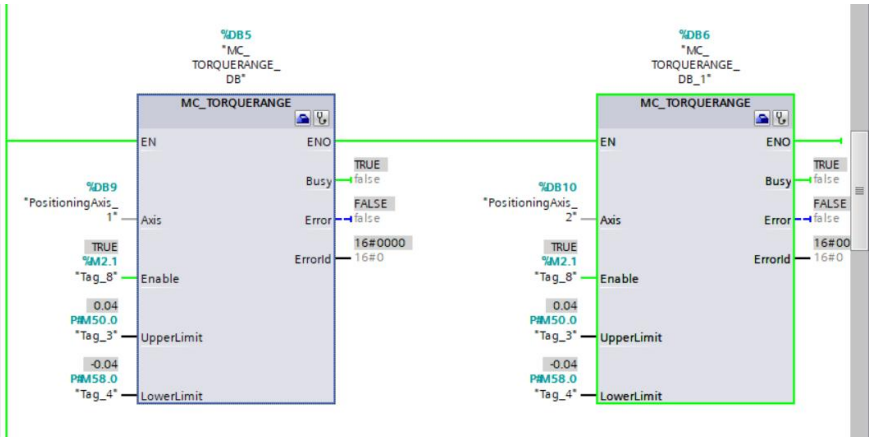
Select the program block, open Main, and enable monitoring . (PLC needs to be determined as RUN)
MC-Power function block, Enable=1 enable, enable driver.



MC-TorqueAdditive function block, torque setting, converting proportional relationship based on the set benchmark torque. The given value of Value=is the actual torque, in N ` m, positive and negative values represent forward and reverse rotation, respectively. Taking a 400W motor with a rated torque of 1.27N ` m as an example, set the benchmark torque in the process object to 3.81N ` m, the torque corresponding to setting Value=0.06 should be 0.06/1.27=4.7%.



MC-TorqueRange function block, torque up and down limits, converting proportional relationships based on the set benchmark torque.



If the process object is not used, torque control is carried out by directly assigning values to the message, as shown in step 7, in the device view of the first axis, the address area of message 750 can be seen, among them, QW44 is the address area for setting additional torque, and QW46 is the address area for setting the upper limit of additional torque, QW48 is the address area for setting the lower limit of additional torque, and IW20 is the real-time torque reading.
Taking a 400W motor with a rated torque of 1.27N ` m as an example, a 3-fold rated torque of 3.81N ` m, and Siemens stipulates that 16 # 4000h linearly corresponds to 300% of the rated torque, so 1% rated corresponds to a given torque of 54.6. Assuming a torque upper limit of 0.635N ` m (+50% rated) and a torque lower limit of -0.762N ` m (-60% rated), directly assign values to message QW46=8192, QW48=-9830.
Torque limit is a combination of message limit and internal torque limit that are effective simultaneously. Use whichever torque limit is small.

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