XINJE

DS5E/DS5L series servo drive
User manual

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．Do not install damaged drives, drives that lack spare parts, or drives whose models do not 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. Do not 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. Do not 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, do not tighten, lest cable damage.

⚡ Operation Cautions

1. Do not 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, do not 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, do not touch the radiator, there is a risk of scald.
5. Under power-on condition, do not change the wiring, there is a risk of injury.
6. Do not switch power frequently. If you need to switch power many times, please control it once in 2 minutes.

⚠ Maintenance and inspection

1. Do not 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. Do not 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.
The panel displays "Code" and "E-310"?	**Please set motor code in P0-33 (See motor nameplate MOTOR CODE for code)**
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 P0-33 on the servo drive.

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

1 Selection of servo syste

1.1 Selection of servo drive

1.1.1 Model name

$$\underline{DS} \; \underline{5\square}\text{-}\underline{2} \; \underline{\square P\square} \text{ - } \underline{PTA}$$

Name	Meaning
DS	Servo drive

Name	Product series
5E	Xnet fieldbus
5L	Pulse model

Name	Rated input voltage
2	AC220V
4	AC380V

Name	Encoder type
T	Communication

Name	Rated output power
0P1	100w
0P2	200w
0P4	400w
0P7	750w
1P5	1.5KW
2P3	2.3KW
2P6	2.6KW

1.1.2 Description of each part

RS232 port

CN0: pulse, direction I/O signal

Power supply

Motor wiring

Regenerative resistor

CN1: Used for Extending Bus Function To connect extension bus module

CN2: encoder cable for drive

1.1.3 Performance specifications

Servo unit		DS5 series servo drive
Applicable encoder		Standard: 17-bit/23-bit communication encoder
Input power supply		DS5□-2□P□-PTA: Single/three phases AC200-240V, 50/60Hz Single phase AC200-240V 50/60Hz is used below 1.5KW (excluding 1.5KW)； It is recommended to use three-phase AC200-240V 50/60Hz when the value is above 1.5KW (including 1.5KW). (For the single-phase power supply, please connect to L1 and L3, otherwise the power failure will affect the memory of parameters.)
		DS5□-4□P□-PTA: three-phase AC340～420V, 50/60Hz
Control mode		Three-phase full-wave rectifier IPM PWM control sinusoidal current drive mode
Using condition	Using temperature	-10～+40 ℃
	Storage temperature	-20～+60 ℃
	Environment humidity	Below 90％RH (no condensation)
	Vibration resistance	4.9m/s^2
Structure		Pedestal installation

1.2 Servo motor selection

1.2.1 Model name

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

Name	Inertia
MS5S	Low inertia
MS5G	Middle inertia
MS5H	High inertia

Name	Seat number
60	60 seat
80	80 seat

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	Design number
S01	standard
S02	Small Aviation Plug Type

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

Name	Voltage level
2	220V
4	380V

Name	Power-off brake
Empty	without
Z	with

Name	Shaft
A	No key
B	With key

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

1.2.2 Description of each part

Encoder

frame

flange

Output Shaft (Drive Shaft)
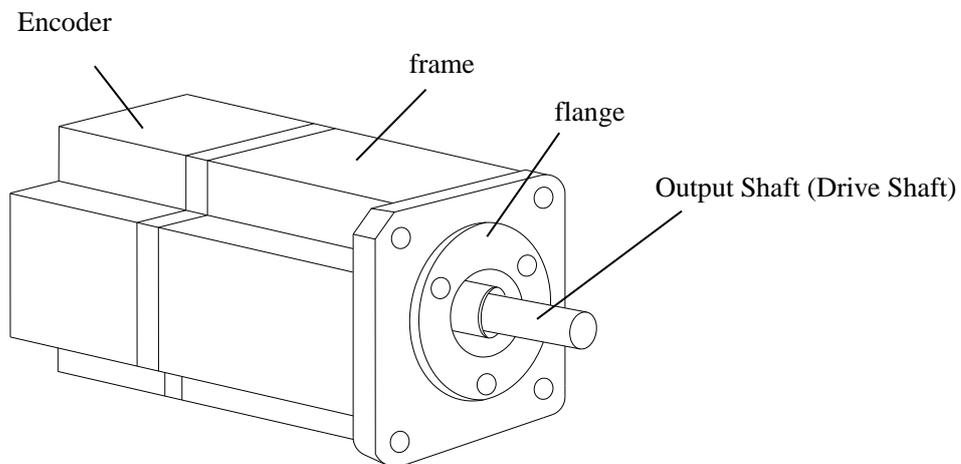
1.3 Cable selection

1.3.1 Model name

■ Encoder cable model

$$CP \;—\; SP \;—\; M \;—\; 02$$

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 for 130 short body motor

Name	Length(m)
03	3
05	5
08	8

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

■ Power cable model

$$CM \;–\; L15 \;–\; M \;–\; 03$$

Name	Cable type
CP	Normal
CPT	High flexibility
CMBT	High flexibility-aviation plug with brake

Name	Plug type
P	Small power 4-core amp plug
W	Small power 6-core water proof aviation plug
L	4-core small aviation plug
XL	4-core medium aviation plug

Name	Diameter(mm²)
07	0.75
15	1.5
25	2.5
60	6
100	10

Name	Length(m)
03	3
05	5
08	8

Name	Cable type
M	Magnetic encoder
Empty	Photoelectric encoder

■ Brake cable model

➤ CB-P03-Length (for 750W and below power motors with motor suffix S01)
➤ CMBT-W07-M-Length (for 750W and below power motors with motor suffix S02)

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+
	6	485-
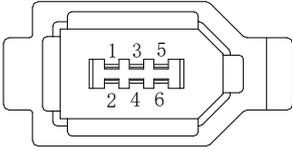
(2) Cable connection of encoder on motor side
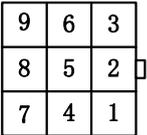
Connector pins	Pin definition		Suitable model
	No.	Definition	
	1	Battery +	
	2	Battery -	
	3	Shielded cable	
	4	485+	40, 60, 80 flange
	5	485-	-S01 motor
	6	/	
	7	5V	
	8	GND	
	9	/	
	No.	Definition	
	1	Shielded cable	
	2	Battery +	
	3	Battery -	40, 60, 80 flange
	4	485+	-S02 motor
	5	485-	
	7	5V	
	8	GND	
	No.	Definition	
	1	Shielded cable	
	2	/	
	3	485-	
	4	485+	110 and above flange
	5	/	motor
	6	GND	
	7	Battery -	
	8	5V	
	9	Battery +	
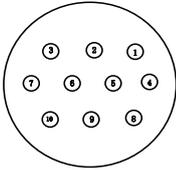
Connector pins	Interface definition		Suitable model
	No.	definition	
	1	/	130 flange medium inertia motor
	2	5V	
	3	GND	
	4	485+	
	5	485-	
	6	Battery +	
	7	Battery -	
	8	/	
	9	/	
	10	Shielded cable	

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 cut.

■ Power cable

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

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

(2) Power cable connection on motor side

Connector pins	Pin definition		Suitable model
	No.	Definition	
	1	U	40, 60, 80 flange -S01 motor
	2	W	
	3	V	
	4	PE	
	No.	Definition	40, 60, 80 flange -S01 motor brake
	1	BK	
	2	BK	
	No.	Definition	750W and below S02 small aviation plug motor
	1	PE	
	2	U	
	3	V	
	4	W	
	5	BK	
	6	BK	
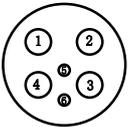
Connector pins	Interface definition		Suitable model
	No.	Definition	
	1	PE	110 and above motor (include 130 flange medium inertia motor without brake)
	2	U	
	3	V	
	4	W	
Connector pins	Interface definition		Suitable model
	No.	Definition	
	1	PE	130 flange medium motor with brake
	2	U	
	3	V	
	4	W	
	5	BK+	
	6	BK-	
	7	/	

Brake pins:

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

1.4 Selection of other accessories

1.4.1 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
DS5□-2□P□-PTA	(1) Using built-in regenerative resistance, short P + and D terminals, P + and C are disconnected. (2) Use external regenerative resistance, connect regenerative resistance to P + and C terminals, remove P + and D short wiring, P0-25 = power value, P0-26 = resistance value. Note: if software version U2-07 < 3700, the parameter P0-24 should be set. The value of 0 is for the built-in resistance to take effect, and the value of 1 is for the external resistance to take effect.

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

Servo driver model	Rmin (Not less than this value)	External regenerative resistance (Recommended resistance value)	External regenerative resistance (Recommended power values)
DS5□-20P1-PTA	50Ω	50Ω-100Ω	Above 200W
DS5□-20P2-PTA			
DS5□-20P4-PTA	40Ω	40Ω-100Ω	Above 500W
DS5□-20P7-PTA			
DS5□-21P5-PTA	25Ω	25Ω-50Ω	Above 1000W
DS5□-22P3-PTA			
DS5□-22P6-PTA			
DS5□-41P5-PTA	55Ω	55Ω - 100Ω	Above 1000W
DS5□-43P0-PTA	55Ω	55Ω - 75Ω	Above 1000W
DS5□-45P5-PTA	25Ω	25Ω - 65Ω	Above 2000W
DS5□-47P5-PTA	25Ω	25Ω - 50Ω	Above 2000W
DS5□-415P0-PTA	20Ω	20Ω - 45Ω	Above 3000W

Note:

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

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

2 Installation of servo system

2.1 Servo driver installation

2.1.1 Installation site

➢ Please install it in the installation cabinet without sunshine or rain.
➢ Do not use this product near corrosive and flammable gas environments such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gas, acid, alkali, salt, etc.
➢ Do not 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").
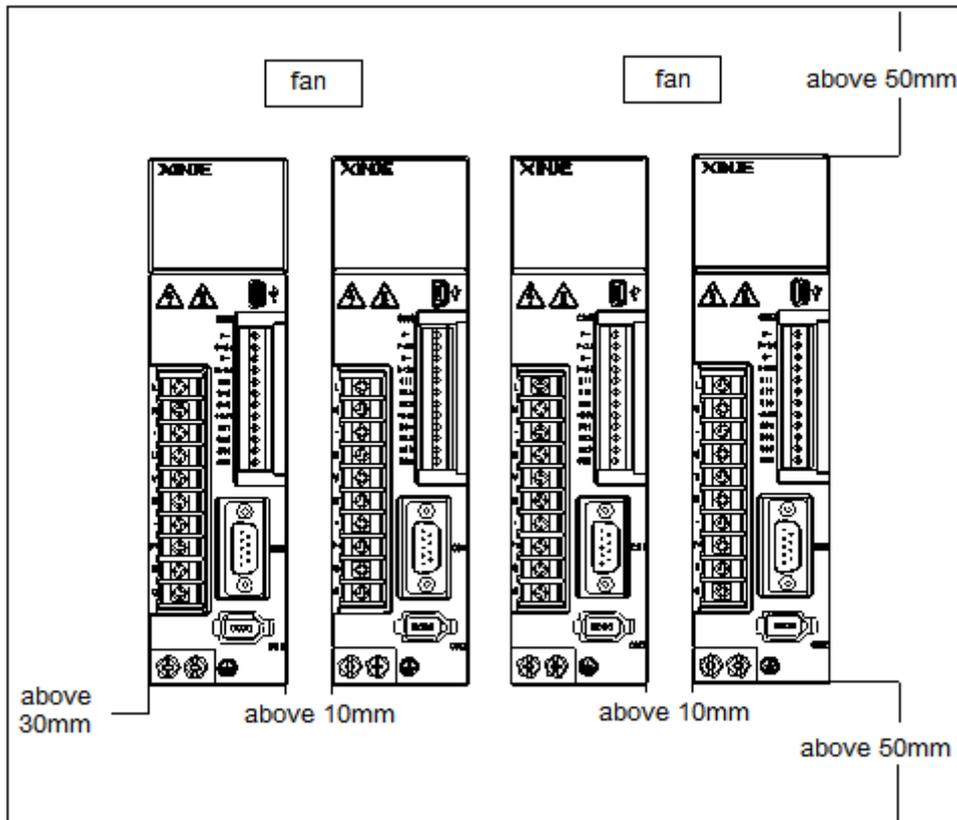
■ **Servo Drive Orientation**

Install the servo drive perpendicular to the wall so the front panel containing connectors faces outward.

■ **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 ℃ maximum

2.2 Servo motor installation

MS 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.

Antirust
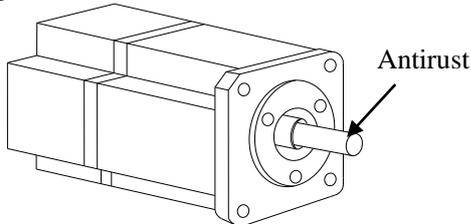
2.2.1 Installation environment

➢ Do not 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;
➢ Do not use motor in enclosed environment. Closed environment will lead to high temperature and shorten service life of motor.

2.2.2 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.

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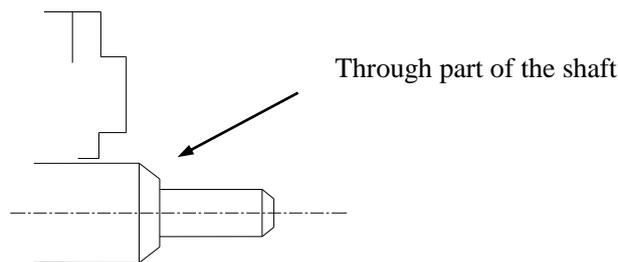
MS series servo motors are for indoor use. Please use them under the following installation conditions:

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

2.2.3 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 do not 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.
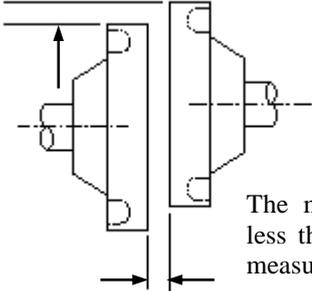
Oil and water solutions	When using in places where water droplets are dropping, please use it on the basis of confirming the protection level of servo motor. (except for the shaft-through part) When oil droplets will drip into the shaft-through part, please specify the servo motor with oil seal. Conditions 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	◆ Do not "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), do not 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. Do not 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.

2.3 Size of servo driver

■ DS5E/L-20P1-PTA, DS5E/L-20P2-PTA, DS5E/L-20P4-PTA   Unit: mm
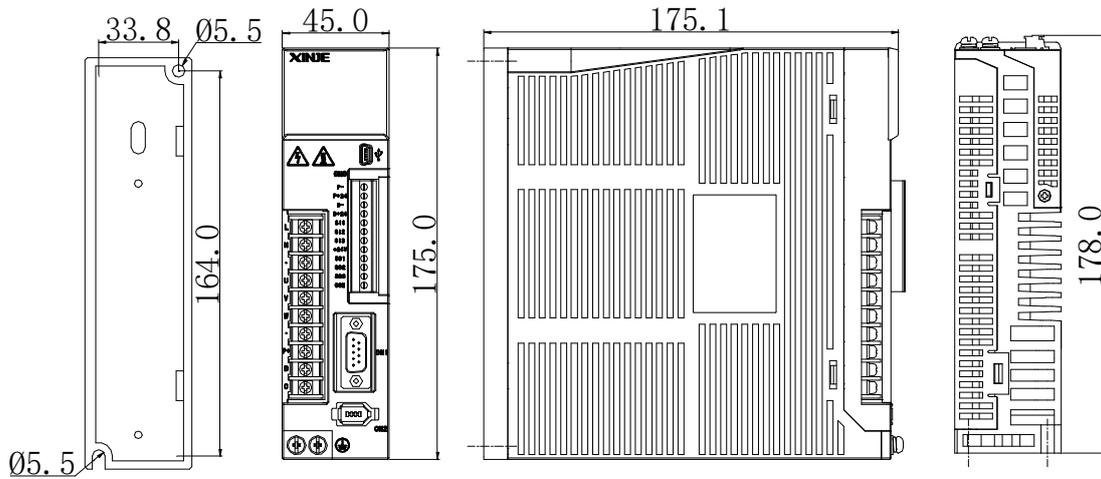
■ DS5E/L-20P7-PTA   Unit: mm
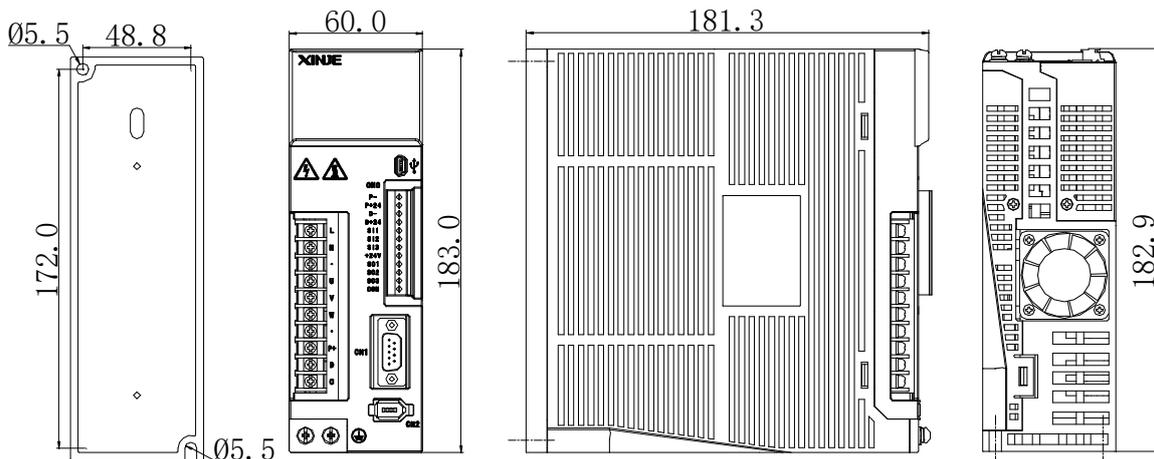
■ DS5E/L-21P5-PTA, DS5E/L-22P3-PTA, DS5E/L-22P6-PTA, DS5E-41P5-PTA   Unit: mm
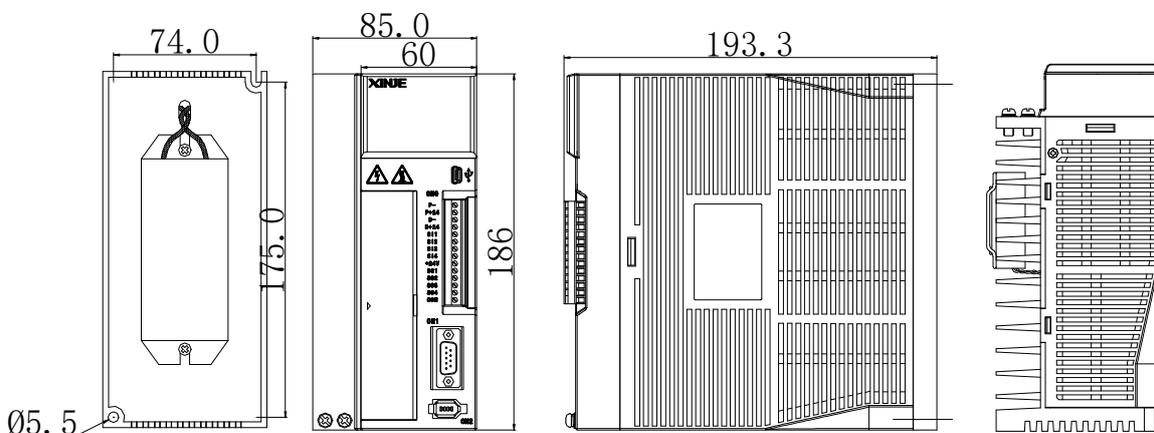
■ DS5E-45P5-PTA, DS5E-47P5-PTA   Unit: mm

135.0   123.5
251.0   239.5
4-φ6.0

■ DS5E-415P0-PTA   Unit: mm

230.0   217.0
120.0
420.0
400.0
217.0

⚠ WARNING
* STORED CHARGE DO NOT TOUCH UNTIL
  10 MIN. AFTER DISCONNECTION
* DO NOT CONNECT AC POWER TO OUTPUT
  TERMINALS OF "U V W"
* RISK OF ELECTRIC SHOCK-DUAL SUPPLY
  DISCONNECT MAINS AND LOADSHARING
  BEFORE SERVICE

160.0
230.0

420.0
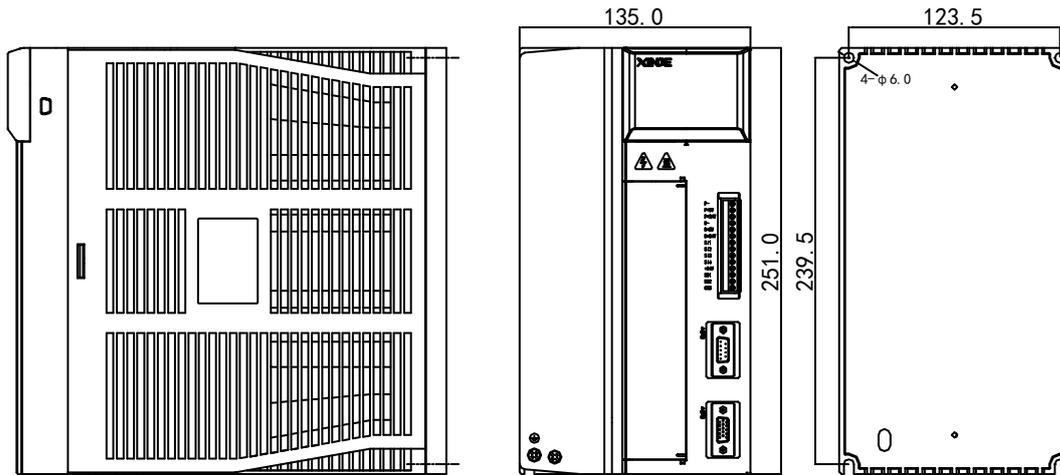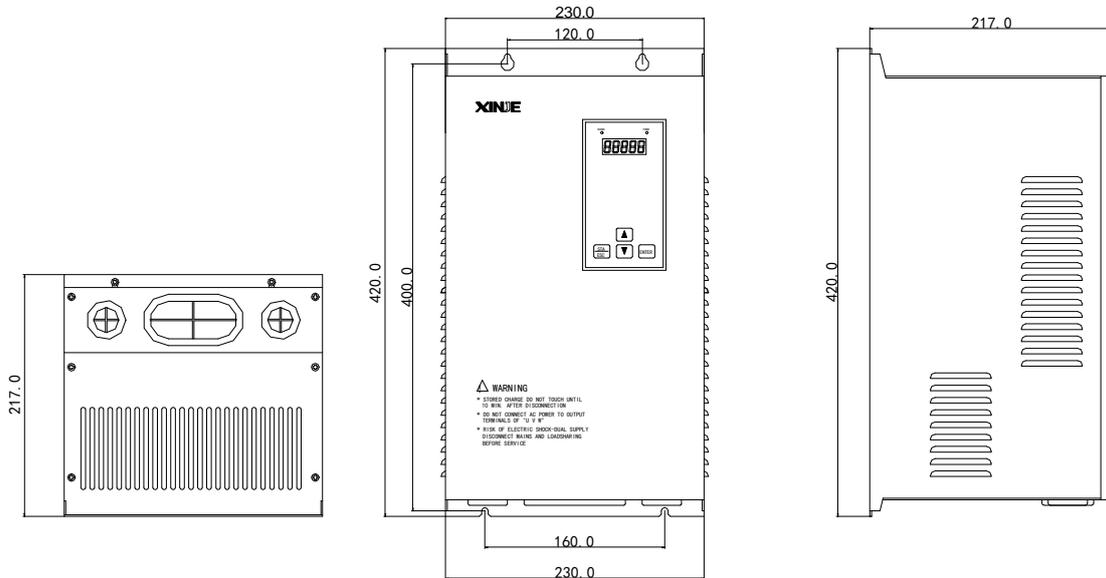
2.4 Size of servo motor

■ 40 series motor installation dimensions   Unit: mm
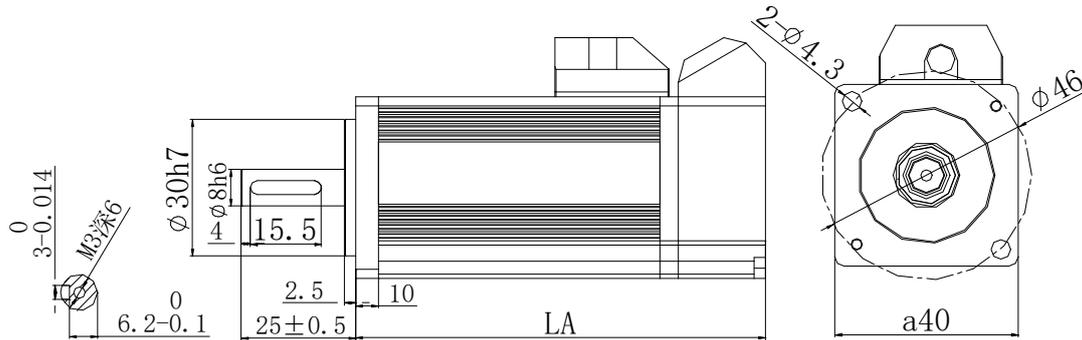
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-40ST-CS00330□□-20P1-S01/S02	89.5	119	Low inertia

■ 60 series motor installation dimensions   Unit: mm
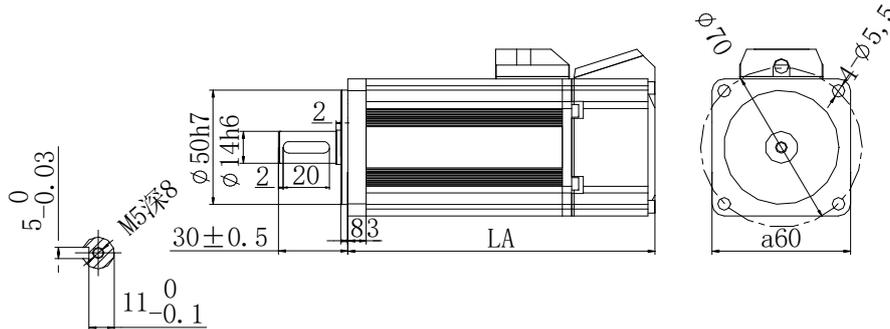
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-60ST-C□00630□□-20P2-S01/S02	79	114	Low inertia
MS5S-60ST-C□01330□□-20P4-S01/S02	99	134	
MS5H-60ST-C□00630□□-20P2-S01/S02	91	126	High inertia
MS5H-60ST-C□01330□□-20P4-S01/S02	111	146	
MS-60ST-T01330-20P4-D01	145	189	
MS5S-60ST-C□00630□□-20P2-S01/S02	79	114	-

■ 80 series motor installation dimensions   Unit: mm
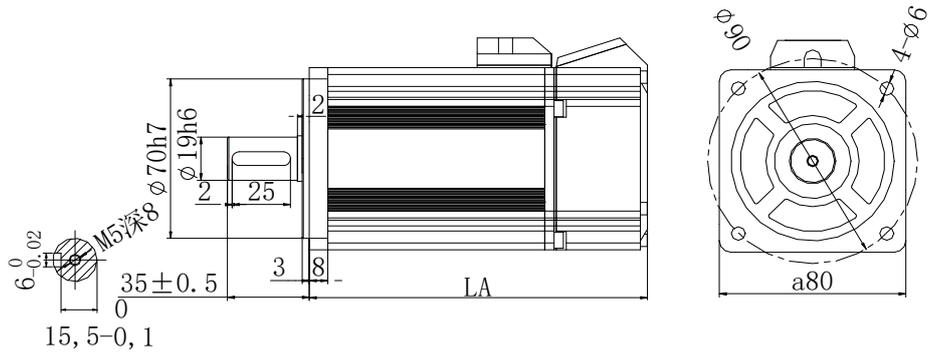
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-80ST-C□02430□□-20P7-S01/S02	107	144	Low inertia
MS5S-80ST-C□03230□□-21P0-S01/S02	128	165	Low inertia
MS5H-80ST-C□02430□□-20P7-S01/S02	119	156	High inertia
MS5H-80ST-C□03230□□-21P0-S01/S02	140	177	High inertia
MS-80ST-T02430□□-20P7	150	199	-
MS-80ST-T03520□□-20P7	179	219	-

■ 110 series motor installation dimensions   Unit: mm
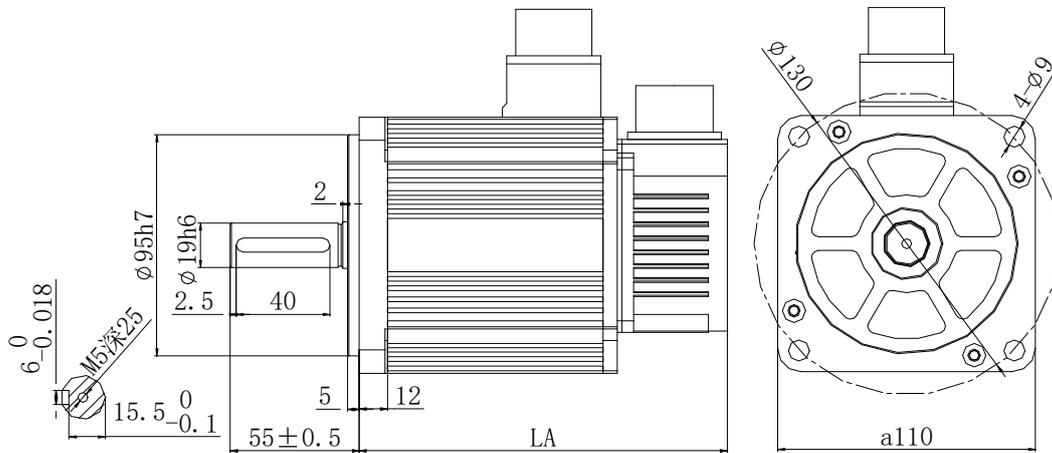
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-110ST-C□03230□□-21P0-S01	157	205	Low inertia
MS5S-110ST-C□04830□□-21P5-S01	166	214	Low inertia
MS5S-110ST-C□06030□□-21P8-S01	181	229	Low inertia
MS5S-110ST-TL03230□□-21P0-S01	157	205	Low inertia
MS5S-110ST-TL04830□□-21P5-S01	166	214	Low inertia
MS-110ST-TL06030□□-21P8-S01	181	229	-
MS-110ST-T04030B-21P2	189	263	-
MS-110ST-T05030B-21P5	181	229	-

■ 130 series motor installation dimensions   Unit: mm
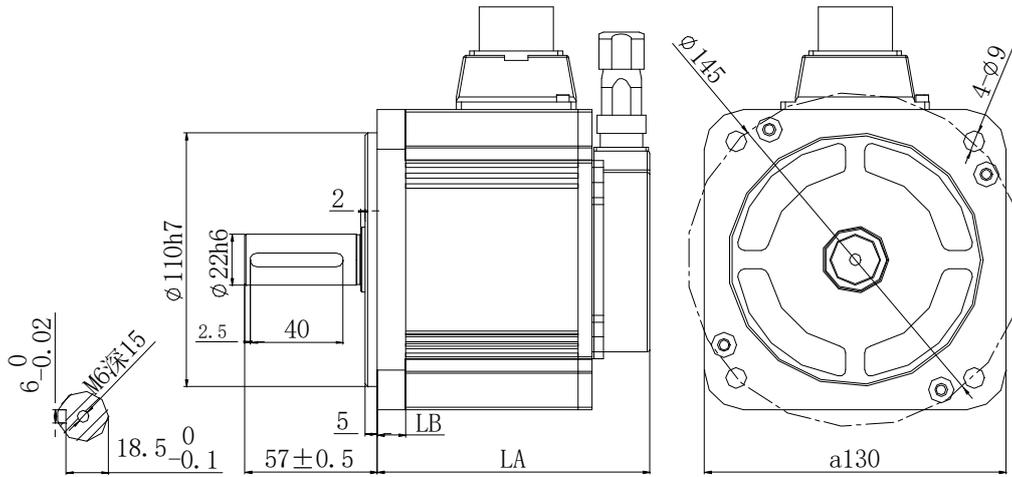
Motor model	LA ±1		LB	Inertia level
	Normal	With brake		
MS5G--130STE-C□05415□□-20P8-S01	117.5	147.0	12.5	Middle inertia
MS5G-130STE-C□07220□□-21P5-S01	132.5	162.5		
MS5G-130STE-C□11515□□-21P8-S01	159.5	189.5		
MS5G-130STE-C□11515□□-41P8-S01				
MS5G-130STE-C□14615□□-22P3-S01	180.5	210.5		
MS5G-130STE-C□14615□□-42P3-S01				
MS5G--130STE-TL05415□□-20P8-S01	134.5	164.5		
MS5G-130STE-TL07220□□-21P5-S01	149.5	179.5		
MS5G-130STE-TL11515□□-21P8-S01	176.5	206.5		
MS5G-130STE-TL11515□□-41P8-S01				
MS5G-130STE-TL14615□□-22P3-S01	197.5	227.5		
MS5G-130STE-TL14615□□-42P3-S01				
MS-130ST-T04030B-21P2	164	223	14	-
MS-130ST-T06025□□-21P5	179	238		
MS-130ST-T10015□□-21P5	205	264		
MS-130STE-T07730□□-22P4	205	264		
MS-130ST-T15015G□□-22P3	235	294		
MS-130ST-T10025□□-22P6	209	290		

■ 180 series motor installation dimensions   Unit: mm
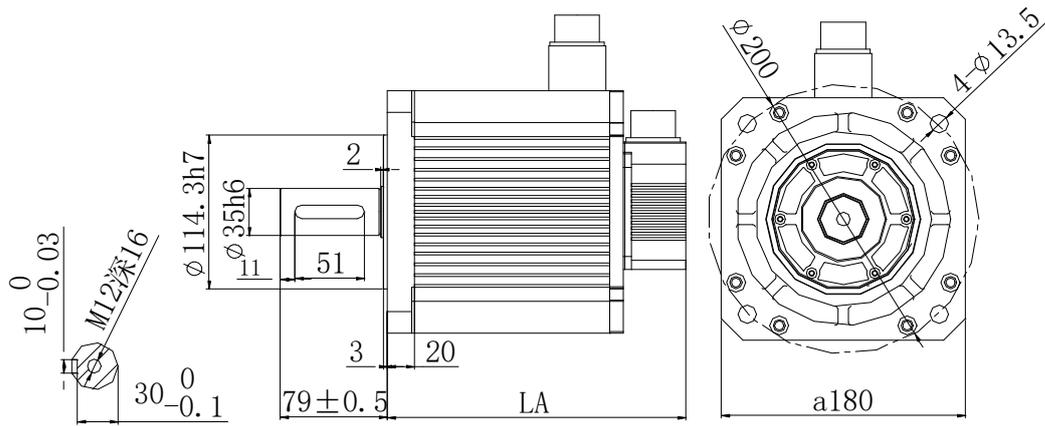
Motor model	LA ±1		Inertia level
	Normal	With brake	
MS5G-180ST-TL19015□□-42P9-S01	221	303	Middle inertia
MS5G-180ST-TL28015□□-44P4-S01	247	329	
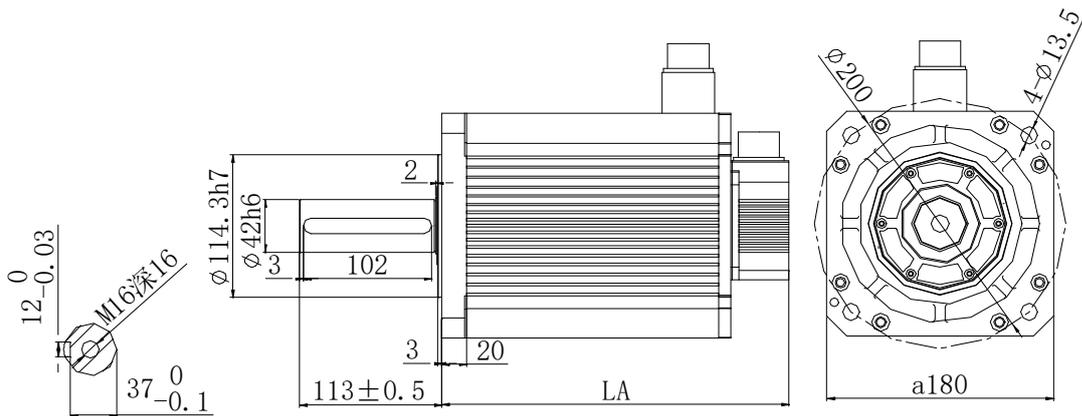
Motor model	LA ±1		Inertia level
	Normal	With brake	
MS5G-180ST-TL35015□□-45P5-S01	277	359	Middle inertia
MS5G-180ST-TL48015□□-47P5-S01	318	400	

■ 220 series motor installation dimensions   Unit: mm
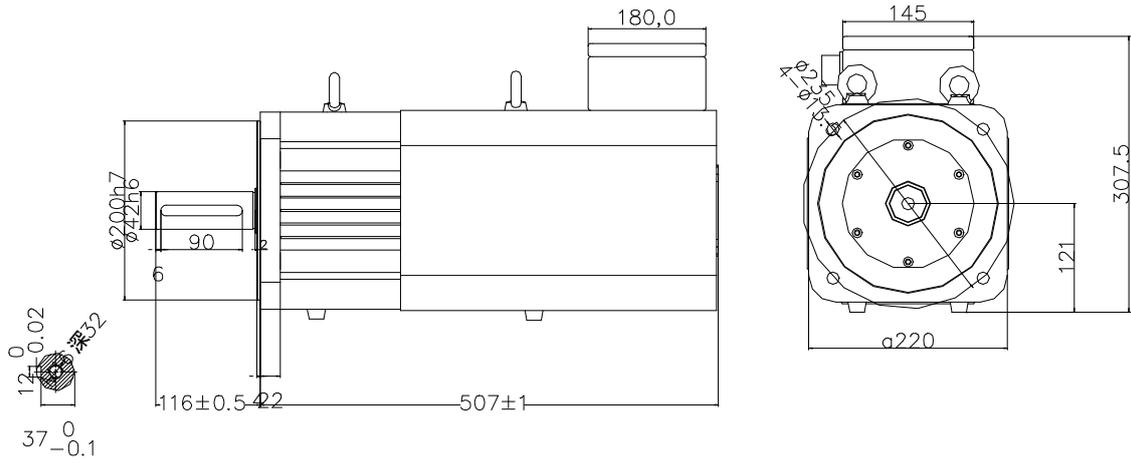
Motor model	LA ±1		Inertia level
	Normal	With brake	
MS-220ST-TL96015□□-415P0	507	607	-

3 Wiring of servo system

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	Grould cable ⏚ diameter mm²
DS5E/L-20P1-PTA	2.0	0.75	0.2（7-core）	2.0
DS5E/L-20P2-PTA	2.0	0.75	0.2（7-core）	2.0
DS5E/L-20P4-PTA	2.0	0.75	0.2（7-core）	2.0
DS5E/L-20P7-PTA	2.0	0.75	0.2（7-core）	2.0
DS5E/L-21P5-PTA	2.0	1.5	0.2（7-core）	2.0
DS5E/L-22P3-PTA	2.0	1.5	0.2（7-core）	2.0
DS5E/L-22P6-PTA	2.0	1.5	0.2（7-core）	2.0
DS5E-41P5-PTA	2.0	1.5	0.2（7-core）	2.0
DS5E/L-43P0-PTA	2.0	2.5	0.2（7-core）	2.5
DS5E-45P5-PTA	6.0	6.0	0.2（7-core）	6.0
DS5E-47P5-PTA	6.0	6.0	0.2（7-core）	6.0
DS5E-415P0-PTA	6.0	6.0	0.2（7-core）	6.0

Note:
(1) Please do not 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 do not touch the power terminal temporarily (10 minutes).
(5) Do not turn ON/OFF power frequently. When the ON or OFF power supply needs to be repeatedly connected, please control it less than once in 2 minutes. Because of the capacitance in the power supply of the servo driver, a large charging current (charging time of 0.2 seconds) will flow through when the power supply is ON. Therefore, if the ON/OFF power supply is frequently used, the performance of the main circuit components in the servo driver will be degraded.

3.1 Main circuit wiring

3.1.1 Servo driver terminal arrangement
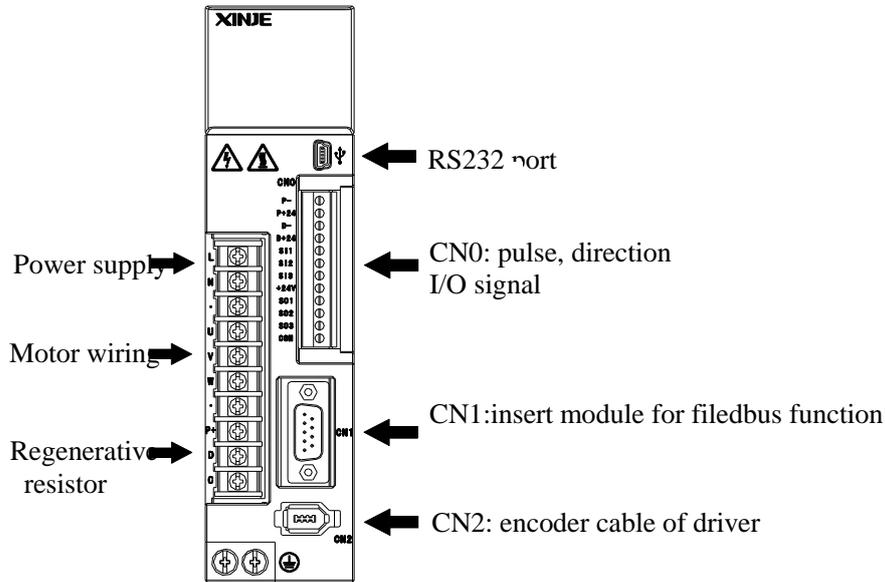
3.1.2 Main circuit terminals and explanations

■ DS5E/L-20P1-PTA, DS5E/L-20P2-PTA, DS5E/L-20P4-PTA, DS5E/L-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 cooling fin, 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

■ DS5E/L-21P5-PTA, DS5E/L-22P3-PTA, DS5E/L-22P6-PTA

Terminal	Function	Explanation
R/S/T	Power supply input of main circuit	3-phase AC 200~240V, 50/60Hz
●	Vacant terminal	-
U, V, W	Motor terminals	Connect the motor Note: the ground wire is on the cooling fin, 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
⏚	Ground terminal	Connect to ground terminal of motor, then connect to the ground
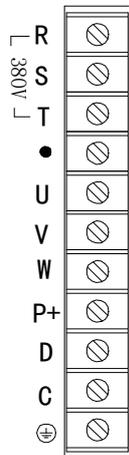
R
S ⌐220V⌐
T
●
U
V
W
P+
D
C
⏚

■ DS5E-41P5-PTA

Terminal	Function	Explanation
R/S/T	Power supply input of main circuit	3-phase AC 340~420V, 50/60Hz
●	Vacant terminal	-
U, V, W	Motor terminals	Connect the motor Note: the ground wire is on the cooling fin, 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
⏚	Power supply input of main circuit	Connect to ground terminal of motor, then connect to the ground

R
S ⌐380V⌐
T
●
U
V
W
P+
D
C
⏚

■ DS5E-43P0-PTA, DS5E-45P5-PTA, DS5E-47P5-PTA
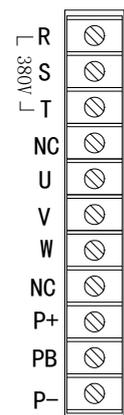
Terminal	Function	Explanation
R/S/T	Power supply input of main circuit	3-phase AC 340~420V, 50/60Hz
NC	Vacant terminal	-
U, V, W	Motor terminals	Connect the motor Note: the ground wire is on the cooling fin, please check it before power on!
P+, PB	External regenerative resistor	Connect regenerative resistor between P+ and PB, P0-25= power value, P0-26= resistor value
P+, P-	Bus terminal	Real-time bus voltage can be measured. Please pay attention to the danger.

R
S ⌐380V⌐
T
NC
U
V
W
NC
P+
PB
P−

P+
P−
R
S
T
PE
U
V
W
PB
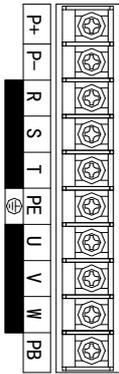
■ DS5E-415P0-PTA

Terminal	Function	Explanation
R/S/T	Power supply input of main circuit	3-phase AC 340~420V, 50/60Hz
PE	Connect to ground	-
U, V, W	Motor terminals	Connect the motor Note: the ground wire is on the cooling fin, please check it before power on!
P+, PB	External regenerative resistor	Connect regenerative resistor between P+ and PB, P0-25= power value, P0-26= resistor value
P+, P-	Bus terminal	Real-time bus voltage can be measured. Please pay attention to the danger.

3.1.3 CN0, CN1, CN2 terminal

3.1.3.1 CN0 terminal

DS5E series only have model DS5E-PTA, DS5L series have model DS5L-PTA-5 (5V pulse input signal) and DS5L-PTA (24V pulse signal input).

CN0(below 1.5KW)	CN0（1.5KW and above）	Model -5 CN0(below 1.5KW)
P− P+24V D− D+24V SI1 SI2 SI3 +24V SO1 SO2 SO3 COM	P− P+24V D− D+24V SI1 SI2 SI3 SI4 +24V SO1 SO2 SO3 SO4 COM	P− P+5V D− D+5V SI1 SI2 SI3 +24V SO1 SO2 SO3 COM

■ CN0 terminal description (below 1.5KW, 3 inputs, 3 outputs)

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

■ CN0 terminal description (above 1.5KW, 4 inputs, 4 outputs)

Name	Description	Name	Description
P-	Pulse input PUL-	SI4	Input terminal 4
P+24V	Open collector input	+24V	Input +24V
D-	Direction input DIR-	SO1	Output terminal 1
D+24V	Open collector input	SO2	Output terminal 2
SI1	Input terminal 1	SO3	Output terminal 3
SI2	Input terminal 2	SO4	Output terminal 4
SI3	Input terminal 3	COM	Output terminal ground

■ CN0 terminal description (below 1.5KW, 3 inputs, 3 outputs)

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

3.1.3.2 CN1 terminal description
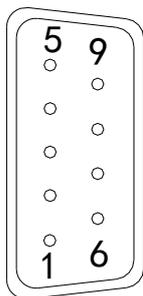
DS5E			DS5L
No.	Name	Description	
1	GND	GND-485	No definition
2	A1	RS485+	
3	B1	RS485-	
4	A2	RS485+	
5	B2	RS485-	
6	GND	GND-485	
7	NC	Reserved	
8	NC	Reserved	
9	NC	Reserved	

Note: DS5E supports motion bus function: Bus module should be selected and plugged into driver CN1 port to realize extended bus function. Note that the switch module can not be hot-plugged. It is suggested that Profibus standard connection cable should be used to achieve the best communication reliability.

3.1.3.3 CN2 terminal description

The terminals of the CN2 connector are arranged as follows (faced solder plates):
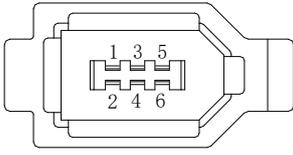
No.	Definition
1	5V
2	GND
3	/
4	/
5	485+
6	485-

3.1.4 Communication port

■ RS-232 communication

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

Driver side-5-pin trapezoidal interface

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	Modification	Effective
P7-10	Modbus station no.	1	1～255	Servo OFF	Immediately

■ RS-485 communication

Pin	Name
CN1-2	A1
CN1-3	B1
CN1-4	A2
CN1-5	B2

Driver side - CN1 port (DB9 male port)

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

Modbus station no. can be set freely, set by P7-00:

Parameter	Function	Default setting	Range	Modification	Effective
P7-00	Modbus station no.	1	0～255	Servo OFF	Immediately

Note:

(1) Support the standard Modbus RTU protocol, which is used as the slave device of Modbus RTU.

(2) RS232 and RS485 communication ports can be used simultaneously.

3.2 Classification and function of signal terminals

3.2.1 Pulse signal

Instruction form	Option	Meaning	P-input signal	D-input signal	Chapter
P0-10 xxx□	0	CW/CCW dual-pulse mode	CW	CCW	5.3.2
	1	AB phase mode	A phase	B phase	
	2	Pulse+direction mode	pulse	direction	
The input signal + of open collector (24V voltage) is P+24V/D+24V.					

The interface circuit of P+D, CW, CCW:

Open collector (24V voltage)

Differential type (5V voltage)
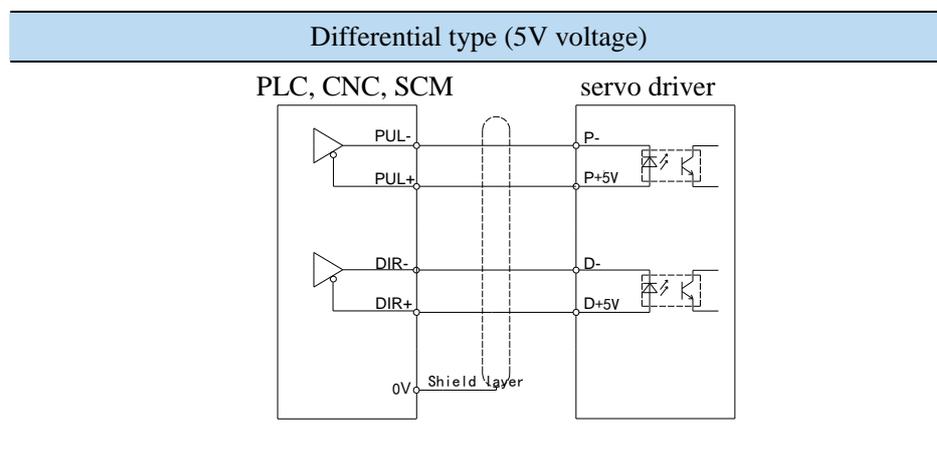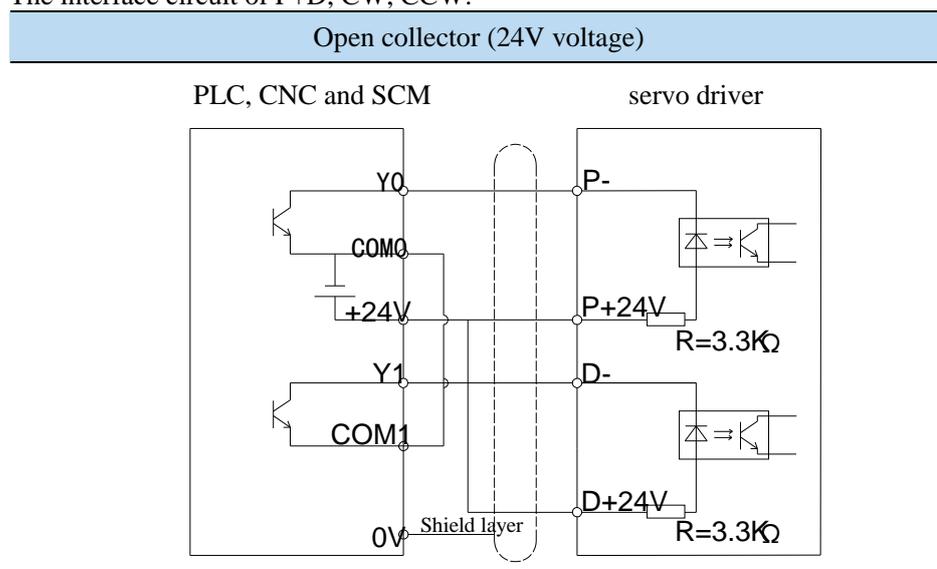
Note:

(1) The supply voltage range of P-/P+24V and D-/D+24V is 18V~25V. If it is below 18V, there may be pulse and direction anomalies.

(2) In order to resist interference, twisted-pair shielding wire must be used.

(3) Servo pulse input port will turn on for 10 mA.

(4) If the controller is XINJE PLC, the rated current of the output port of the pulse is 50mA. According to this data, theoretically a single pulse can drive at most five servos. No more than three are recommended.

3.2.2 SI input signal

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

Type	Input terminal	Function	Reference chapter
Digital input	SI1~SI4	Multifunctional input signal terminal	5.12

Open collector (power supply is 24V)	Relay type (power supply is 24V)
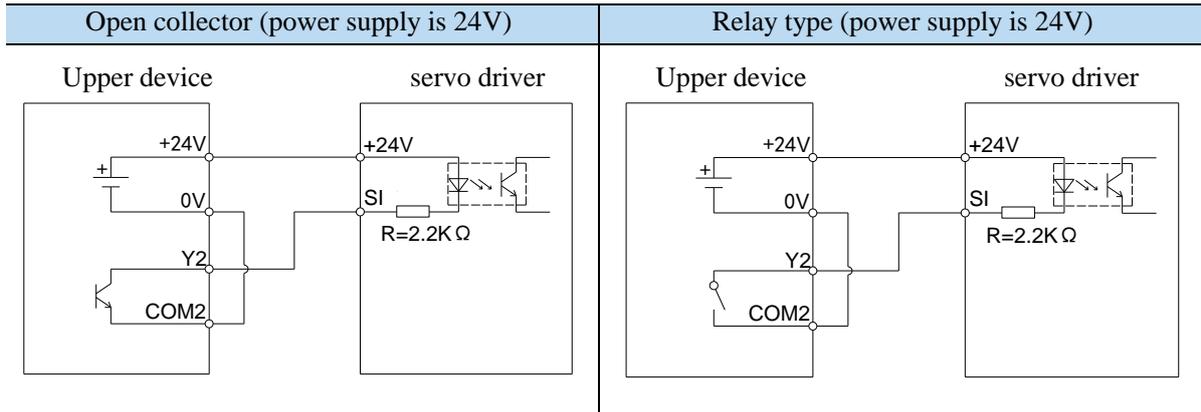
Note:

The maximum allowable voltage and current of the collector open circuit output circuit are as follows:

Voltage: DC 30V (maximum)

Current: DC 50mA (maximum)

3.2.3 SO output signal

Type	Output terminal	Function	Reference chapter
Optocoupler output	SO1~SO3 (750W and below) SO1~SO4 (above 1.5KW)	Multifunctional output terminal	5.12.7

Optocoupler type	Relay type
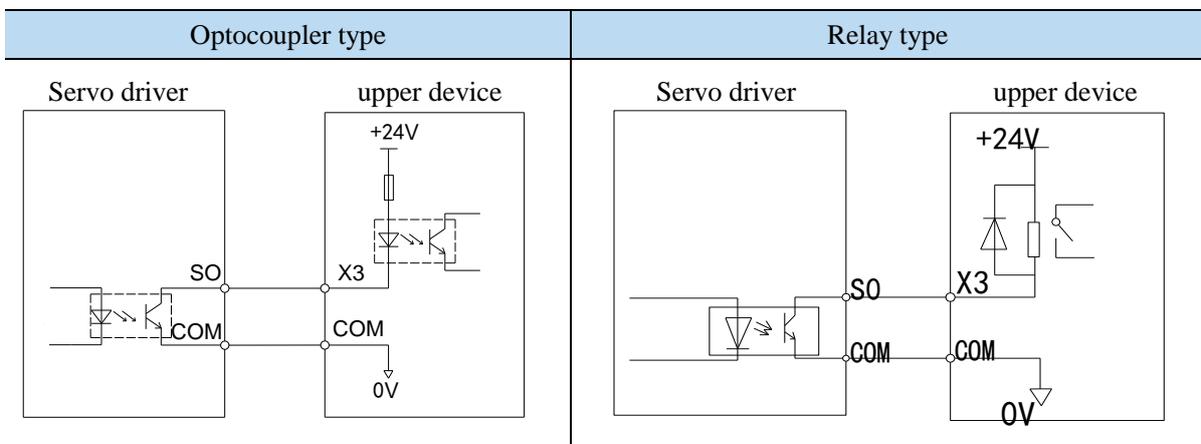
Note: The maximum load current is 400 mA (if the brake motor is controlled by SOx, please confirm the brake current first, and if it is larger than 400 mA, please use the intermediate relay).

3.2.4 Analog input circuit（**DS5E/5L not support**）

3.2.5 Encoder feedback output signal （**DS5E/5L not support**）

4 Operate panel

4.1 Basic operation

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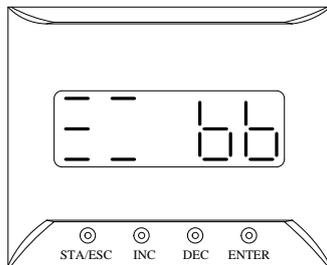
Button	Operation
STA/ESC	Short press: state switch, state return
INC	Short Press: The display data increases Long press: The display data increases continuously
DEC	Short Press: The display data decreases Long press: The display data decreases continuously
ENTER	Short press: shift; Long press: Set and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

4.1.2 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.
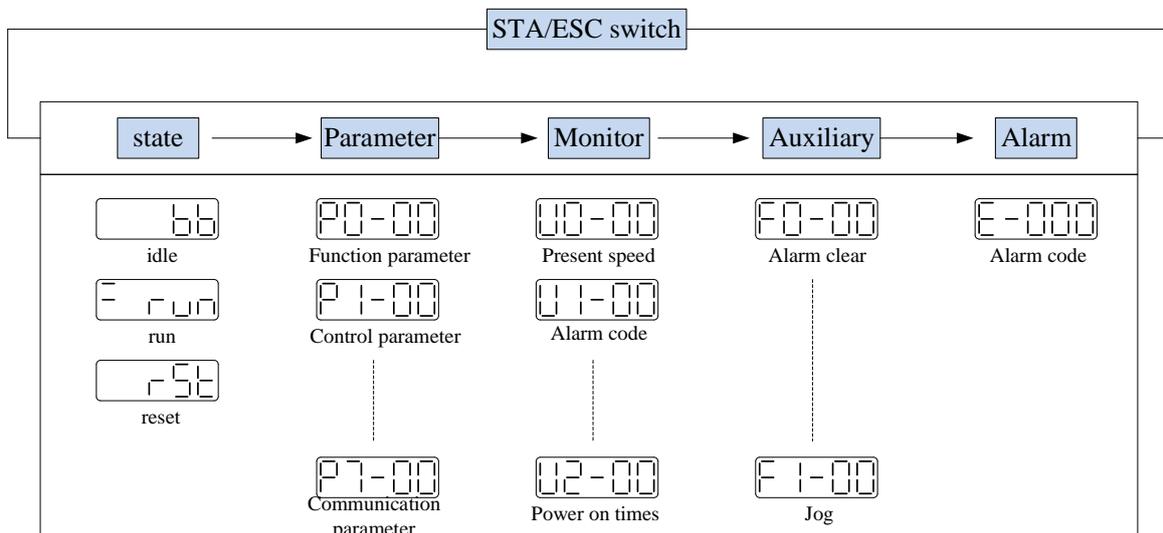
- Parametric setting Px-xx: The first X represents the group number, and the last two X represents the parameter serial number under the group.
- Monitor status Ux-xx: The first X represents the group number, and the last two X represents the parameter number under the group.
- Auxiliary function Fx-xx: 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.

4.2 Running Display Status Description

■ Speed torque control mode
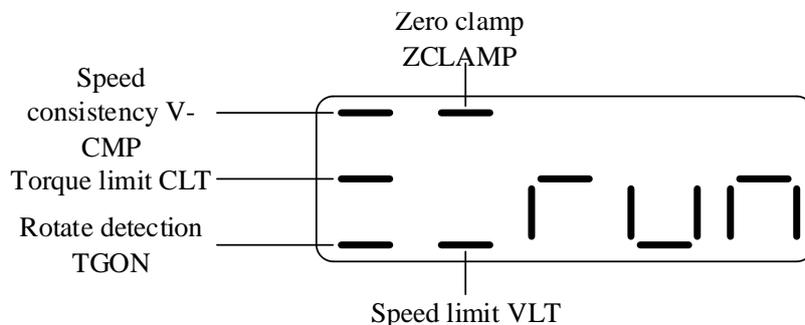
1. Digit display contents

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（单位：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, turn on the light when the torque is controlled. Forward speed limit in torque control: P3-16; reverse speed limit: P3-17.

2. Short code display content

Short code	Display contents
bb	Standby status Servo OFF status. (The motor is in a non-electrified state)
run	In operation Servo enabling state. (The motor is on-line)
rSt	Need reset status Servo needs to be re-energized
Pot	Forbidden forward drive state P-OT ON status. Refer to Section 5.2.4, "Overrun Prevention".
not	Forbidden reversal drive state N-OT ON status. Refer to Section 5.2.4, "Overrun Prevention".

■ Position control mode

Positioning completion COIN
Positioning near
NEAR
Rotate detection
TGON

1. 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)
P5-36 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)

2. Short code display contents

Short code	Display contents
bb	Standby status Servo OFF status. (The motor is in a non-electrified state)
run	In operation Servo enabling state. (The motor is on-line)
rst	Need reset status Servo needs to be re-energized
Pot	Forbidden forward drive state P-OT ON status. Refer to Section 5.2.4, "Overrun Prevention".
not	Forbidden reversal drive state N-OT ON status. Refer to Section 5.2.4, "Overrun Prevention".

4.3 Group U monitor parameters

■ U0-21 input signal status

Lighting means that the corresponding item has signal input.

Lighting means that the corresponding item has no signal input.

10 9 8 7 6 5 4 3 2 1

STA/ESC   INC   DEC   ENTER
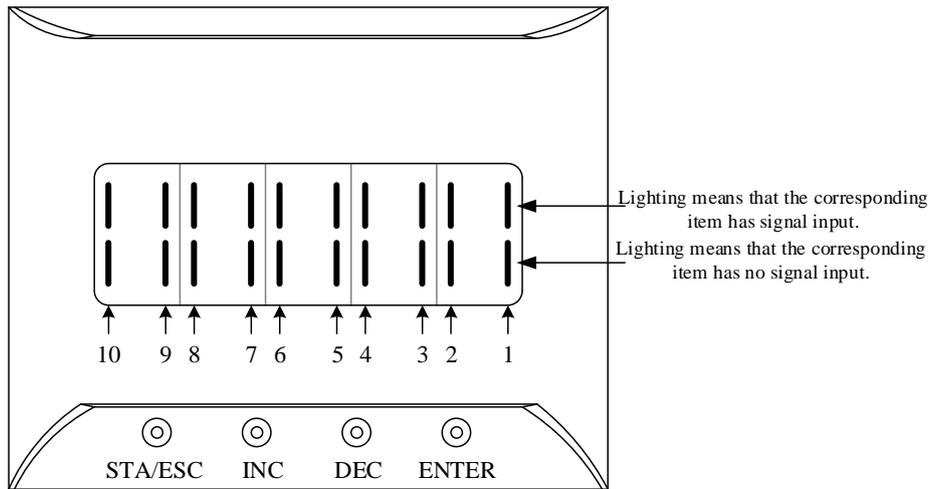
■ U0-21 input signal 1 distribution

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

Lighting means that the corresponding item has signal input

Lighting means that the corresponding item has no signal input

20 19 18 17 16 15 14 13 12 11

STA/ESC   INC   DEC   ENTER
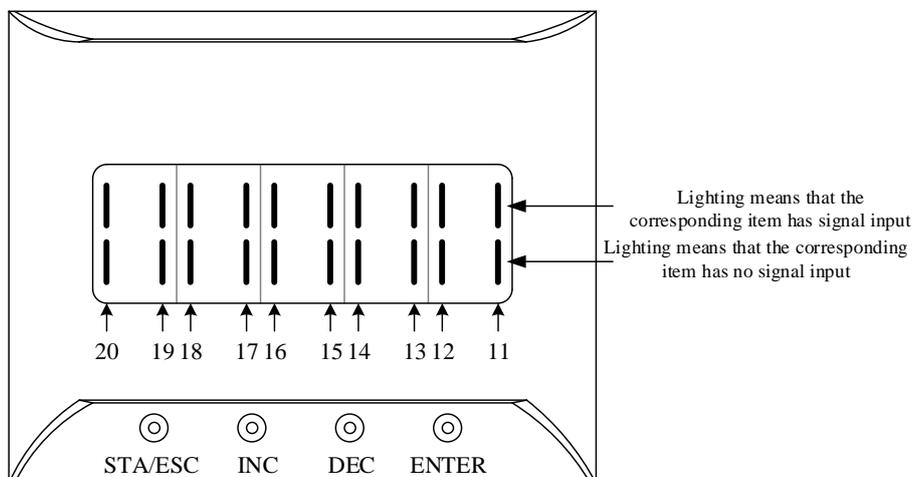
■ U0-22 input signal 2 distribution

Segment code	Description	Segment code	Description
11	/C-SEL control mode selection	12	/ZCLAMP zero clamp
13	/INHIBIT instruction pulse prohibition	14	/G-SEL gain switch
15	/CLR pulse clear	16	/CHGSTP change step
17	Reserved	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.			

■ U0-23 output signal status
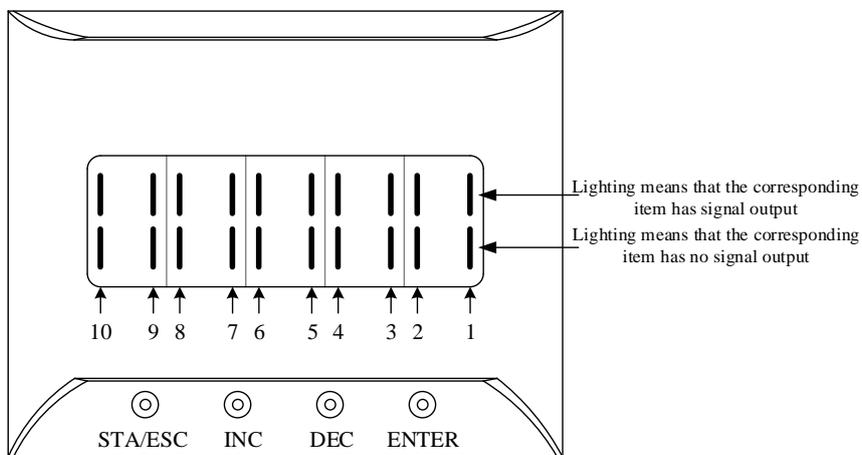
■ U0-23 output signal 1 distribution

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

Lighting means that the corresponding item has signal output

Lighting means that the corresponding item has no signal output

20　19 18　17 16　15 14　13 12　11

STA/ESC　INC　DEC　ENTER
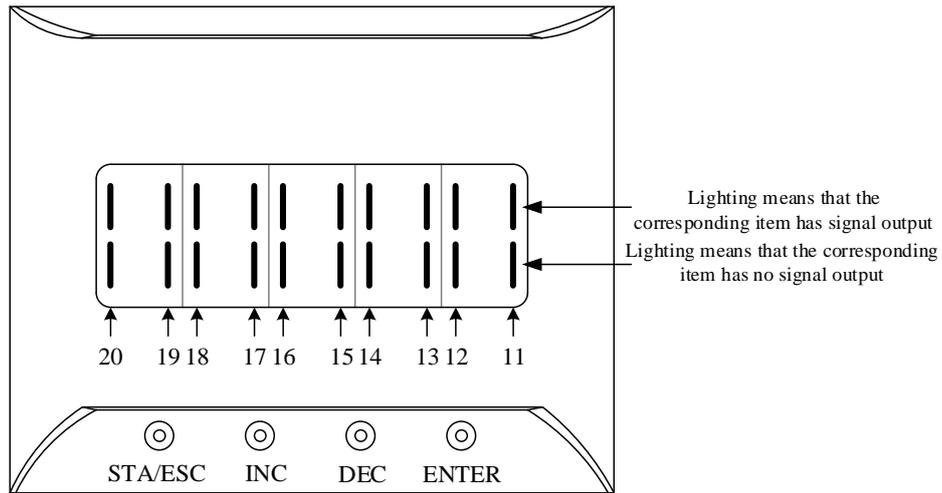
■ U0-24 output signal 2 distribution

Segment code	Description	Segment code	Description
11	Alarm （/ALM）	12	Reserved
13	Reserved	14	Reserved
15	Speed reach（/V-RDY）	16	Custom output 1
17	Custom output 2	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.			

4.4 Group F Auxiliary Functional Parameters

4.4.1 Group F0

Function code	Description	Function code	Description
F0-00	Alarm clear	F0-07	Panel inertia identification
F0-01	Resume to default settings	F0-08	Panel external instruction auto-tuning
F0-02	Clear the position offset	F0-09	Panel internal instruction auto-tuning
F0-04	Clear up historical alarm records	F0-10	Panel vibration suppression 1
		F0-11	Panel vibration suppression 2

1. **Alarm clear（F0-00）**

Setting F0-00=1 can reset the alarm status. When an alarm occurs, please first eliminate the cause of the alarm, and then clear up the alarm.

2. **Resume to default setting（F0-01）**

Set F0-01=1 when enabler is shut down, press ENTER to resume to default settings, no need to cut power.

3. **Clear the position offset（F0-02）**

Set F0-02=1 to clear the offset.

4. **Clear up historical alarm records（F0-04）**

Set F0-04=1 can clear up historical alarm records from U1-14 to U1-53.

5. **Panel inertia identification （F0-07）**

Refer to panel inertia identification operation steps chapter 6.3.4.

6. **Panel external instruction auto-tuning（F0-08）**

Refer to external instruction auto-tuning chapter 6.5.5.

7. **Panel internal instruction auto-tuning（F0-09）**

Refer to internal instruction auto-tuning chapter 6.5.4.

8. **Panel vibration suppression（F0-10, F0-11）**

Refer to vibration suppression chapter 6.7.4.

4.4.2 Group F1

Function code	Description	Function code	Description
F1-00	Jog run	F1-04	Tref（torque analog）zero-correction (not support)
F1-01	Test run	F1-05	Forced enable
F1-02	Current Sampling Zero-correction	F1-06	Reset circles of absolute encoder
F1-03	Vref (speed analog) zero-correction (not support)	-	-

1. **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.
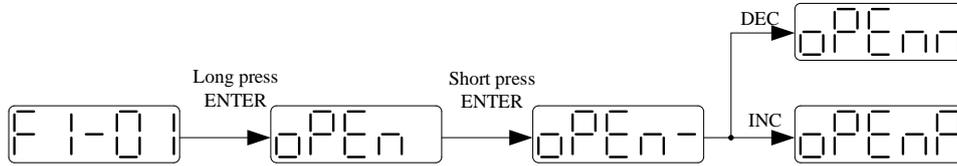
2. Jog run（F1-00）

Before entering the jog run mode, please confirm that the test run is normal when the motor is empty, so as to confirm that the servo connection is correct.

Jog run mode requires the driver to be idle in bb status!

Starting with the 3700 firmware version, the jog run function changes from position mode to speed mode. The acceleration and deceleration time is controlled by P3-09 and P3-10.
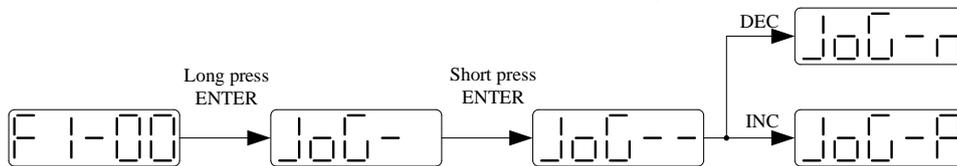
Parameter	Meaning	Default setting	Unit	Setting range	Change	Effective
P3-18	JOG speed	100	1rpm	0～1000	Servo OFF	At once

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

When the servo driver is self-renewed or the motor runs unsteadily after a long time, the user is advised to use the current sampling zero-correction function.
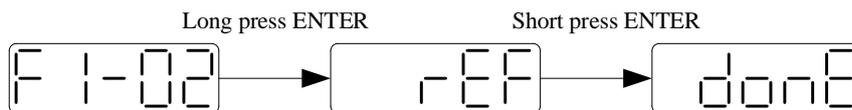
Press STATUS/ESC to exit.

4. Forced enable（F1-05）

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

Note: Forced enable fails after re-energizing.

4.5 Fault alarm handling

When a fault occurs, the alarm status is automatically jumped out, and the alarm number is displayed. When there is no fault, the alarm status is invisible. In the alarm state, the fault can be reset by writing 1 to F0-00 through panel operation.

If the servo power supply OFF makes the servo alarm, it is not necessary to clear the alarm.

Note: When an alarm occurs, the cause of the alarm should be eliminated first, and then the alarm should be removed.

4.6 Parameter setting example

An example is given to illustrate the operation steps when the content of parameter P3-09 is changed from 2000 to 3000.

Step	Panel display	Used buttons	Operations
1	bb	STA/ESC INC DEC ENTER	No operation
2	P0-00	STA/ESC INC DEC ENTER	Press STA/ESC
3	P3-00	STA/ESC INC DEC ENTER	Press INC for three times to show P3-00
4	P3-00	STA/ESC INC DEC ENTER	Press ENTER, the last 0 will flash
5	P3-09	STA/ESC INC DEC ENTER	Press INC for 9 times
6	P3-09	STA/ESC INC DEC ENTER	Long press ENTER to show the value of P3-09
7	3000	STA/ESC INC DEC ENTER	Press INC, DEC, ENTER to increase decrease or shift, after changing, long press ENTER to confirm
8	END		
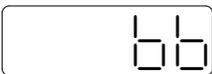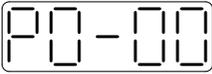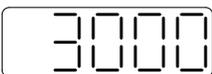
Note: When the setting parameter exceeds the range that can be set, the driver will not accept the setting value, and the driver will report E-021 (parameter setting exceeds the limit). The parameter setting overrange usually occurs when the upper computer writes parameters to the driver through communication.

4.7 Change motor code

A servo driver can be equipped with a variety of motors with similar power levels. Different types of motors are distinguished by the motor code on the motor nameplate. Before debugging the servo system, make sure that the motor code P-33 matches the motor nameplate label.

Long press ENTER → P0-33 → Short press ENTER → Input motor code → Complete the setting → Re-power on → confirm
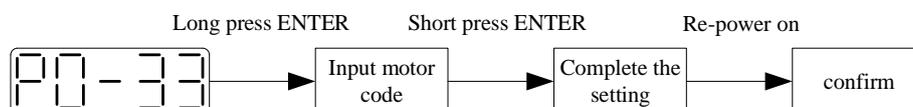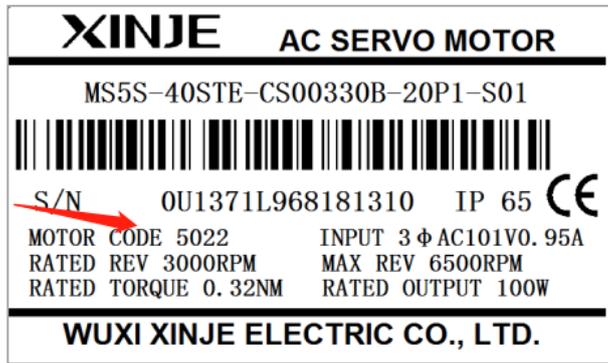
Note: Errors in motor code setting will prompt E-310 (motor code error), which can be set again after F0-00 clears the alarm.

5 Operation of Servo System

5.1 Selection and Switching of Control Mode

5.1.1 Selection of control mode

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

User parameter		Control mode	Reference
P0-01 Submode 1	1	Torque control (internal setting)	5.9
	3	Speed control (internal setting)	5.6
	5	Position control (internal position instruction)	5.4
	6 (default setting)	Position control (external pulse instruction)	5.3
	7	Speed control (pulse frequency instruction)	5.7
	8	Fieldbus torque mode	5.10
	9	Fieldbus speed mode	5.10
	10	Fieldbus position mode	5.10
P0-02 submode 2	Ditto	When the/C-SEL signal is valid, the servo system will switch to the mode chosen by P0-02.	

Position control is the control of moving to target position through the pulse instruction input in servo driver from upper device. The position is controlled by the number of input pulses and the speed is controlled by the frequency of input pulses, which is used in situations where positioning action is needed. Position instructions can be combined by external pulse input, total number of internal given position instructions and speed limitation. Position control mode is mainly used in situations requiring positioning control, such as manipulators, grinders, engraving machines, CNC machine tools and so on.

Speed control refers to the control of mechanical speed through speed instructions. Through digital, analog voltage or communication given speed instructions, the servo driver can achieve fast and accurate control of mechanical speed.

The current of servo motor has a linear relationship with the torque, so the control of the current can realize the control of the torque. Torque control refers to the control of motor output torque through the torque instruction. Torque instructions can be given by digital, analog voltage or communication. Torque control mode is mainly used in devices that have strict requirements for material force, such as winding and unwinding devices. In some tension control situations, the given value of torque should ensure that material force is not affected by the change of winding radius.

5.1.2 The switch of control mode

Control mode switching refers to the switching between mode 1 and mode 2 through external input signals when the servo panel displays run.

1. **Control mode switching signal**

Parameter	Name	Default setting	Suitable mode	Meaning	Change	Effective
P5-30	/C-SEL	n.0000	All	To switch the control mode	Anytime	At once
Range 0000-0014, can be distributed to other input terminal through P5-30.						

2. Perform the function

Signal	Status	Control mode
/C-SEL	0: off	P0-01: the control mode set by mode 1
	1: on	P0-02: the control mode set by mode 2

5.2 Basic function setting

Parameter	Name	Reference
P0-03	Enable mode	5.2.1
P5-20	Servo ON setting /S-ON terminal	
P0-05	Rotate direction switching	5.2.2
P0-27	Servo OFF stop mode	5.2.3
P0-28	motor overrun stop mode	
P0-29	alarm stop mode	
P0-30	Stop overtime time	
P3-32	Break torque	
P5-22	forward run prohibition /P-OT	5.2.4
P5-23	Reverse run prohibition /N-OT	
P5-44	Power off break /BK	5.2.5
P5-47	Alarm output /ALM	5.2.6

5.2.1 Servo enable

Servo enabling signal effectively represents the electrification of the servo motor. When the servo enabling signal is invalid, the motor does not operate.

Parameter	Name	Setting	Meaning	Change	Effective
P0-03	Enable mode	0	Not enable	Servo OFF	At once
		1(default)	I/O enable /S-ON （set P5-20）		
		2	Software enable（F1-05 or enabled by software）		
		3	Fieldbus enable		

Parameter	Name	Setting	Meaning	Range
P5-20	enable /S-ON	n.0001 (default)	When the SI1 terminal is connected, the servo motor is in run state and can be operated.	The range of parameters is 0001-0014. The parameters P5-20 can be assigned to other input terminals.
		n.0010	The servo system is always valid, no external input signal is needed, and the servo system is always on.	

5.2.2 Rotation direction switching

Users can change the direction of rotation of servo motor through parameter P0-05. It is stipulated that the "forward rotation" of the motor is "counter-clockwise rotation" and "reverse rotation" is "clockwise rotation". (All of them are facing the motor shaft)

Mode	Forward rotation	Reverse rotation
Standard setting CCW is forward rotation	CCW	CW

Reverse mode CW is forward rotation	CW	CCW

Parameter	Setting	Meaning
P0-05	0 (default)	Standard setting (CCW is forward rotation)
	1	Reverse mode (CW is forward rotation)

5.2.3 Stop mode

The stop mode when servo is off or alarm.

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-27	Servo OFF stop mode	0	-	0 or 2	Servo OFF	At once
P0-29	Alarming stop mode	2	-	0 or 2	Servo OFF	At once

0: Inertial operation stops and remains in inertial operation after stopping.
2: The deceleration brake stops, and the inertia running state is maintained after the stop.

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-30	Stop overtime time	20000	1ms	0～65535	Servo OFF	At once
P3-32	Break torque	300	1%	0～1000	Anytime	At once

Note:

(1) When the stop mode is set to 0, the motor starts to stop by inertia when the servo OFF occurs and the alarm occurs, and then turns to free stop when the speed is less than P5-03 (rotation detection speed). The servo will time the inertial stop process. In the process of inertial stopping, if the timing time is longer than P0-30 and the motor speed has not been reduced below P5-03, the servo will stop freely and give the stop timeout alarming.

(2) When the stopping mode is set to 2, the motor will produce a braking torque of P3-32 after the occurrence of servo OFF and alarm. The motor will start braking and stop until the speed is less than P5-03 (rotation detection speed), and then turn to free stop. At the same time, the servo will timing the braking stop stage. In the process of inertial stopping, if the timing time is longer than P0-30 and the motor speed has not been reduced below P5-03, the servo will stop freely and give the stop timeout alarming.

Set the stop mode when overrun.

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-28	Servo overrun stop mode	2	-	0～3	Servo OFF	At once

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 does

	3	Alarm（E-260）

Note:

 1) When the deceleration stops, the braking torque is also P3-32, and the stopping overtime time also plays a role in the overrun process.

 2) In position control, there may be position deviation pulse when the motor is stopped by over-range signal. To remove the position deviation pulse, the clearance signal /CLR must be input. If the servo unit still receives pulses, these pulses will accumulate until the servo unit alarms.

5.2.4 Overrun prevention (P-OT, N-OT)

 1. Use of Overrun Signal

 The over-run prevention function of the servo unit refers to the safety function of forcing the servo motor to stop by inputting the signal of the limit switch when the movable part of the machine exceeds the designed safe moving range. Be sure to connect the limit switch as shown below.
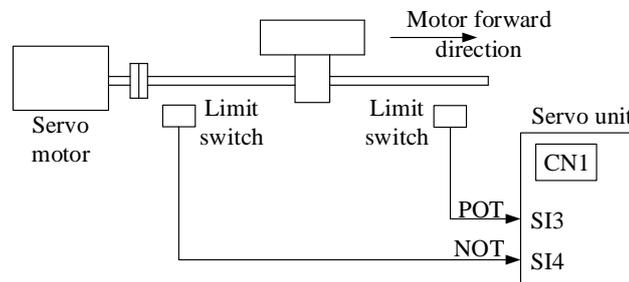
 Rotary applications such as round tables and conveyors do not need the function of overrun prevention. At this time, there is no need to connect the overrun prevention with input signals.

2. Set the overrun signal

Parameter	Signal name	Setting	Meaning	Range
P5-22	Forward prohibition /P-OT	n.0003 (default)	When the SI3 terminal signal is turned on, the forward rotation of the motor is forbidden.	The parameter range is 0000-0014. can be assigned to other input terminals through P5-22.
		n.0013	Forward rotation of motor is prohibited when SI3 has no signal, and forward rotation of motor is allowed when SI3 has signal.	
P5-23	Reverse prohibition /N-OT	n.0004 (default)	When SI4 terminal signal is turned on, motor reverse rotation is prohibited.	The parameter range is 0000-0014. can be assigned to other input terminals through P5-23.
		n.0014	When SI4 has no signal, it is forbidden to reverse the motor; when SI4 has signal, it is allowed to reverse the motor.	

5.2.5 Electric loss brake（BK）

When the servo motor controls the vertical load, the purpose of using the "brake servo motor" is: when the power supply of the system is placed in the "OFF", the movable part will not move under the action of gravity.
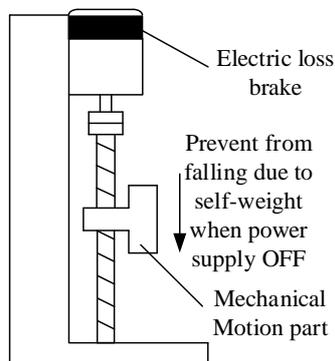
Note: The brake built in the servo motor is a fixed special brake without excitation. It can not be used for dynamic braking. Please use it only when the servo motor is in a stop state.

1. Connection examples
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.
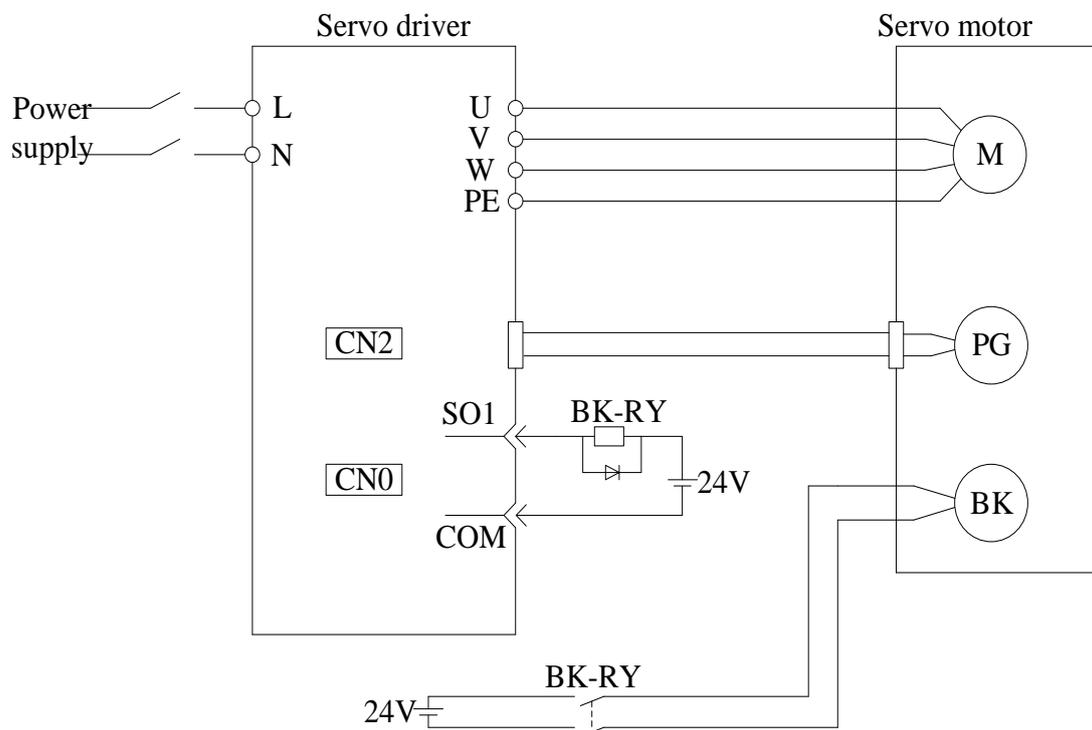
Note:
(1) The voltage of the power-loss brake is 24V.
(2) In the figure above, the BK signal is output by SO1, and the parameter P5-44 should be set to n.0001.

2. BK signal

Parameter	Signal name	setting	Meaning	Range
P5-44	Brake lock /BK	n.0000 (default)	Default unallocated output terminal	The range of parameters is 0001-0014.
		n.0001	Use SO1 terminal output signal to control brake	can be assigned to other output terminals through P5-44.

3. Switching time of BK signal and S-ON signal

Because of the action delay time of brake, the machine moves slightly under the action of gravity and so on. P5-07 parameter is used to adjust the time. Delay this time to release the brake after enabling or lock the brake and delay this time when the enable signal is off.

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P5-07	Servo OFF delay time	500	1ms	0～65535	Servo OFF	At once

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

When setting the servo motor with brake, the output signal of the control brake "/BK" and the time of ON/OFF action of the servo SON signal are shown below. That is, before the output /BK signal lock-in is opened, the servo motor has entered the power-on enabling state; after not output /BK signal and brake is locked, the servo motor is disconnected from the power-on state.
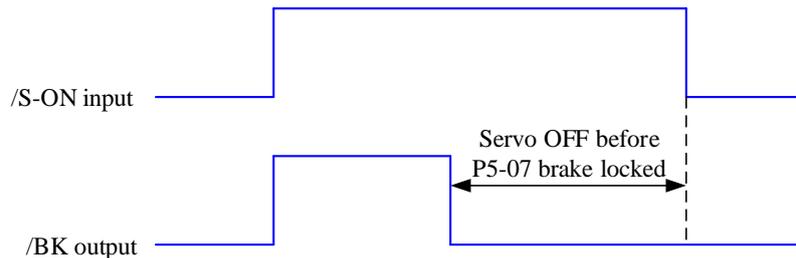
4. Setting of brake closing parameters

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P5-08	Brake command output speed	30	rpm	20～10000	Servo OFF	At once
P5-09	Brake command wait time	500	ms	0～65535	Servo OFF	At once

When the alarm occurs, the motor quickly becomes non-electrified. Because of gravity or inertia and other reasons before the brake action time, the machine will move. To avoid this situation, the above parameters need to be set.

The sequence diagram is as follows:

/ S-ON input or alarm power off | Servo ON | Servo OFF

Motor rotation speed (Rpm) | P5-08 Deceleration stop or free stop

/BK output | Brake release | Brake locked

P5-09

/ S-ON input or alarm power off | Servo ON | Servo OFF

Motor rotation speed (Rpm) | P5-08 Deceleration stop or free stop

/BK output | Brake release | Brake locked

P5-09
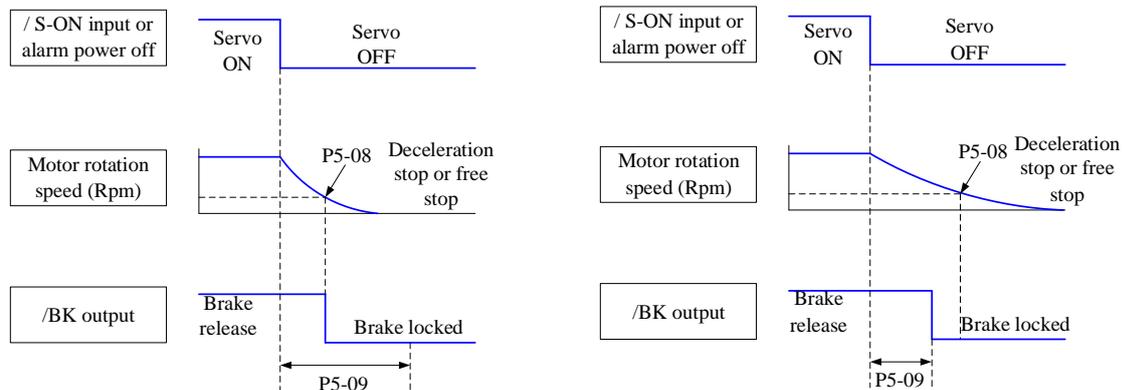
Since the brake of the servo motor is designed to be used as a position holder, it must be activated at the right time when the motor stops. While observing the action of the machine, adjust the user's parameters.

The conditions for the conversion of the / BK signal from ON to OFF in motor rotation are as follows (any of the two conditions takes effect):

1) When the speed of the motor is below the set value of P5-08 after servo OFF;

2) When the servo OFF exceeds the set time of P5-09.

5.2.6 Alarm output signal

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

Note:

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

(2) The output of the functional parameters can not be repeated.

5.2.7 Anti-blocking alarm

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 P3-28 and the internal reverse torque limit of P3-29, it will show the alarm E-165 blocking overtime (this alarm is not detected when P0-74/75 is set to 0).

Parameter	Meaning	Default setting	Unit	Setting range	Change	Effective
P0-74	Blocking alarm time	0	1ms	0~65535	Anytime	At once
P0-75	Blocking alarm speed	50	rpm	5~9999	Anytime	At once

If the alarm occurs during the normal working process of the servo, please confirm:

(1) Monitor the torque of U0-02 and check the reasonableness of setting the limit values of P3-28 and P3-29.

(2) Check the external mechanical structure and installation.

(3) P0-74 blocking alarm time default value:

    100W (20P1): 2000 default is 2s

    20P2/20P4：3000 default is 3s

    20P7：5000 default is 5s

    415P0：20000 default is 20s

    Other models: default is 0s

5.3 Position control (external pulse instruction)

Basic parameters		
Parameter	Name	Reference
P0-01	control mode selection	5.3.1
P0-09	forward direction of pulse instruction	5.3.2
P0-10	pulse instruction form	
P0-11	Motor pulse numbers per rotation*1	5.3.3
P0-12	Motor pulse numbers per rotation*10000	
P0-13	Electronic gear ratio (numerator)	
P0-14	Electronic gear ratio (denominator)	
P0-92～P0-93	Electronic gear ratio (numerator) double words	
P0-94～P0-95	Electronic gear ratio (denominator) double words	
P5-20	Servo ON signal /S-ON	5.2.1

Other optional parameters			
Key words	Parameter	Name	Reference
Command filter	P1-24	Position command filter type	5.3.4
	P1-25	Position command filter time constant	
Pulse offset clear	P5-34	Pulse offset clear /CLR	5.3.5
Positioning completion	P5-00	Positioning completion width	5.3.6
	P5-01	Positioning completion detection mode	
	P5-02	Positioning completion hold time	
	P5-37	/COIN-HD Positioning completion hold	
	P5-38	/COIN Positioning completion signal output	
Positioning near	P5-46	Positioning near output /NEAR	5.3.7
	P5-06	Positioning near output signal width	
Pulse prohibition	P5-32	Instruction pulse prohibition /INHIBIT	5.3.8
Pulse offset limit	P0-23	Pulse offset limit	5.3.9

5.3.1 Control mode selection

Paramter	Setting value	Meaning	Change	Effective
P0-01	6	Control the position by external pulse instructions	Servo OFF	At once

5.3.2 Forward direction of pulse instruction and pulse form

1. set the forward direction of pulse instruction

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

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

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-09.3 n.□xxx	Predistribution of input pulse command filter	1	-	0~7	Servo OFF	Re-power on
P0-09.3 setting value is n (range is 0~7), the received pulse number is 2^{-n} of normal one. The received frequency is 2^{-n} of original one. For example, pulse number per rotation is 10000, sending frequency is 10KHz, pulse number is 10000, when P0-09=1000, then U0-12=5000, U0-00 is 2^{-n} of original one.							

2. set the pulse instruction form

Parameter	Meaning	setting	Meaning	Change	Effective
P0-10 n.xxx0	Pulse instruction form	0	CW, CCW mode	Servo OFF	At once
		1	AB phase		
		2	Pulse+direction(default)		

3. Details of pulse instruction

P0-10xxx□	Forward rotation	Reverse rotation
0：CW/CCW	CCW ⎤ OFF CW ⎡⎤⎡⎤	CCW ⎡⎤⎡⎤ CW ⎤ OFF

1：AB	Phase A _90°_ Phase B	Phase A _90°_ Phase B
2：P+D	pulse direction ON	pulse direction OFF
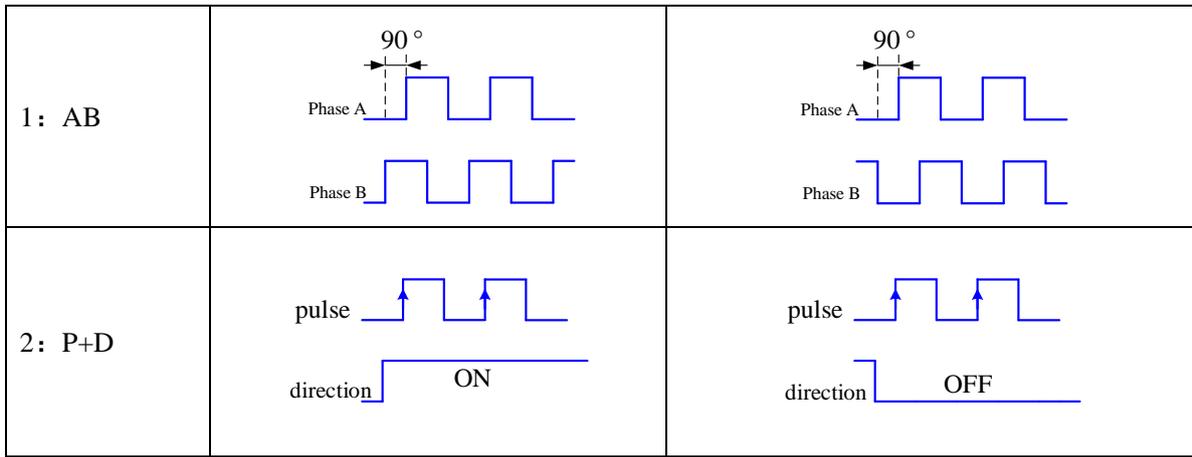
4. Pulse specification

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

5.3.3 Electronic gear ratio

Parameter	Meaning	Default setting	Unit	Range	Change	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	Servo OFF	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	-	1～65535	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	-	1～65535	Servo OFF	At once

Note: 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. 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.

The "electronic gear" function has two main applications: one is to adjust the number of command pulses required by the motor to rotate one turn to ensure that the motor speed can meet the required speed. For example, the maximum pulse frequency of the upper computer PLC is 200 KHz. If the electronic gear ratio is not modified, the motor needs 10,000 pulses to rotate one circle, then the maximum speed of the motor is 1200 rpm. If the ratio of the electronic gear is 131072:5000, or the number of pulses per revolution is 5000, then the motor can reach 2400 rpm speed.

Take 17-bit encoder motor as an example: the ratio of electronic gears is 131072:10000 or the number of pulses per revolution is 10000, and the highest frequency of pulse transmitted by PLC is 200 KHz.

Two circle radius ratio: 2:1
Big circle run one rotation (need 20000 pulses), small circle run two rotations.

Max speed 600rpm
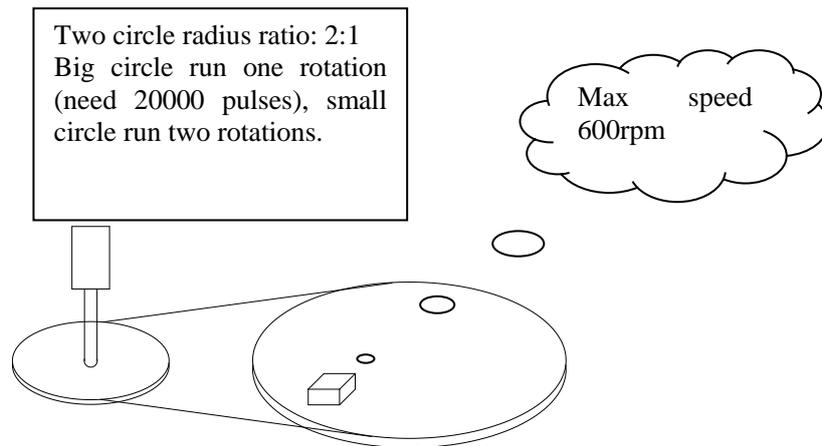
Electronic gear ratio is 131072:5000 or pulses per rotation is 5000, PLC max output pulse frequency is 200KHz.

Two circle radius ratio: 2:1
Big circle run one rotation (need 10000 pulses), small circle run two rotations.

Max speed 1200rpm
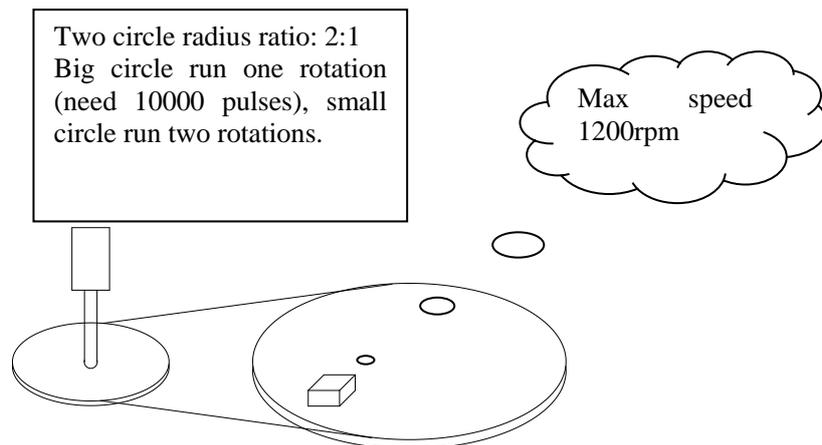
Set the actual length per command pulse for precise positioning. For example: the object moves 1um per command pulse. The command pulses of load rotating one circle = 6mm / 1um = 6000. In the case of deceleration ratio is 1:1, set pulse per rotation P0-11=6000, P0-12=0. Then if the PLC outputs 6000 pulses, the object will move 6mm.
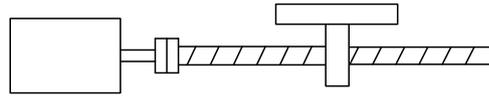
Encoder: 131072（17-bit）　ball screw pitch: 6mm

Not use electronic gear ratio	Use electronic gear
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.

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

Calculate the electronic gear ratio or pulse numbers per rotation using the following steps:

Steps	Content	Description
1	Confirm the machine specification	Confirm the deceleration ratio, ball screw distance, pulley diameter
2	Confirm the encoder pulse	Confirm the servo motor encoder accuracy
3	Set the command unit	Set the actual distance or angle corresponding to 1 pulse of the controller
4	Calculate the command pulses the load shaft rotates 1 circle	Calculate the command pulses per rotation f based on the command unit
5	Calculate the pulses per rotation (P0-11/P0-12)	For example, the mechanical reduction ratio of motor shaft and load shaft is m/n (servo motor run m circles while load shaft run n circles), P0-11/P0-12=(f×m)/n
6	Calculate the electronic gear ratio (P0-13/P0-14)	For example, the mechanical reduction ratio of motor shaft and load shaft is m/n (servo motor run m circles while load shaft run n circles), P0-13=encoder accuracy×m P0-14=f×n

Note:

1) The number of pulses per rotation and the ratio of electronic gears can limit the amount of instructions required for the servo motor to rotate one turn. They are complementary, but the priority of the number of pulses per turn is higher than the ratio of electronic gears. Only when the number of pulses per turn is set to zero, the ratio of electronic gears will take effect. This is what users need to pay attention to. In special cases, if the number of pulses per revolution is decimal, the use of electronic gear ratio should be considered.

2) When P0-13 and P0-14 exceed the set range, please divide the denominator into integers within the set range. The approximate score does not affect the use without changing the ratio. If the parameters are still beyond the range of setting after approximation, please use P0-92~P0-95.

3) The resolution of DS5 series servo motor encoder is 131072 (17 bits) and 8388608 (23 bits). According to the use of motor.

4) The instruction unit does not represent the processing accuracy. The precision of servo positioning can be improved by refining the instruction unit on the basis of mechanical accuracy. For example, in the application of the screw, the accuracy of the machine can reach 0.01mm, so the 0.01mm instruction unit equivalent is more accurate than the 0.1mm instruction unit equivalent.

2. Example of setting the electronic gear ratio

Step	Ball screw	Round table	Belt + pulley
	Load shaft ↔P P: pitch $1\text{rotate} = \dfrac{P}{\text{command unit}}$	Load shaft $1\text{ rotate} = \dfrac{360°}{\text{command unit}}$	πD Load shaft D: pulley diameter $1\text{rotate} = \dfrac{πD}{\text{command unit}}$
1	Ball screw pitch: 6mm Machine deceleration ratio: 1/1	1-circle rotate angle: 360° Deceleration ratio: 3/1	Pulley diameter: 100mm Deceleration ratio: 2/1
2	Encoder resolution 131072	Encoder resolution 131072	Encoder resolution 131072
3	1 command unit: 0.001mm	1 command unit: 0.1°	1 command unit: 0.02mm
4	6mm/0.001mm =6000	360/0.1=3600	314mm/0.02mm =15700
5	P0-11=6000 P0-12=0	P0-11=3600 ×1/3=1200 P0-12=0	P0-11=15700 ×1/2=7850 P0-12=0
6	B/A=131072/6000	B/A=131072/1200	B/A=131072/7850
7	P0-13=131072 P0-14=6000 Reduction of the fraction P0-13=8192 P0-14=375	P0-13=131072 P0-14=1200 Reduction of the fraction P0-13=8192 P0-14=75	P0-13=131072 P0-14=7850 Reduction of the fraction P0-92/93=65536 P0-94/95=3925 Here using group 2 electronic gear ratio
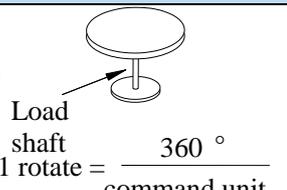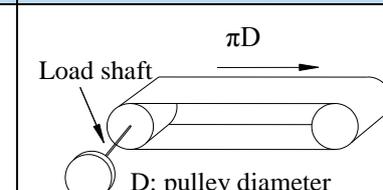
5.3.4 Position command filter

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P1-24	First-order low-pass filtering time of position instruction	0	0.1ms	0～65535	Servo OFF	At once
P1-25	Position instruction smoothing filtering time	0	0.1ms	0～65535	Servo OFF	At once

When set to 0, the filter becomes invalid.

First-order low-pass filter of position instruction	Position instruction smoothing filter
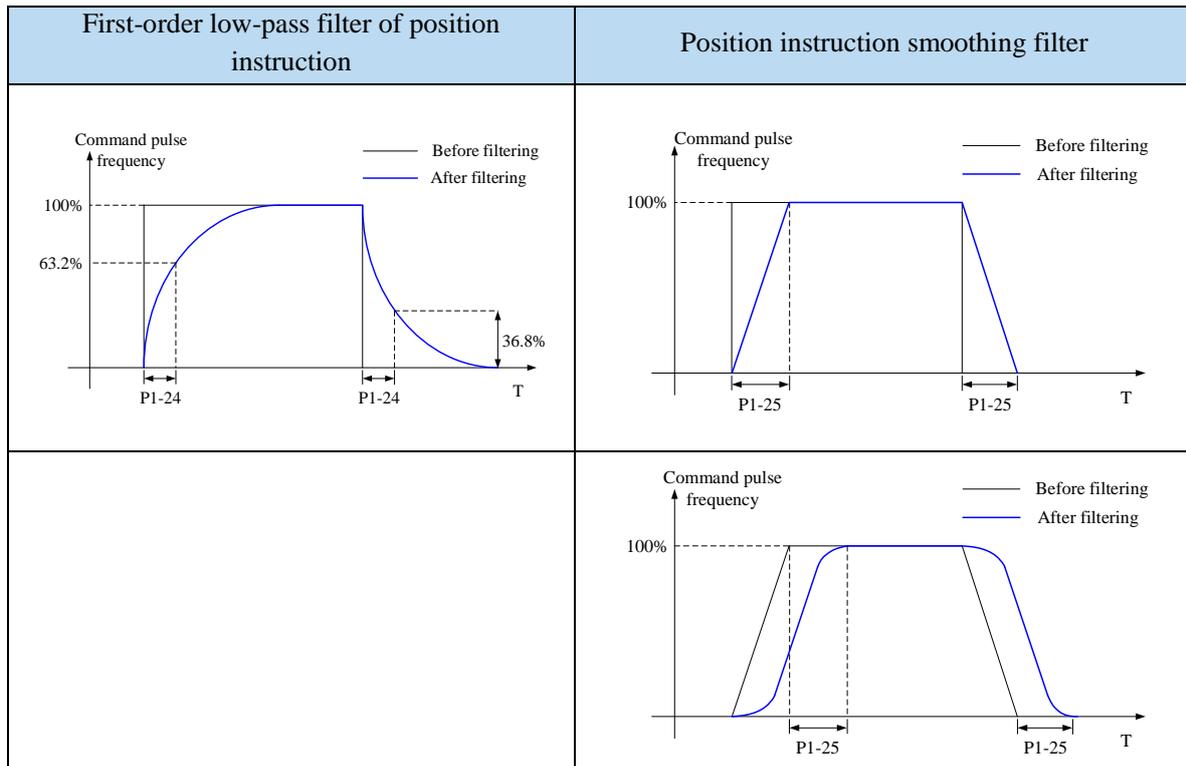
5.3.5 Pulse offset clear（/CLR）

Pulse deviation value refers to the difference between the command pulse of the command controller (such as PLC) and the feedback pulse of the servo unit in the position mode. Its unit is 1 command unit, which is related to the command unit determined by the electronic gear ratio.

Parameter	Signal name	Setting	Meaning	Range
P5-34	Pulse offset clear /CLR	n.0000 (default)	Default unallocated input terminal	The range of parameters is 0001-0014. can be assigned to other input terminals through P5-34.
		n.0002	Use SI2 input signal	

5.3.6 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.

Parameter	Signal name	Setting	Meaning	Range
P5-37	Positioning completion hold /COIN-HD	n.0000 (default)	Default unallocated output terminal	The range of parameters is 0001-0014. can be assigned to other output terminals through P5-37.
		n.0002	Use SO2 output signal	
When the COIN signal keeps P5-02 time, the COIN-HD signal is output.				

Parameter	Signal name	Setting	Meaning	Range
P5-38	Positioning completion output /COIN	n.0001 (default)	When the servo positioning is completed, SO1 and COM are connected, and the positioning signal is output.	The range of parameters is 0001-0014. can be assigned to other output terminals through P5-38.
		n.0011	When the servo positioning is completed, the SO1 and COM are switched off	

Parameter	Meaning	Default setting	Unit	Range	Change	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

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.	/S-ON Signal status — ON | U0-08 | Pulse offset — P5-00 | ΔU0-12 | Pulse command /COIN Signal status — ON / OFF / ON
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.	/S-ON Signal status — ON | U0-08 | Pulse offset — P5-00 | ΔU0-12 | Pulse command | U0-00 | Actual speed — P5-03 /COIN Signal status — ON / OFF / ON
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.	/S-ON Signal status — ON | U0-08 | Pulse offset — P5-00 | ΔU0-12 | Pulse command — P5-02 /COIN Signal status — ON / OFF / ON — P5-02 /COIN-HOLD Signal status — OFF / ON

5.3.7 Positioning near signal（/NEAR）

Parameter	Signal name	Setting	Meaning	Range
P5-46	Positioning near /NEAR	n.0000 (default)	Default unallocated output terminal	The range of parameters is 0001-0014. can be assigned to other output terminals through P5-46.
		n.0002	Output signal from SO2 terminal	

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

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

When the pulse deviation of the servo driver is lower than the set value of this parameter, the positioning near signal (/NEAR) is output. Please set this parameter to be larger than the width of the positioning completion. The pulse deviation can be monitored by parameter U0-08.
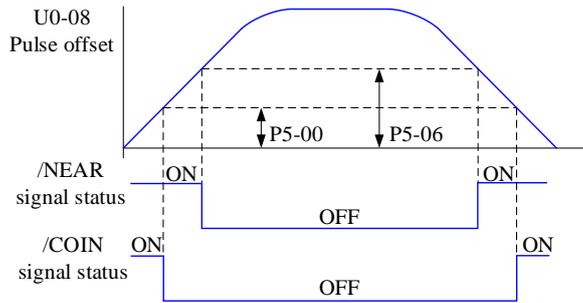
5.3.8 Instruction pulse prohibition（/INHIBIT）

Parameter	Signal name	Setting	Meaning	Change
P5-32	Instruction pulse prohibition /INHIBIT	n.0000 (default)	Default unallocated input terminal	The range of parameters is 0001-0014.
		n.0002	input signal from SI2 terminal	can be assigned to other input terminals through P5-32.

Represents the function of stopping instruction pulse input in position control. When the / INHIBIT signal is ON, the pulse instruction is no longer counted.

5.3.9 Position pulse deviation setting

In position control, when the deviation pulse exceeds a certain limit, an alarm will occur. This threshold is the deviation pulse limit.

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P0-23	Pulse deviation limit	2000	0.01 rotation	0～65535	Anytime	At once

When the deviation pulse limit is 0, the deviation pulse will not be detected.
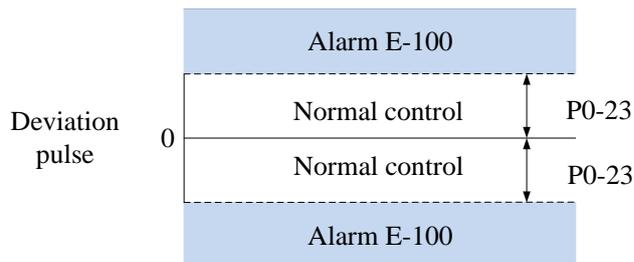
5.4 Position control (internal instruction)

Basic parameter		
User parameter	Name	Reference
P0-01	control mode selection	5.4.1
P4-03	Internal position mode	5.4.2
P4-10～P4-254	Internal position 1 to 35 parameters	5.4.3
P5-35	Change step signal /CHGSTP	5.4.4
P5-32	Pause present segment signal /INHIBIT	5.4.5
P5-31	Jump present segment signal /Z-CLAMP	5.4.6
P5-20	Servo ON signal /S-ON	5.2.1
P4-04	Effective segment numbers	5.4.3

Other optional parameters			
Key words	User parameters	Name	Reference
Find origin point	P4-00	Number of Z-phase signal after leaving limit switch	5.4.7
	P4-01	Speed of hitting the proximity switch	
	P4-02	Speed of leaving proximity switch	
	P5-27	/SPD-D: define the origin in position mode	
	P5-28	/SPD-A: find reference origin on forward side in position mode	
	P5-29	/SPD-B: find reference origin on reverse side in position mode	
Pulse offset clear	P5-34	pulse offset clear	5.3.5
Positioning completion	P5-38	Positioning completion signal output /COIN	5.3.6
	P5-00	positioning completion width	
Positioning near	P5-46	Positioning near signal output /NEAR	5.3.7
	P5-06	positioning near signal width	
Set segment number through communication	F2-09	35 segments position setting	5.4.8

5.4.1 Control mode selection

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

5.4.2 Internal position mode

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

			setting	
	n.□xxx	No meaning		
	n.x□xx	Waiting mode	0	0～1
	n.xx□x	Change step mode	0	0～4
	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.
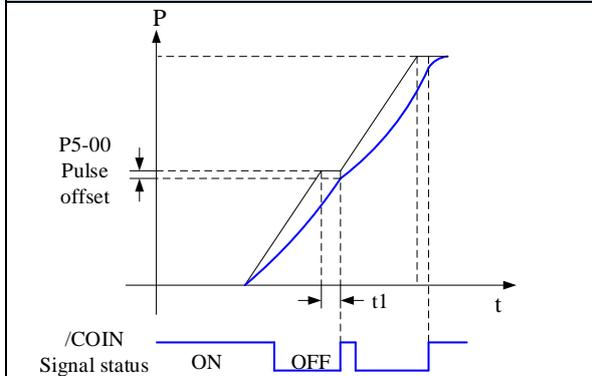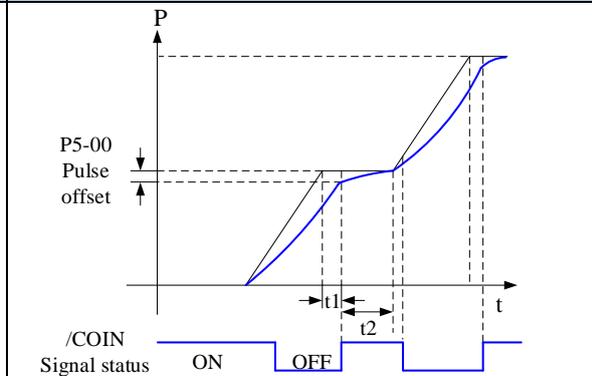
Wait mode = 1, adjust time = 0ms	Wait mode = 1, adjust time > 0ms
After the drive output 1-segment position command, it will not wait for the completion of motor positioning, and start the next position command at once.	After the drive output 1-segment position command, it will not wait for the completion of motor positioning, but pass the adjust time, and then start the next position command. T2 is adjust time. Refer to parameter P4-11.
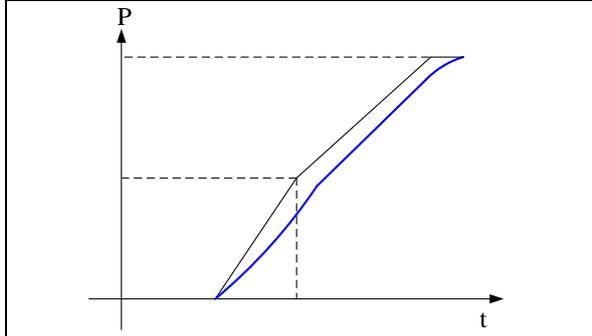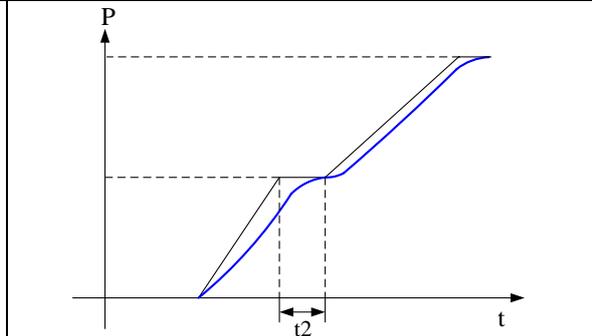
2. change step mode

n.xx□x	Description	
0: Change the step when signal is ON, recycling		t1=P4-11, t2=P4-21 1. If /CHGSTP is ON, servo will run segment 1 and 2. 2. If /CHGSTP is OFF in one segment, servo will finish this segment and stop running the next segment.
1: Change the step at the rising edge of the signal, single-step run		Suppose there are 2 segments. t1=P4-11 In this mode, the adjust time is ineffective. The servo will run the next command once the current pulse is finished and the new command is coming.
2: Start at the rising edge of the signal, sequential run all, not recycling		Suppose there are 2 segments. t1=P4-11 /CHGSTP signal is ineffective when one cycle has not been finished, such as the second /CHNGSTP signal in the diagram.
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 chapter 5.4.8.	
4: /CHSTP double edge triggering		/CHSTP rising edge triggers the first segment, the falling edge triggers the second segment.
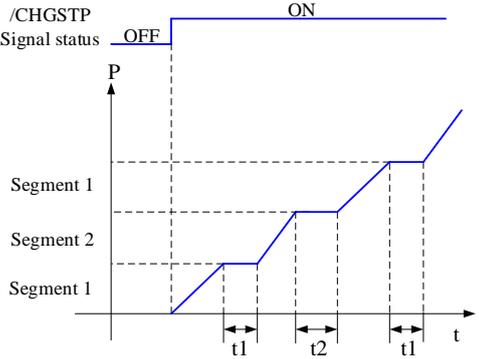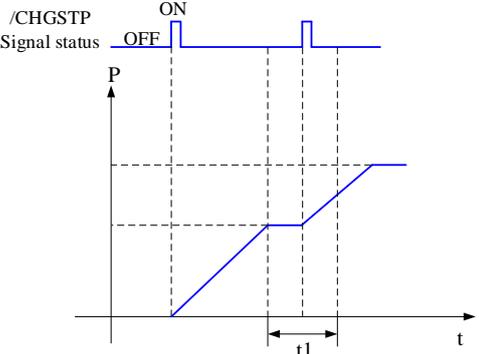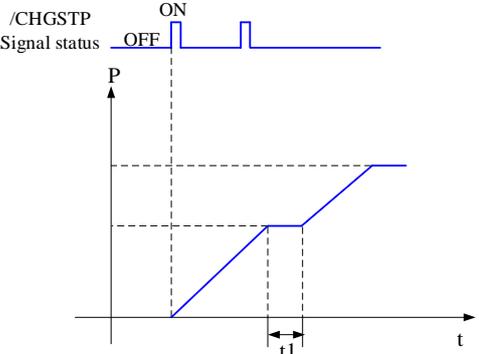
n.xx□x	Description
5: /PREFA(P5-57) /PREFB(P5-58) /PREFC(P5-59) Choose the segment through terminal, the range is segment 1~3	<table><tr><td>/PREFC</td><td>/PREFB</td><td>/PREFA</td><td>Segment number</td></tr><tr><td>0</td><td>0</td><td>0</td><td>-</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1 (segment 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>
6: /PREFA(P5-57) /PREFB(P5-58) /PREFC(P5-59) Choose the segment through terminal, the range is segment 1~8. Hardware version 3730 and higher can support this mode.	<table><tr><td>/PREFC</td><td>/PREFB</td><td>/PREFA</td><td>Segment no.</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1 (segment 1 position)</td></tr><tr><td>0</td><td>0</td><td>1</td><td>2 (segment 2 position)</td></tr><tr><td>0</td><td>1</td><td>0</td><td>3 (segment 3 position)</td></tr><tr><td>0</td><td>1</td><td>1</td><td>4 (segment 4 position)</td></tr><tr><td>1</td><td>0</td><td>0</td><td>5 (segment 5 position)</td></tr><tr><td>1</td><td>0</td><td>1</td><td>6 (segment 6 position)</td></tr><tr><td>1</td><td>1</td><td>0</td><td>7 (segment 7 position)</td></tr><tr><td>1</td><td>1</td><td>1</td><td>8 (segment 8 position)</td></tr></table> Note: P5-35 change step signal rising edge will trigger each segment of position (rising edge is not effective when running).

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

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	Any	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		

3. Positioning mode

n.xxx□	Meaning
0	Relative positioning
1	Absolute positioning
0: relative positioning	1: absolute positioning (take the reference origin as the absolute positioning origin)

5.4.3 Position segment 1 to 35 parameter settings

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P4-10+（n-1）*7	Pulse number (low bit)	0	1 pulse	-9999～9999	Servo OFF	At once
P4-11+（n-1）*7	Pulse number (high bit)	0	10000 pulses	-32767～32767	Servo OFF	At once
P4-12+（n-1）*7	Speed	0	0.1rpm	0～65535	Servo OFF	At once
P4-13+（n-1）*7	Trapezoid acceleration time	0	ms	0～65535	Servo OFF	At once
P4-14+（n-1）*7	Trapezoid deceleration time	0	ms	0～65535	Servo OFF	At once
P4-15+（n-1）*7	Reserved	-				
P4-16+（n-1）*7	Adjust time	0	ms	0～65535	Servo OFF	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. If one of the segment speed is zero, servo will skip this segment and run the next segment.
4. 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.
5. 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.
6. In absolute positioning mode, if 2 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.

The internal position has 35 segments. P4-04 can set the effective segment. For example, P4-04 set to 5 means segment 1~5 are effective.

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

5.4.4 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 chapter 5.4.2.	Range: 0000-0014. Distribute to input terminal through P5-35. When it set to 0001, it means input from SI1.

5.4.5 Pause the present segment signal（/INHIBIT）

Parameter	Signal name	Setting	Meaning	Range
P5-32	Pause the present segment /INHIBIT	n.0000	Defaulted is not distribute to input terminal. Stop the pulse input in position control mode. When /INHIBIT is ON, stop counting the pulses.	Range: 0000-0014. Distribute to input terminal through P5-32. When it set to 0001, it means input from SI1.

5.4.6 Skip the 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: 0000-0014. Distribute to input terminal through P5-31. When it set to 0001, it means input from SI1.

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

Change step mode P4-03 n.xx□x	Skip the present segment	Actions
0	/Z-CLAMP	Cancel current segment, execute the next segment at once
1		Cancel current segment, execute the next segment when the change step signal is ON
2		Cancel current segment, execute the next segment at once
3		Cancel current segment, set the F2-09 again

5.4.7 Reference origin

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

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P4-00 n.xx□x	Origin function	0	-	0～1	Servo OFF	At once
Note: This function is applicable to position mode 5 and 6; when this parameter is set to 0, the function of Origin-finding is invalid; when it is set to n.001x, the function of Origin-finding can be used.						

Signal setting

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

Related parameter setting:

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

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

Find reference origin diagram:
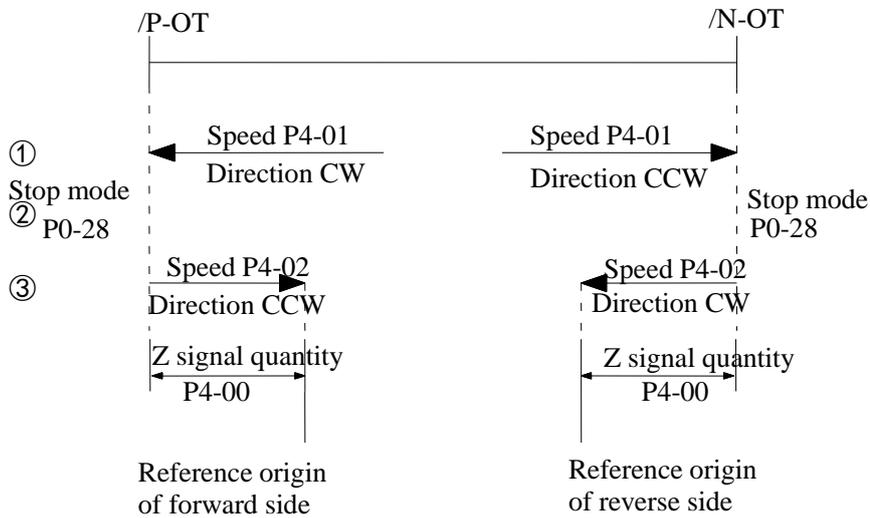
Sequential diagram of finding reference origin on forward side:
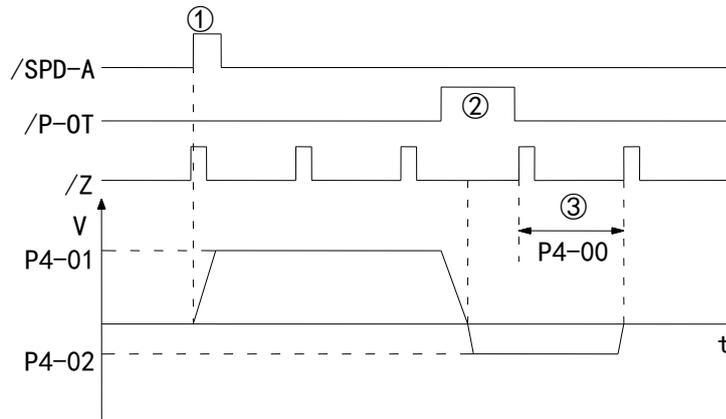
Steps:

(1). Install limit switch at forward and reverse side. At the rising edge of /SPD-A, motor runs forward at the speed of P4-01 to find the reference origin on forward side.

(2). After the working table hit the limit switch, the motor stop as the mode set by parameter P0-28

(3). Motor leaves the limit switch at the speed of P4-02. After the working table left the limit switch, the motor run at the Z phase signal position of No.n optical encoder. This position is considered as the coordinates origin, n is decided by parameter P4-00.

5.4.8 Set the segment number through communication

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
F2-09	Set the segment number through communication	0	-	0～35	Anytime	At once
This parameter is set to certain segment, it will execute this segment. No need step change signal. This parameter can be changed through communication. For example: execute segment 2. Set F2-09=0, then set F2-09=02.						

5.4.9 Motion start signal（/MRUN）

Parameter	Meaning	Default setting	Meaning	Change
P5-50	Motion start /MRUN	n.0000	Defaulted is not distribute to output terminal. It is only valid in internal position mode, similar to positioning complete signal in external pulse mode. It will output when the motor is running, and will not output when the motor stop.	Range 0000-0014, it can be distributed to output terminal by P5-50. When it is set to 0001, means output signal from SO1.

5.5 Speed control (analog voltage command) (not support)

5.6 Speed control (internal speed)

Basic parameter			
Parameter	Name		Reference
P0-01	Control mode selection		5.6.1
P5-20	Servo ON signal /S-ON		5.2.1
P3-05	Internal speed 1		
P3-06	Internal speed 2		5.6.2
P3-07	Internal speed 3		
P5-27	/SPD-D internal speed direction selection		
P5-28	/SPD-A internal speed selection		5.6.4
P5-29	/SPD-B internal speed selection		

Other parameters			
Key word	Parameter	Name	Reference
Proportion action	P5-21	Proportion action command /P-CON	5.6.12
Zero clamp	P5-31	Zero clamp /ZCLAMP	
	P3-12	Zero clamp mode	5.6.6
	P3-13	Zero clamp speed	
Same Speed checking	P5-39	/V-CMP speed coincidence checking	5.6.8
	P5-04	speed coincidence checking signal width /V-CMP	
Torque limit	P3-28	Internal forward torque limit	
	P3-29	Internal reverse torque limit	
	P3-30	Forward external torque limit	
	P3-31	Reverse external torque limit	5.6.7
	P5-25	Forward external torque limit /P-CL	
	P5-26	Reverse external torque limit /N-CL	
	P5-42	Torque up to limit value output /CLT	
Soft start	P3-09	soft start acceleration time	5.6.3
	P3-10	soft start deceleration time	
Filter	P1-22	Position command filter mode	5.6.11
	P1-23	Speed command filter time	
	P5-51	Speed reach output /V-RDY	5.6.9
	P5-05	Reach detection speed	

5.6.1 Control mode selection

Parameter	Set value	Meaning	Modify	Effective
P0-01	3	Speed control: internal speed selection	Servo OFF	Immediately

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.

Servo unit

Input
/SPD-D
/SPD-A
/SPD-B

Speed selection

| SPEED1 P3-05 |
| SPEED2 P3-06 |
| SPEED3 P3-07 |

M

Servo motor

No need external speed or pulse generator

User parameter

Run the motor at set speed

5.6.2 Internal speed setting

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

5.6.3 Soft start

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

Rated speed
Target speed
Speed up time
P3-09
Speed down time
P3-10
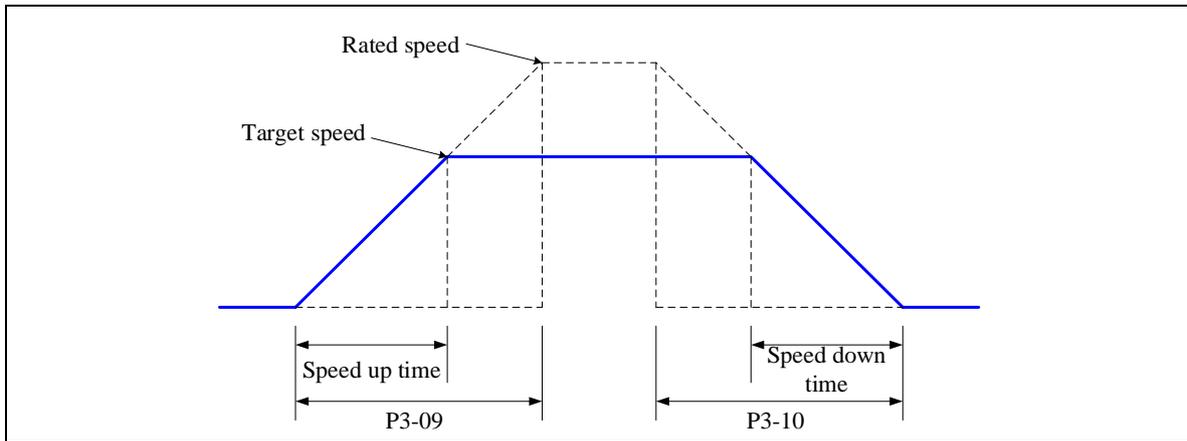
5.6.4 Input signal setting

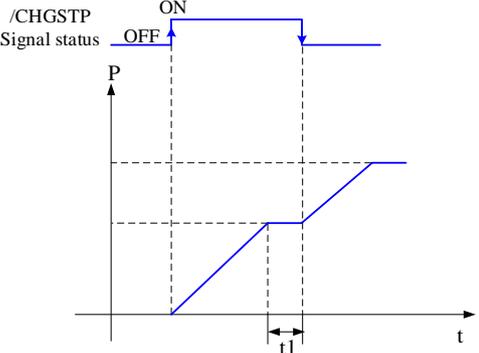| Parameter	Signal	Default setting	Range	Modify	Effective
P5-27	Internal direction /SPD-D	n.0000	Range: 0000-0014. Distribute to input terminal through P5-27.	Anytime	At once
P5-28	Internal speed /SPD-A	n.0000	Range: 0000-0014. Distribute to input terminal through P5-28.		
P5-29	Internal speed /SPD-B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

(1) Function realization

Input signal			Running speed
SPD-D（P5-27）	SPD-A（P5-28）	SPD-B（P5-29）	
0: forward run	0	0	Internal speed is zero
	0	1	P3-05：SPEED1
	1	1	P3-06：SPEED2
	1	0	P3-07：SPEED3
1: reverse run	0	0	Internal speed is zero
	0	1	P3-05：SPEED1
	1	1	P3-06：SPEED2
	1	0	P3-07：SPEED3

Note: The values of SPD-A and SPD-B are 1, indicating that the input level of SI terminal is valid, and 0 is invalid.

(2) Running example
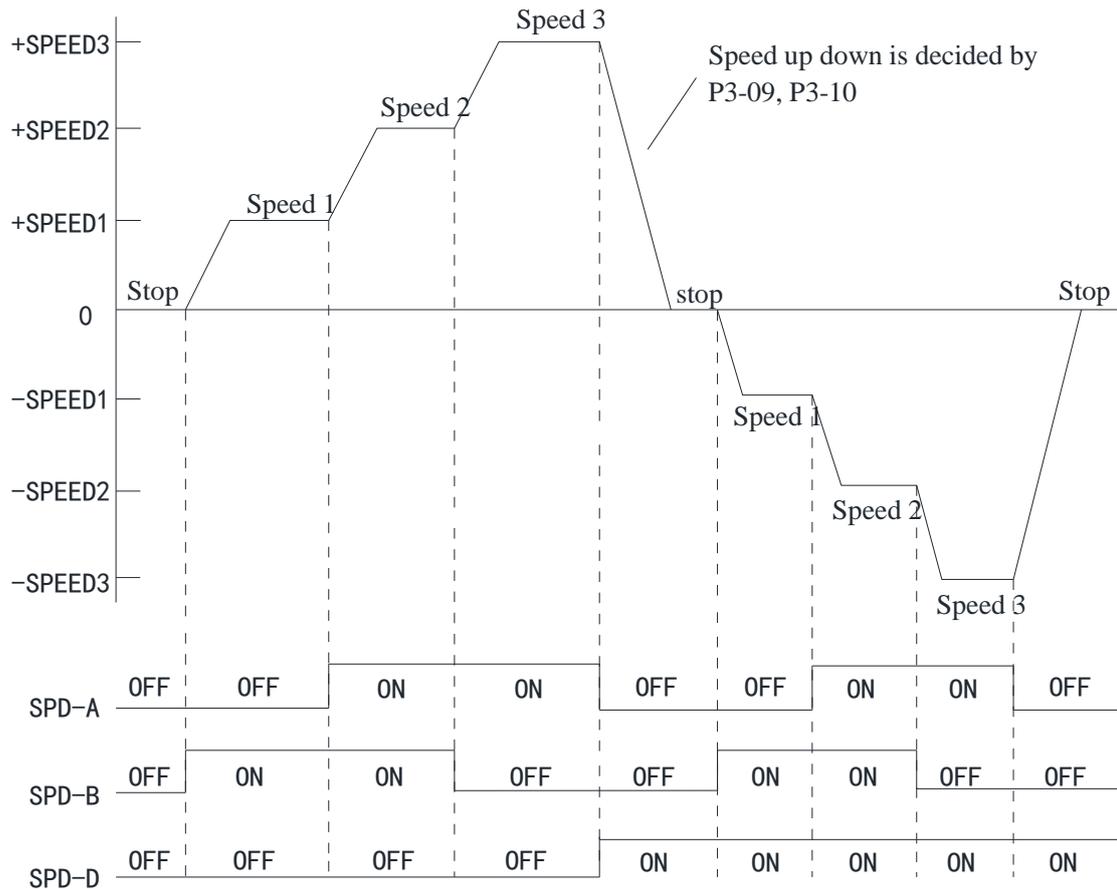
5.6.5 Speed command limit

Parameter	Meaning	Default setting	Unit	Range	Change	Effective
P3-14	Forward max speed command limit	4000	rpm	0～65535	Servo OFF	At once
P3-15	Reverse max speed command limit	4000	rpm	0～65535	Servo OFF	At once
Note: P3-14 and P3-15 are effective in all the modes.						

5.6.6 Zero clamp（/ZCLAMP）

(1) Function

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

(3) Parameter setting

parameter	Meaning	Default setting	Unit	Range	Change	Effective
P3-13	Zero clamp speed	10	rpm	0～300	Servo OFF	At once
P3-12	Zero clamp mode	0	-	0～3	Servo OFF	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.

5.6.7 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.						

3. 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

4. Relationship

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

P-CL/N-CL	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

5. 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.

5.6.8 Same speed detection（/V-CMP）

Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	Effective
P5-39	/V-CMP	n.0000	3, 4, 7	Same speed detection	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

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

5.6.9 Speed reach signal（/V-RDY）

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

By default, no terminal is allocated, the parameter range is 0000-0014, which is allocated to the output interface through parameter P5-29. When set to 0002, the signal is output from the SO2 terminal.

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

5.6.10 Alarm speed

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P3-21	Forward alarm speed	4000	rpm	0～65535	Servo OFF	At once
P3-22	Reverse alarm speed	4000	rpm	0～65535	Servo OFF	At once

Note:
1. the parameters P3-21 and P3-22 are effective in all the modes.
2. the default value is 120% of rated speed. for example: rated speed is 1500, max speed is 1800; rated speed is 3000, max speed is 3600.
3. these parameters are related to E-080. When the motor is out of control or the speed keeps rising caused by external force and over the alarm speed, servo will show E-080 alarm.

5.6.11 Filter

Parameter	Meaning	Default setting	Unit	Range	Modify	Effective
P1-22	Speed command filter selection	0	-	0～1	Servo OFF	At once
P1-23	Speed command filter time	0	0.1ms	0～65535	Servo OFF	At once

P1-22	Contents
0	First-order Inertial Filter
1	Smooth filter

5.6.12 Proportion action command (/P-CON)

Parameter	Signal	Type	Default	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. /P-CON signal can be distributed to input terminal via parameter P5-21.

5.7 Speed control (pulse frequency command)

Basic parameter		
Parameter	Name	Reference
P0-01	Control mode selection	5.7.1
P5-20	Servo ON signal /S-ON	5.2.1
P0-10	Pulse command form	5.3.2
P0-15	Command pulse frequency at rated speed	5.7.2
P0-16	Speed command pulse filter time	5.7.4

Other parameters			
Key word	Parameter	Name	Reference
Proportion action	P5-21	Proportion action command /P-CON	5.6.12
Zero clamp	P5-31	Zero clamp /ZCLAMP	5.6.6
	P3-12	Zero clamp mode	
	P3-13	Zero clamp speed	
Same speed detection	P5-39	/V-CMP speed coincidence checking	5.6.8
	P5-04	speed coincidence checking signal width /V-CMP	
Torque limit	P3-28	Internal forward torque limit	5.6.7
	P3-29	Internal reverse torque limit	
	P3-23	T-REF distribution	
	P3-30	Forward external torque limit	
	P3-31	Reverse external torque limit	
	P5-25	Forward external torque limit /P-CL	
	P5-26	Reverse external torque limit /N-CL	
	P5-42	Torque up to limit value output /CLT	
Speed reach detection	P5-51	Speed reach output /V-RDY	5.6.9
	P5-05	Reach detection speed	

5.7.1 Control mode selection

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

5.7.2 Pulse frequency command

Pulse frequency command is the same as external pulse command position control, refer to chapter 5-3-2.

5.7.3 Command pulse frequency at rated speed

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

5.7.4 Speed command pulse filter time

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

5.8 Torque control (analog voltage command) (not support)

5.9 Torque control (internal setting)

Basic parameter		
Parameter	Name	Reference
P0-01	Control mode selection	5.9.1
P5-20	Servo ON signal /S-ON	5.2.1
P3-33	Internal torque command	5.9.2

Other parameters			
Key words	Parameter	Name	Reference
Speed limit	P3-16	Internal forward speed limit of torque control	5.9.3
	P3-17	Internal reverse speed limit of torque control	
	P3-14	Forward max speed limit	5.6.5
	P3-15	Reverse max speed limit	
	P5-43	Speed up to limit value output /VLT	5.9.4
/SPD-D direction selection	P5-27	Speed direction change	5.6.4

5.9.1 Control mode selection

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

5.9.2 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.						

5.9.3 Internal speed limit for 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 only the MAX speed. (The maximum speed is the smaller value in P3-14/P3-15 and P3-16/P3-17)

5.9.4 Speed up to limit value output

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

5.10 Motion bus control

Characteristics of Motion Bus

Motion control is the real-time control and management of the position and speed of mechanical moving parts, so that they can move according to the expected trajectory and the specified motion parameters. It used XINJE industrial bus communication protocol, support all the products of XINJE.

XDC series PLC which adopts bus motion control mode replaces the traditional pulse transmission mode. It uses bus communication and 3M communication baud rate. The system has faster speed, simple wiring and sharing wiring.

Bus parameters						
parameter	Function	Range	Set value	Default value	Modify	Effective
P0-01	Control mode	1: torque (command) 2: torque (analog)(not support) 3: speed (terminal command) 4: speed (analog)(not support) 5: position (internal) 6: position (pulse) 7: speed (pulse) 8: fieldbus torque mode 10: fieldbus position mode	10	6	Servo OFF	At once
P0-03	Enable mode	1: IO enable 2: software enable 3: fieldbus enable	3	1	Servo OFF	At once
P7-00	RS485 station no.	1~20	-	1	Servo OFF	At once
P7-01	RS485 serial port	n.xx□□	Baud rate: 06：19200 07：38400 08：57600 09：115200 0A：192000 0B：256000 0C：288000 0D：384000 0E：512000 0F：576000 10：768000 11：1M	2213	2206	Servo OFF	At once

			12：2M 13：3M 14：4M 15：5M 16：6M				
		n.x□xx	Stop bit: 0: 2 bits 2: 1 bit				
		n.□xxx	Parity bit 0: no parity 1: odd parity 2: even parity				
P7-02	RS485 communication protocol	1：Modbus 2：XNet		2	1	Servo OFF	At once
P7-05	Slave station quantity	1~256		-	10		
P7-06	Repeat times	1~500		-	3		

Monitoring parameters

Parameter	Explanation	Mark
U0-61	Communication error times	
U0-62	Synchronization frame receive error times (overtime or data error)	
U0-64	Data frame receive error times (overtime or data error)	
U0-66	CRC error times	
U0-67	UART error times	UART module error reasons: 1. RS485 noise is too large 2. CPU hasn't read offset register data in time caused the data damaged.
U0-68	Communication overtime times	If the servo continuous communication error period ≥P7-06, U0-68 +1, servo XNet state switches to "initial state", the priority of UART decreases, wait the synchronization frame, servo will not alarm right now.

5.10.1 Bus wiring

XD/XG series bus programmable controller can also be called bus multi-axis motion controller. Fieldbus technology is used to communicate between bus-type multi-axis motion controller and servo driver, so it has the advantages of high performance, high reliability, simple maintenance and saving wiring (wiring sharing).

Servo control system bus connection of X-NET motion bus: XDC/XDE inserts RS485 extended BD board XD-NE-BD into the BD card slot located on the front of the PLC (double BD board extension port type selects left port). There are four terminals on the BD board, from left to right: A, B, SG (signal ground) and FG (shielding ground).

The communication ports A and B of BD board are connected to A1 and B1 terminals of JA-NE-L module of DS3E series servo driver. SG signal is connected to SG terminal of JA-NE-L module. The nine-pin port of the JA-NE-L module is inserted into the nine-pin port of the CN1 port of the servo driver.

Servo Control System Bus Connection of X-NET Motion Bus: XG1

XG1 must use serial port 2 to communicate with the servo. The serial port 2 terminals are SG, B and A from top to bottom respectively. Communication terminal A and B are connected to A1, B1 terminals of JA-NE-L module of DS3E series servo driver, A1 and A2 of JA-NE-L module are

short-connected, B1 and B2 are short-connected. SG signal is connected to SG terminal of JA-NE-L module. The nine-pin port of the JA-NE-L module is inserted into the nine-pin CN1 port of the servo driver.

If a PLC is used to control multiple servos, the BD board and JA-NE-L board of the PLC are equipped with terminal resistance. If the PLC is connected with multiple servos, in order to form a closed loop and reduce interference, the terminal resistance of the BD board of the PLC and the last JA-NE-L board of the electrical connection should be ON, and the terminal resistance of the middle JA-NE-L board should be OFF.

5.10.2 Motion parameters

Address	Definition	Type	Unit	Default value	Note
SM2010+20*(N-1)	Servo enable	16-bit integer		0	ON: servo enable OFF: servo not enable
SM2013+20*(N-1)	Clear servo alarm				System will automatical reset after enable
SD2008+60*(N-1)	Present position	32-bit integer		Pulse numbers	Absolute position, converted by the number of target position feedback pulses
SD2010+60*(N-1)	Present speed	32-bit integer		Pulse numbers	Calculating by Feedback Value

Public parameters

Address	Definition	Connecting 10 axes (Including less than 10 axes)	Connecting 20 axes (Including more than 10 axes)
SFD2990	Instruction refresh period (unit: us)	3000(default, same to servo parameter P7-07)	6000
SFD2991	Slave station number	10(default)	20
SFD2992	Error retry time	3(default)	3

5.10.3 Bus position mode

Address	Definition	Type	Unit	Default value	Note
SFD3000 +60*(N-1)	Running mode	16-bit integer		0	0: Position control with trajectory planning 1: Real-time position control without trajectory planning (position and speed need to be updated for each motion bus cycle) 2: Real-time speed control (given update speed and torque per bus cycle)
SFD3001 +60*(N-1)	Motor type	16-bit integer		0	0: No configuration 1: Incremental Servo 2: Single-loop absolute value servo

Address	Definition	Type		Initial value	Note
					3: Multi-loop absolute value servo 4: Stepping motor
SFD3002 +60*(N-1)	Encoder ppr /1 rotation	32-bit integer		10000	The feedback counting value of encoder rotating one circle, it can change the encoder ppr through this register.
SFD3004 +60*(N-1)	movement/1 rotation	32-bit integer	Pulse number	10000	The reference equivalent of motion (screw lead), the unit is pulse number, which is the movement quantity. The pulse number motor rotating one circle. The motor will rotate one circle as the pulse number set by this register.
SFD3048 +60*(N-1)	positioning completion width initial value	32-bit integer	Pulse number	10	positioning completion width initial value. PLC has positioning completion signal in this width, no need to wait for the completion of pulse sending.

Note: the details please refer to XNET manual.

5.10.4 Bus torque mode

X-NET bus torque mode is a control system for controlling motor output torque. In practical application, given a value of torque, the value of torque is related to load and speed.

The coils and registers related to torque mode

Address	Definition	Type	Initial value	Setting value	Note
SFD3000 +60*(N-1)	Running mode	16-bit integer	0	3	0: position ontrol with motion planning 3: user-defined motion planning
SFD3029 +60*(N-1)	Upper limit of Position feedback offset	16-bit integer	2500	-1	Positive integer: upper limit of offset -1: ignore the offset

Address	Definition	Type	Unit	Note
SD2006+ 60*(N-1)	Present displacement	32-bit integer	Pulse number	The displacement relative to the last time stop position
SD2008+ 60*(N-1)	Present position	32-bit integer	Pulse number	Absolute position, converted by target position feedback pulse numbers
SD2010+ 60*(N-1)	Present speed	32-bit integer	Pulse number/second	Converted by the feedback value
SD2012+ 60*(N-1)	Instant speed setting		Pulse number/second	Speed setting of single control period
SD2020+ 60*(N-1)	Present torque	Floating number	N.m	Servo P7-02=3, SD2029+60*(N-1) set to 1, SD2020+60*(N-1) shows present torque.

Address	Definition	Type		Note
SD2024+ 60*(N-1)	Torque setting	32-bit integer	1/1000 rated	Effective mode: Servo P0-01=8 (Torque Mode) is always valid. Servo P0-01 = 9 or 10 (speed mode or position mode): SD2028 + 60* (N-1) = 1 is valid.
SD2026+ 60*(N-1)	Reverse torque setting	32-bit integer	1/1000 rated	In speed mode and position mode, it takes effect when SD2028 = 1. At this time, the values of servo P3-28 and P3-29 are invalid. Torque mode is invalid.
SD2028+ 60*(N-1)	torque control mode setting	16-bit integer		Servo P0-01 = 9 or 10 (speed mode or position mode): SD2028 + 60* (N-1) = 1, the values in SD2024 + 60* (N-1), SD2026 + 60* (N-1) are valid, and the values of servo P 3-28, P 3-29 are invalid.
SD2029+ 60*(N-1)	Torque feedback enable bit	16-bit integer		0: invalid 1: SD2020+60*(N-1) shows the present torque(servo P7-02 should set to 3).
SD2032+ 60*(N-1)	Speed control	32-bit integer	Pulse number/second	

Note: the details please refer to XNET manual.

5.10.5 Bus speed mode

The speed mode of X-NET bus is a kind of control system which takes speed as the control target and achieves the action requirement through constant given speed.

Address	Definition	Type	Initial value	Setting value	Note
SFD3000 +60*(N-1)	Running mode	16-bit integer	0	3	0: position ontrol with motion planning
SFD3029 +60*(N-1)	Upper limit of position feedback offset	16-bit integer	2500	-1	Positive integer: upper limit of offset -1: ignore the offset

Address	Definition	Type	Unit	Note
SD2008+ 60*(N-1)	Present position	32-bit integer	Pulse number	Absolute position, converted by target position feedback pulse numbers
SD2010+ 60*(N-1)	Present speed	32-bit integer	Pulse number/second	Converted by the feedback value
SD2012+ 60*(N-1)	Instant speed setting		Pulse number/second	Speed setting of single control period

SD2032+ 60*(N-1)	Speed control	32-bit integer	Pulse number/second	

Note:

(1) Set SFD3029+60*(N-1) to -1, otherwise SD2002+60*(N-1) will report position deviation 20006;

(2) In the speed mode, only the speed curve can be generated by controlling the motor speed with given SD2032+60* (N-1), which is independent of SD2034+60* (N-1) and SD2036+60* (N-1).

(3) the PLC address details please refer to XNET manual.

5.11 Absolute value system

5.11.1 absolute value 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 do not use encoder cable with battery unit, please set P-79 to 1, that is, multi-loop absolute value encoder is used as single-loop 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 single-loop encoder and no longer remember position (use absolute encoder as single-loop encoder without battery)	
		2	Use as absolute encoder, ignore the multi-loop overflow alarm	

5.11.2 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)
        CP-B-BATT
        CPT-B-BATT (Special for Tank Chain)

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;
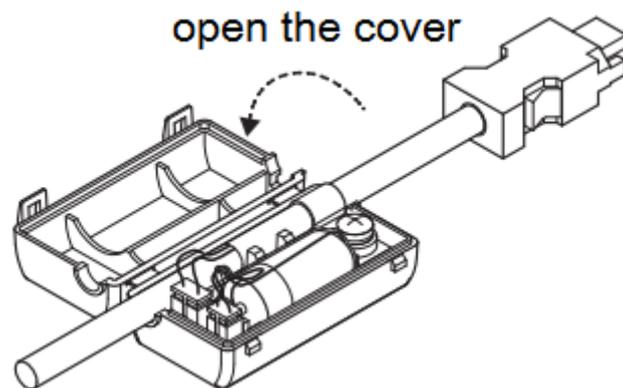
    (3) Take out the old battery, install the new one.
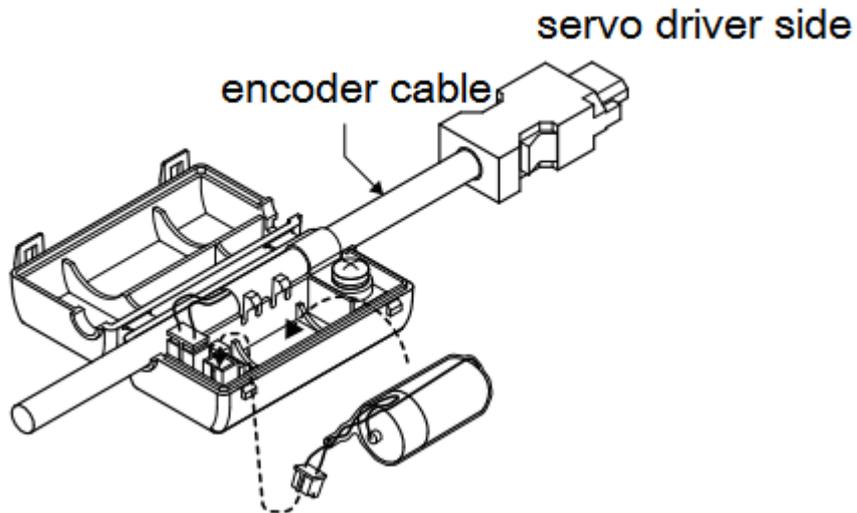
(4) Close the cover of the battery unit
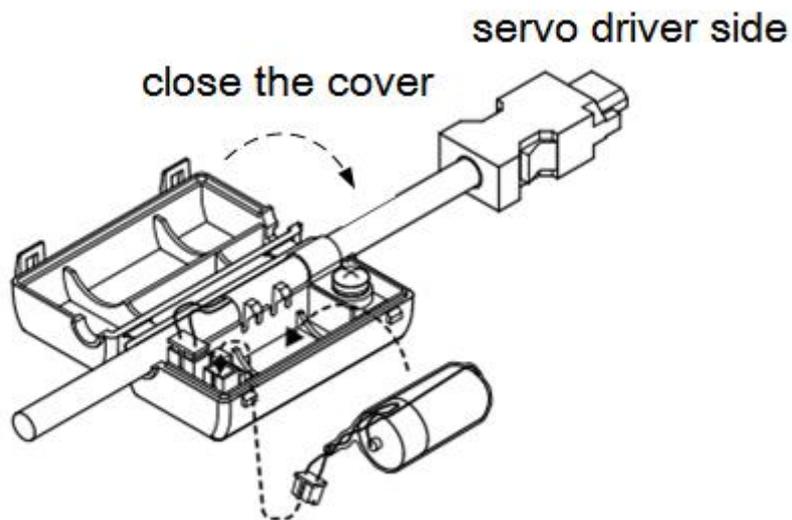
(5) After replacing the battery, in order to remove the "Encoder Battery Alarm (E-222)" display, please restore the factory settings and cut off the power supply of the servo unit;
(6) Connect the power supply of the servo unit again;
(7) Make sure the error display disappears and the servo unit can operate normally.

5.11.3 The upper limit of revolving circles

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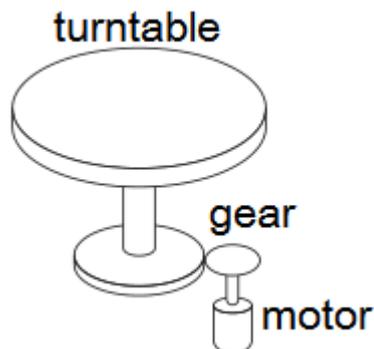
Because it can only rotate in one direction, after a certain period of time, the number of revolving cycles will always exceed the upper limit of absolute value encoder.

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

5.11.4 Read absolute position through communication

Basic parameters		
User parameter	Name	Use
U0-10	encoder feedback value	Absolute value single-turn position, read 0x100A hexadecimal address through Modbus RTU double-word, which is the current encoder single-turn position;
U0-11		
U0-91	present turns of multi-turn absolute	The hexadecimal address of 0x105F is read by Modbus RTU double word, which is the current encoder position.
U0-57	absolute encoder present position feedback low 32-bit	The hexadecimal address of 0x1039 is read by Modbus RTU double word, which is the current encoder position with positive and negative pulses.
U0-58		
U0-59	absolute encoder present position feedback high 32-bit	The hexadecimal address of 0x1041 is read by Modbus RTU double word, which is the high position of the current encoder, low bit data is needed.
U0-60		

Servo driver transmits position data information of encoder through RS485 port and Modbus RTU protocol.

◆ 17-bit absolute value encoder has 131072 pulses per cycle.
First read the U0-60 (0x1041) value
(1) 0 means running in the positive direction. The current position of the encoder is U0-57*1+U0-58*2^16.
(2) -1 means running in the opposite direction. The current encoder value is: (U0-57-65535)*1+(U0-58-65535)*2^16+(U0- 59-65535)*2^32.
If the position is read by XINJE HMI and the U0-57 (Modbus address is decimal 4153) double-word is read, the high-low byte exchange should be selected. If communicating with Xinje PLC, direct double-word reading is ok.

◆ 23-bit absolute value encoder, one-cycle pulse number is 8388608.
First read the U0-60 (0x1041) value
(1) 0 means running in the positive direction. The current encoder value is

U0-57*1+U0-58*2^16+U0-59*2^32.

(2) -1 means running in the opposite direction. The current encoder value is: (U0-57-65535)*1+ (U0-58-65535)*2^16+ (U0-59-65535)*2^32.

Communication parameter description

RS485 default communication parameters: baud rate 19200 bps; data bit 8; stop bit 1; even parity; Modbus station number 1.

Note: Refer to Appendix 1 (P7-XX) for communication parameter description.

5.11.5 Reset absolute encoder position

Parameters	Name
F1-06	Clear the turns of absolute encoder
U0-94	Relative encoder feedback value which can be reset
U0-95	
U0-96	
U0-97	

◆ F1-06 clears the turns

Encoder turns clearing should be done when servo driver is OFF. The clearing methods include servo panel clearing and Modbus-RTU communication clearing. After the operation, U0-91 is 0, U0-57~U0-59 will change.

1. Servo panel clearing

Enter parameter F1-06 when servo is in bb state:

Press【INC】to 1, and keep press【ENT】to confirm and exit.
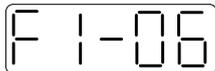
Clear the absolute encoder turns through F1-06 on the servo panel.

2. Modbus-RTU communication clearing

Write 1 to the Modbus address 0x2106 to clear the turns.

It will take effective when servo is in bb state, after clearing, write 0 in 0x2106.

◆ F1-06 zero position calibration

Encoder zero position calibration only can be done through Modbus-RTU communication. Write 3 to the modbus address 0x2106.

U0-94~U0-97 will display the motor absolute position after calibration.

Note: Every time the servo power is turned on again, the absolute position of the encoder will be updated from U0-94 to U0-97, which can not record the calibration position before power failure.

5.12 I/O signal

5.12.1 Servo alarm output（/ALM）and alarm reset （/ALM-RST）

- **Servo alarm output /ALM**

Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	effective
P5-47	/ALM	n.0002	All	Output normally open signal from SO2 terminal	anytime	At once
When the servo driver is powered on, detecting abnormality will output alarm signal.						

- **Alarm reset /ALM-RST**

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

5.12.2 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 OFF	At once
P3-20	Reverse warning speed	Motor related	rpm	0～65535	Servo OFF	At once

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

5.12.3 Rotating detection output（/TGON）

1. signal setting

Parameter	Signal	Default setting	Suitable mode	Meaning	Modify	effective
P5-40	/TGON	n.0000	All	Rotating detection output	Anytime	At once

It is the output signal indicating that the servo motor is rotating at a speed higher than the set value.
1. No terminal output signal is assigned by default. The parameter range is 0000-0014, which is allocated to other output terminals through parameter P5-40.
2. When the speed of the servo motor is higher than the set value of P5-03, the signal that the servo is rotating is considered.

2. related parameters

Parameter	Meaning	Default value	Unit	Range	Modify	Effective
P5-03	Rotating detection speed /TGON	50	rpm	0～10000	Servo OFF	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.
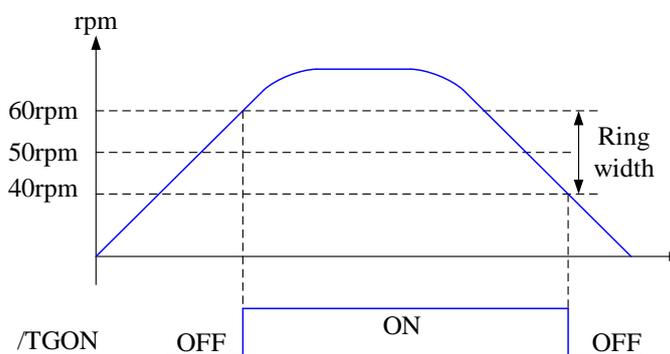
5.12.4 Servo ready output（/S-RDY）

Parameter	Signal name	Setting	Meaning	修改范围
P5-41	Ready /S-RDY	n.0003 (default)	SO3 and COM pass through when servo is ready	The range is 0000-0013. It can distribute to other output terminal through P5-41.
		n.0013	SO3 and COM cut off when servo is ready	

Note:
  (1) S-RDY output condition selection, set by P5-70:
  (2) When P5-70 is set to 0, the terminal is turned on after the initialization of the driver is completed and the servo has no alarm state.
  (3) P5-70 is set to 1: This terminal will not be turned on until it is enabled and the servo has no alarm status.

5.12.5 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.

Encoder Z phase signal

P5-48=n.0011
SO1 output

P5-48=n.0001
SO1 output

2ms
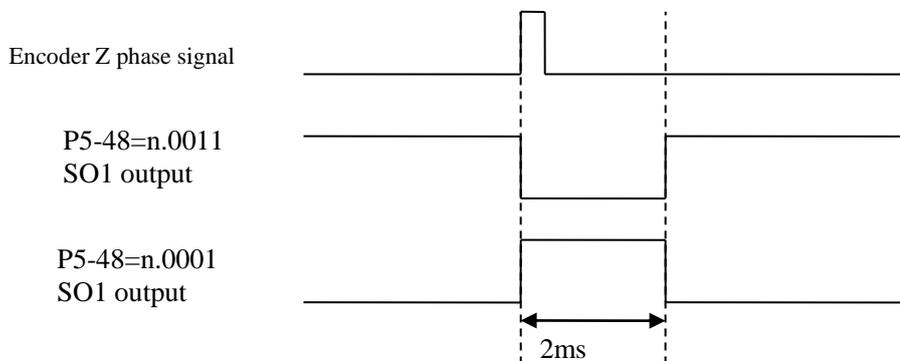
5.12.6 User-defined output signal

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:

	The trigger condition of user-defined output 1					
P5-10	Default trigger condition	Trigger condition setting	Unit	Suitable mode	Change	effective
	0	See below table: optional trigger condition	Related to trigger condition	All the modes	servo OFF	At once

P5-11	The comparison value for the trigger condition of user-defined output 1						
	Unit		Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition		0	-32768~32767	All the modes	Servo OFF	At once

P5-12	When P5-10≥P5-11 or P5-10<P5-11, SOx output					
	Setting value	Function	Default value	Suitable mode	Change	Effective
	0	P5-10≥P5-11, SOx output	0	All the modes	Servo OFF	At once
	1	P5-10＜P5-11, SOx output				
	2	P5-10 absolute value ≥P5-11, SOx output				
	3	P5-10 absolute value ≤P5-11, SOx output				

P5-13	User-defined output 1 hysteresis loop					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	0~65535	All the modes	Servo OFF	At once

P5-52	Output terminal setting of user-defined output 1			
	Signal name	Default setting	Meaning	Change
	User-defined output 1	n.0000	Default setting 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	Change	Effective
	0	See below table: optional trigger condition	Related to trigger condition	All the modes	Servo OFF	At once

P5-15	The comparison value for the trigger condition of user-defined output 2					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	-9999~9999	All the modes	Servo OFF	At once

P5-16	When P5-14≥P5-15 or P5-14<P5-15, SOx output					
	Setting value	Function	Default setting	Suitable mode	Change	Effective
	0	P5-14≥P5-15, SOx output	0	All the modes	Servo OFF	At once
	1	P5-14＜P5-15, SOx output				
	2	P5-14 absolute value ≥P5-15, SOx output				
	3	P5-14 absolute value ＜ P5-15, SOx output				

P5-17	User-defined output 2 hysteresis loop					
	Unit	Default setting	Range	Suitable mode	Change	Effective

	Related to trigger condition	0	-32768~32767	All the modes	Servo OFF	At once
P5-53	Output terminal setting of user-defined output 2					
	Signal name	Default setting	Meaning	Change		
	User-defined output 2	n.0000	Default setting is not distribute to the output terminal	Range 0000-0014, distribute to the output terminal through P5-53		

Note: please refer to chapter 5-12-3 for hysteresis loop.

Optional trigger conditions:

Condition no.	Meaning	Unit
0	-	-
203	Current command	Rated current %
205	Current feedback	Rated current %
301	Speed command	rpm
302	Speed feedback	rpm
308	Speed deviation	rpm
4402	Position command	1 command
4404	Position feedback	1 command
1406	Position deviation	1 command
502	Bus voltage	V
503	Drive internal temperature	℃
506	Average output power	W
508	Average thermal power	W

5.12.7 I/O signal distribution

■ **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 chapter 5.12.8.

■ **Default setting of input terminal**

Input terminal	SI1	SI2	SI3	SI4
signal	/S-ON	/ALM-RST	/P-OT	/N-OT

■ **Output signal distribution**

Parameter	Parameter Meaning	Set value	Meaning
P5-37～P5-47 P5-51～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

■ **Default setting of output terminal**

Output terminal	SO1	SO2	SO3
Signal	/COIN	/ALM	/S-RDY

5.12.8 Input SI filter time

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

P5-34=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

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

6 Servo gain adjustment

6.1 Overview of servo gain adjustment

6.1.1 Overview and process

Servo drivers need to drive motors as quickly and accurately as possible to track instructions from the host computer or internal settings. In order to meet this requirement, the servo gain must be adjusted reasonably.

The output value of servo gain is in adaptive mode, but different machines have different requirements for servo responsiveness. The following figure is the basic process of gain adjustment. Please adjust according to the current state and operation conditions of the machine.
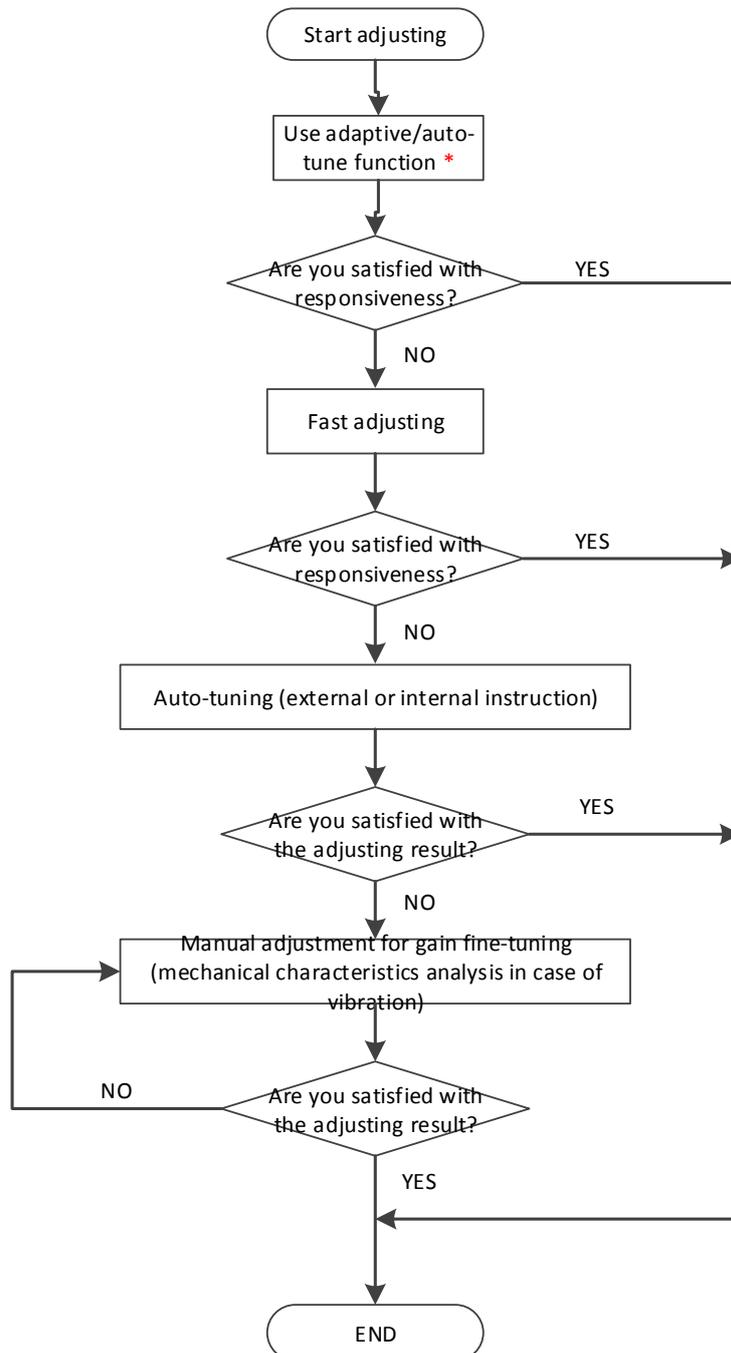
Note: * 3KW and below models use auto-tune mode (hardware version before 3730 is adaptive mode), above 3KW models use adaptive mode.

6.1.2 The Difference of these adjustment modes

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

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

6.1.3 Model loop gain

In the auto-tuning mode, besides the gain of speed loop and position loop, there is also the gain of model loop, which has a great influence on the servo responsiveness. When the model loop is not open, the servo responsiveness is determined by the gain of the position loop, and when the model loop is open, the servo responsiveness is determined by the gain of the model loop. The model loop is equivalent to feed-forward function in the driver control loop, and its specific function refers to chapter 6.6 manual adjustment.

When the auto-tuning mode is soft, the function of the model loop will automatically turn off; when the auto-tuning mode is fast positioning or fast positioning (control overshoot), the function of the model loop will automatically turn on.

Auto-tuning mode

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

Model loop function

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

	n.□□□1	Model loop turn on			

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

■ Model loop function turns off (soft mode)

Low Rigidity and Low Response	High Rigidity and Medium Response
Load inertia ratio P0-07: 500%	
speed loop gain P1-00: 200	speed loop gain P1-00: 800
speed loop integral P1-01: 3300	speed loop integral P1-01: 825
position loop gain P1-02: 200	position loop gain P1-02: 700
Phenomenon: Running jitter, slow response	Phenomenon: smooth operation and fast response
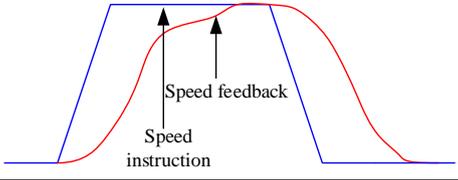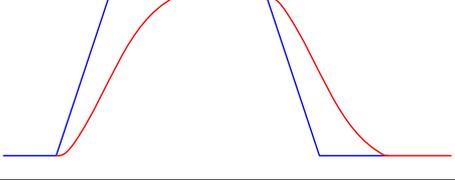
■ Model loop function turns on (fast positioning or fast position(control overshoot))

Low Rigidity and Low Response	High Rigidity and Low Response	High Rigidity and High Response
Load inertia ratio P0-07: 500%		
speed loop gain P1-00: 200	speed loop gain P1-00: 800	speed loop gain P1-00: 800
speed loop integral P1-01: 3300	speed loop integral P1-01: 825	speed loop integral P1-01: 825
position loop gain P1-02: 200	position loop gain P1-02: 700	position loop gain P1-02: 700
Model loop gain P2-49: 300	Model loop gain P2-49: 300	Model loop gain P2-49: 4000
Phenomenon: Running jitter, slow response	Phenomenon: smooth operation and slow response	Phenomenon: smooth operation and fast response
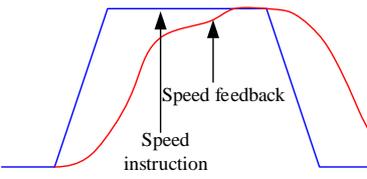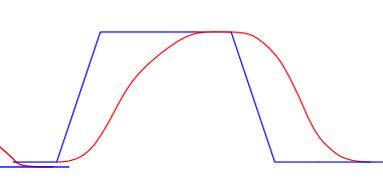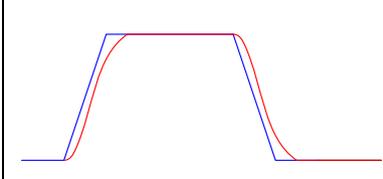
Note: The above curves only show the effect of the parameters, not the real running curves.

6.1.4 Torque disturbance observation

Disturbance observer can reduce the influence of external disturbance on servo system and improve the anti-disturbance ability by detecting and estimating the external disturbance torque of the system and compensating the torque command.

If the soft mode is selected in the auto-tuning mode, the disturbance observer will be closed automatically, and the gain of the disturbance observer will not change. If the fast positioning or fast positioning (control overshoot) is selected, the disturbance observer will be opened automatically, and the gain of the disturbance observer will be modified to 85. The relevant parameters of this function no need to be set manually by users.

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

Parameter	Meaning	Default setting	Unit	Setting range	Modification	Effective
P2-41	Disturbance observer gain	99	-	0～100	anytime	At once

6.2 Adaptive

6.2.1 Overview

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

6.2.2 Notes

➢ When the servo unit is installed on the machine, it may produce instantaneous sound when the servo is ON. This is the sound when the automatic notch filter is set, not the fault. For the next time the servo is ON, no sound will be emitted.

➢ When the inertia of the motor exceeds the allowable load, the motor may produce vibration. At this time, please modify the adaptive parameters to match the present load inertia.

➢ In adaptive operation, in order to ensure safety, the adaptive function should be executed at any time when the servo enablement can be stopped or turned off urgently.

6.2.3 Operation steps

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

Parameter		Meaning	Default setting	Modification	Effective
P2-01	n.□□□0	Adaptive shutdown	n.□□□1	Servo OFF	Re-power on
	n.□□□1	Adaptive Opening			

6.2.4 Inertia mode

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

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

Parameter	Meaning	Default setting	Modification	Effective
P2-05	Adaptive speed loop gain	400[Note1]	Servo OFF	Re-power on
P2-10	Adaptive speed loop integral	500	Servo OFF	Re-power on
P2-11	Adaptive position loop gain	100	Servo OFF	Re-power on
P2-07	Adaptive inertia ratio	0	Servo OFF	Re-power on
P2-08	Adaptive speed observer gain	60	Servo OFF	Re-power on

P2-12	Adaptive stable max inertia ratio	30	Servo OFF	Re-power on
P2-16	Adaptive motor rotor inertia coefficient	100	Servo OFF	Re-power on
P2-19	Adaptive bandwidth	50[Note2]	Anytime	At once
P6-05	Adaptive large inertia mode speed loop gain	200	Servo OFF	Re-power on
P6-07	Adaptive large inertia mode inertia ratio	50	Servo OFF	Re-power on
P6-08	Adaptive large inertia mode speed observer gain	40	Servo OFF	Re-power on
P6-12	Adaptive large inertia mode max inertia ratio	50	Servo OFF	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.

6.2.5 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 inertia	Switch to adaptive large inertia mode or set P2-08=40, P2-12=50, P2-07=50

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

6.2.6 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.

6.2.7 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	First speed loop gain
	P1-05	Second speed loop gain
	P1-01	First speed loop integral time constant
	P1-06	Second speed loop integral time constant
	P1-02	First position loop gain
	P1-07	Second position loop gain
	P2-49	Model loop gain
	P0-07	First inertia ratio
	P0-08	Second inertia ratio
Switch	P5-33	/G-SEL gain switch
	P5-36	/I-SEL inertia ratio switch

6.3 Rotary inertia presumption

6.3.1 Overview

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

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

Parameter	Meaning	Default setting	Unit	Setting range	Modification	Effective
P0-07	First inertia ratio	200	%	0~50000	Anytime	At once

6.3.2 Notes

Occasions where inertia cannot be presumed
➢ Mechanical systems can only operate in one direction

The occasion where inertia presumption is easy to fail

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

Notes of Inertia Presumption

➢ 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 not 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 t0 500 times for the driver firmware 3700 and higher version (parameter upper limit value is 50000).

6.3.3 Operation tool

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

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

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

6.3.4 Operation steps

Estimate the inertia through the driver panel

1. Parameter setting

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

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

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:

$$\_IAt\ -$$

Press ENTER, servo is enabled:

$$\_IAt\ --$$

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

$$\_IAt-P \quad \text{or} \quad \_IAt-n$$

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	Initial inertia too small; Maximum speed too large; Torque limit too small

		instruction speed will lead to inaccurate identification of inertia ratio. ③ torque limit too small（P3-28/29）	
Err-2	value error is too large when calculating the inertia	① The maximum speed limit is too small (P2-17), but it is recommended not to be less than 500 rpm. Low instruction speed will lead to inaccurate identification of inertia ratio. ② The presumed inertia trip is too small. It is suggested that the minimum for P2-15 should no be less than 50 (0.5 cycles). If the trip is too small, the identification of inertia ratio will be inaccurate. ③ mechanism friction too large ④ overshoot	The maximum speed limit is too small; the travel is too small; the friction of the mechanism is too large; the overrun occurs
Err-3	Driver internal trip calculation error	① The presumed inertia trip is too small. It is suggested that the minimum for P2-15 should no be less than 50 (0.5 cycles). If the trip is too small, the identification of inertia ratio will be inaccurate.	Contact us
Err-5	Unrestrained Vibration in the Process of Inertia Identification	Unhandled vibration occurs	Unhandled vibration occurs
Err-6	Driver 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
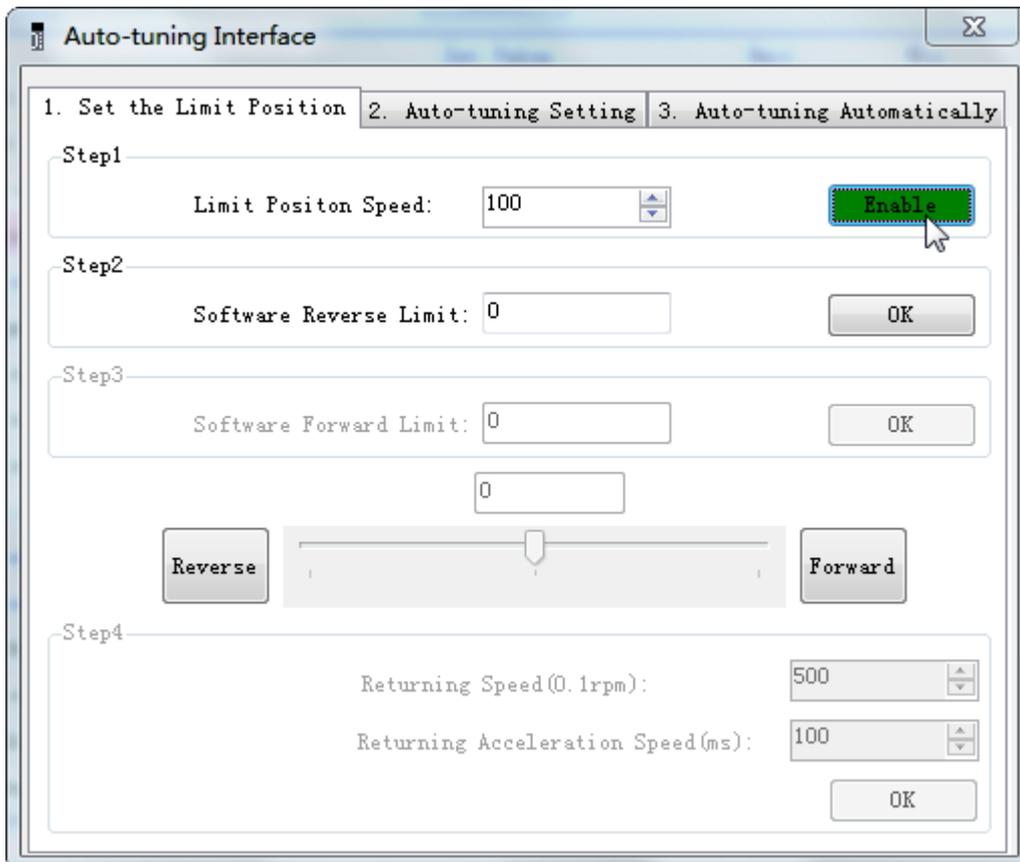
2. select jog setting or manual setting to configure the inertia estimation trip
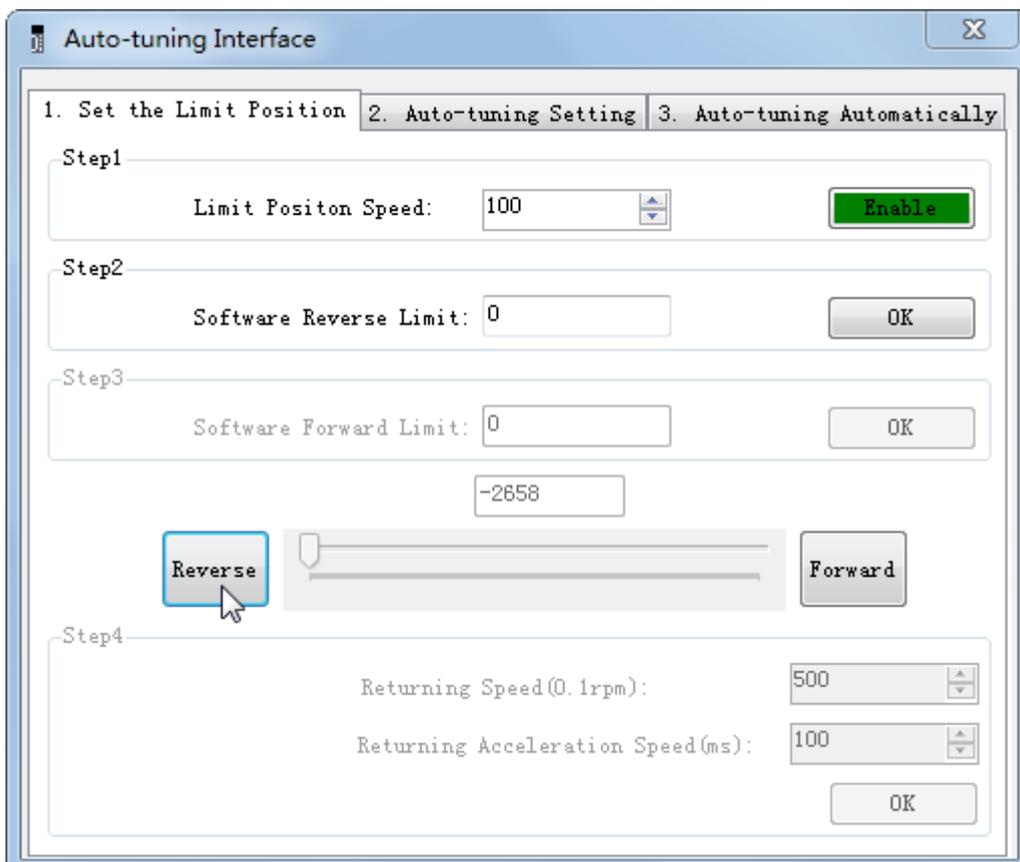
3. Set the auto-tuning interface
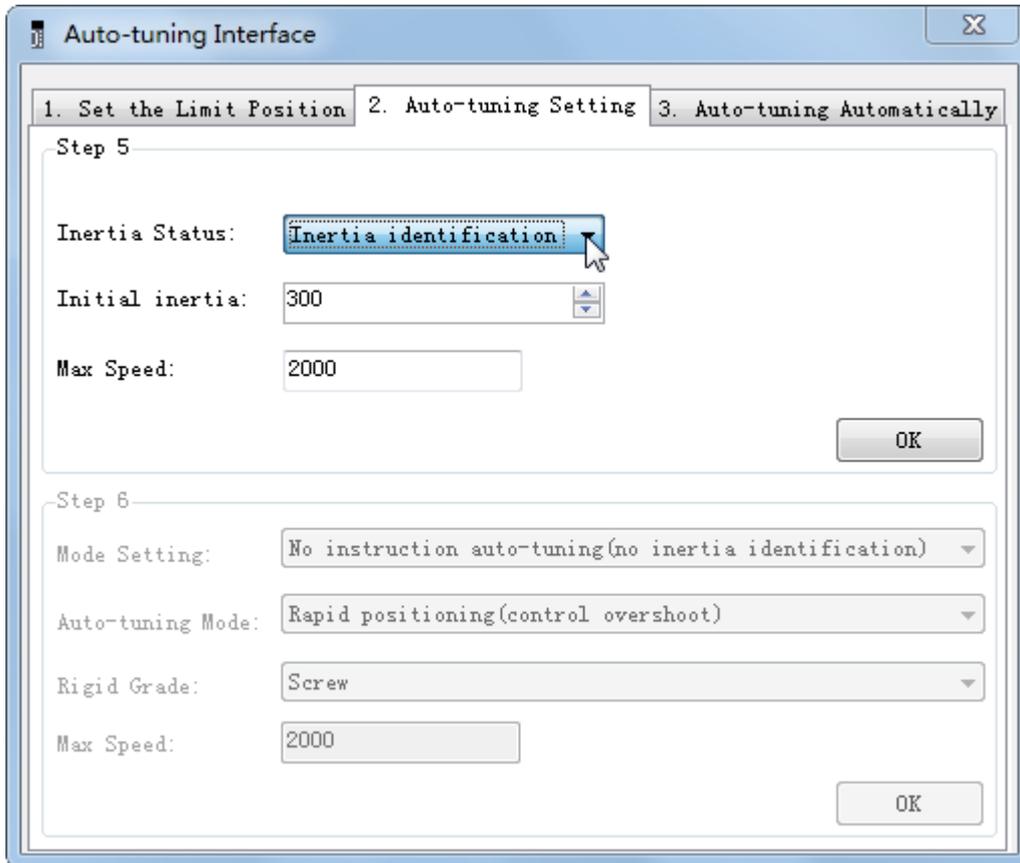
4. Click ok to start inertia identification.
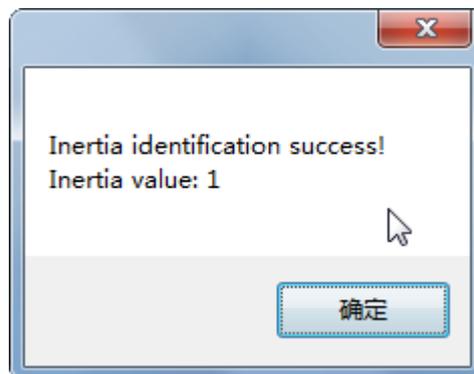
Note:

(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.

6.4 Fast adjustment

6.4.1 Overview

Fast adjustment needs to set the moment of inertia of load first, then turn off the adaptive function. If the inertia does not 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.

6.4.2 Fast adjustment steps

1. estimate the load inertia through servo driver panel or XinJeServo software
2. shut down adaptive mode, set P2-01.0 to 0
3. set the rigidity level P0-04

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

P2-01=n. 0 0 1 0
      ↳ P2-01.0

6.4.3 Rigidity level corresponding gain parameters

■ **Rigidity level of firmware 3640**

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
1	100	6600	100	100	100
2	200	3300	200	100	300
3	300	2200	300	100	400
4	400	1650	400	100	500
5	450	1467	400	90	600
6	500	1320	450	80	700
7	550	1200	450	70	800
8	600	1100	500	60	900
9	650	1015	550	50	1000
10	700	943	600	40	1100
11	750	880	650	30	1200
12	800	825	700	20	1300
13	850	776	750	10	1400
14	900	733	800	10	1500
15	1000	660	900	10	1600
16	1050	629	950	10	1800
17	1100	600	1000	10	2000
18	1150	574	1050	10	2200
19	1200	550	1100	10	2400
20	1300	508	1100	10	2600
21	1400	471	1200	10	2800
22	1500	440	1300	10	3000
23	1600	413	1400	10	3500
24	1700	388	1500	10	4000
25	1800	367	1600	10	4500
26	1900	347	1700	10	5000
27	2000	330	1800	10	5500
28	2100	314	1900	10	6000
29	2200	300	2000	10	6500

30	2300	287	2100	10	7000
31	2400	275	2200	10	7500

■ **Rigidity level of firmware 3700 and higher versions**

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(version after 3730)
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
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

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(version after 3730)
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 level should be set according to the actual load. The larger the P-04 value, the greater the servo gain. If there is vibration in the process of increasing the rigidity level, it is not suitable to continue to increase. If vibration suppression is used to eliminate vibration, it can try to continue to increase. The following is the recommended rigidity level of the load, for reference only.
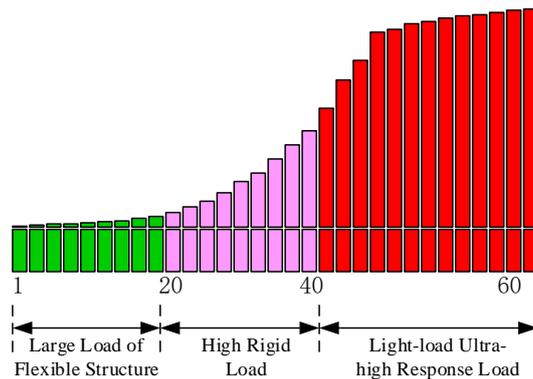
Flexible structure large load: refers to the type of synchronous belt structure, large load inertia equipment.

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

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

Driver power	Default parameters		Rigidity level for firmware 3640	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

6.4.4 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 does not meet the mechanical requirements, please gradually increase or decrease the settings.

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

6.5 Auto-tuning

6.5.1 Overview

Auto-tuning is divided into internal instruction auto-tuning and external instruction auto-tuning.
Auto-tuning (internal instruction) refers to the function of automatic operation (forward and reverse reciprocating motion) of servo unit without instructions from the upper device and adjusting according to the mechanical characteristics in operation.
Auto-tuning (external instruction) is the function of automatically optimizing the operation according to the instructions from the upper device.
The automatic adjustments are as follows:
➤ Load moment of inertia
➤ Gain parameters (speed loop, position loop, model loop gain)
➤ Filter (notch filter, torque instruction filter)

6.5.2 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.

6.5.3 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 item
Internal instruction auto-tuning	XinJeServo software	All the versions support
external instruction auto-tuning	Driver panel	Driver firmware needs 3700 and higher versions

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

6.5.4 Internal instruction auto-tuning steps

Driver panel auto-tuning steps
1. The inertia identification is carried out, and the inertia estimation steps please refer to chapter 6.3.4 operation steps.
2. Enter F0-09, panel display is iat-；

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

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

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

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

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

■ Panel alarm in auto-tuning process

Error code	Meaning	Reasons
Err-1	Failure to search for optimal gain	Too large inertia ratio; too weak rigidity of mechanism
Err-2	Overtrip alarm in auto-tuning process	Please make sure that there is no overrun and alarm before auto-tuning.
Err-6	Driver 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
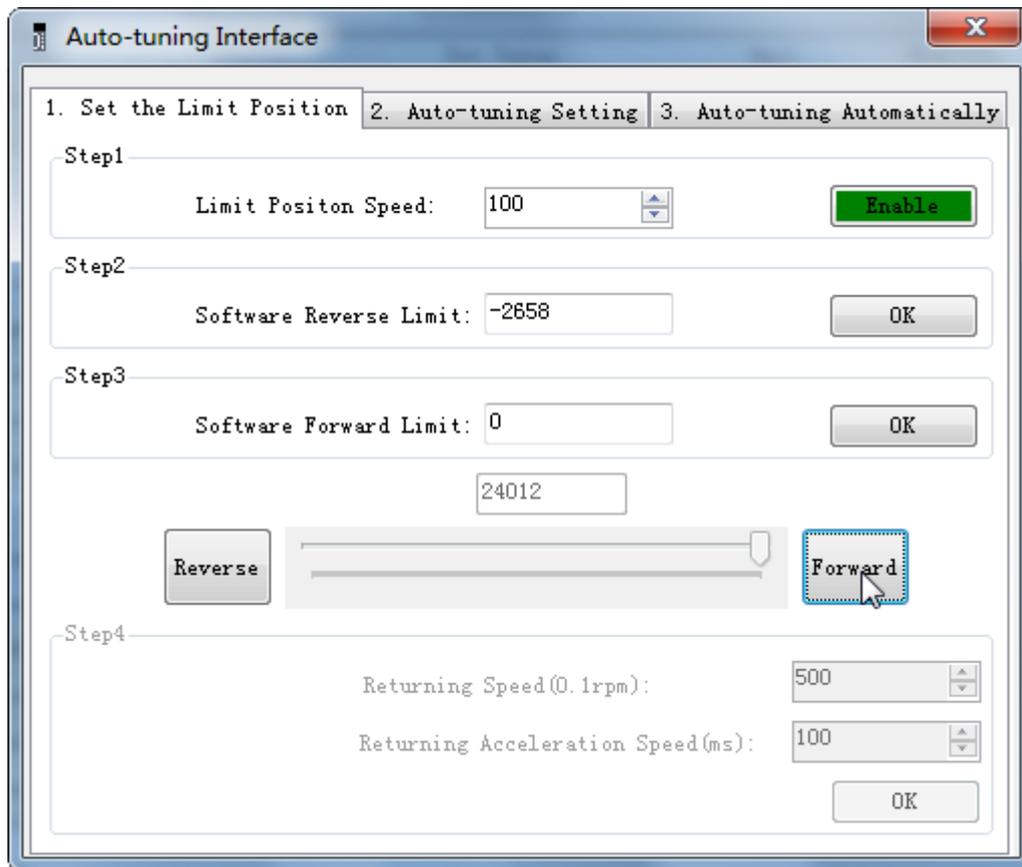
3. set the auto-tuning interface
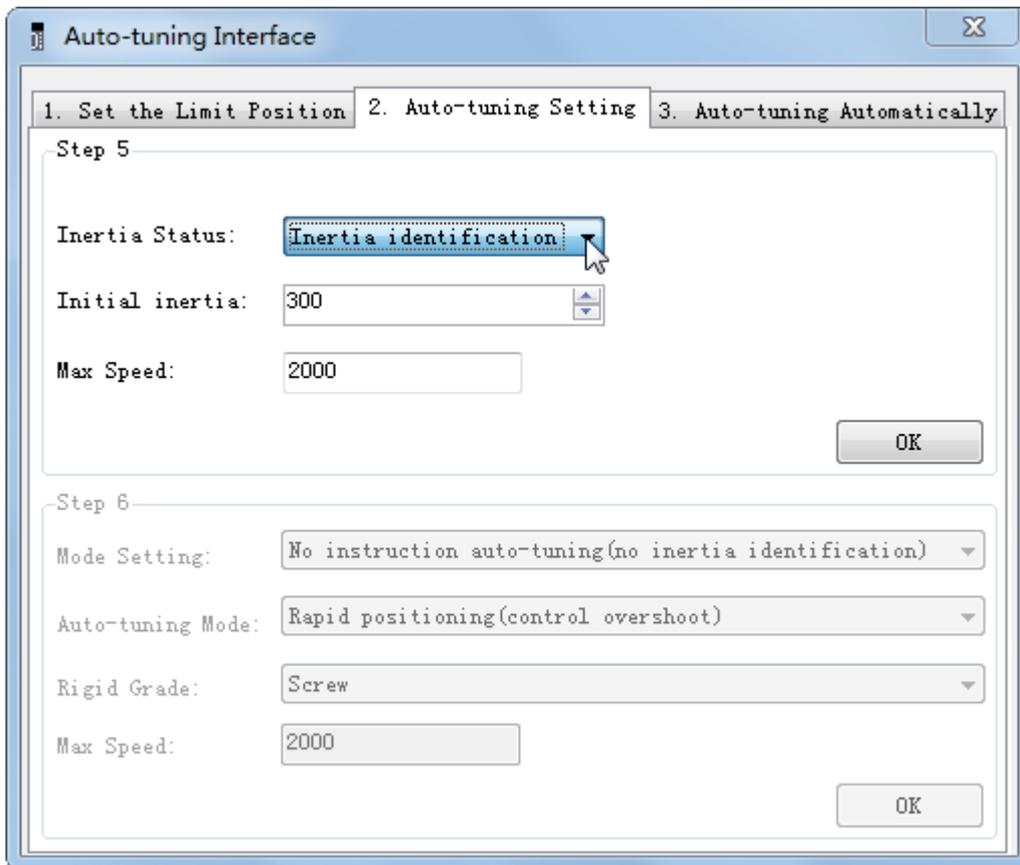
4. click ok to estimate the inertia.
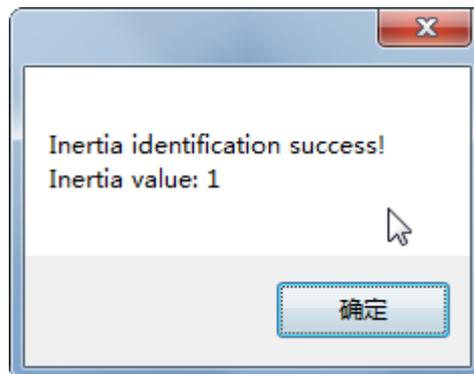
5. set the auto-tuning parameters
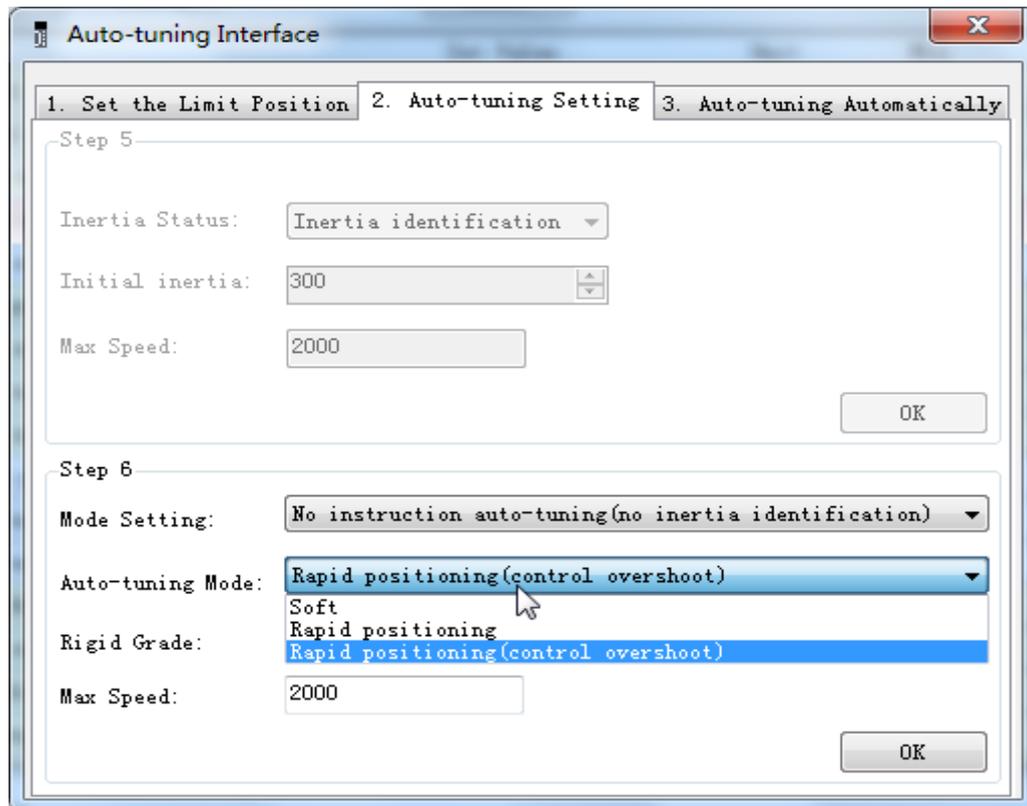
Load type	Description
Synchronous belt	Fit for the adjustment of lower rigidity mechanism such as synchronous belt mechanism.
Screw rod	It is suitable for adjustment of higher rigidity mechanism such as ball screw mechanism. If there is no corresponding mechanism, please choose this type.
Rigid connection	It is suitable for the adjustment of rigid body system and other mechanisms with higher rigidity.

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

Selection of auto-tuning mode:

(1) Soft (P2-02.0=1):

This method does not open the gain of the model loop and runs softly. It is suitable for the occasion where the mechanical rigidity is insufficient and the response requirement is not high.

(2) Rapid positioning (P2-02.0=2):

This method has the fastest response for auto-tuning parameters, but has no special suppression to overshoot.

(3) Rapid positioning (control overshoot) (P2-02.0=3):

This method has quickly response for auto-tuning parameters and suppresses overshoot.

6. Start auto-tuning
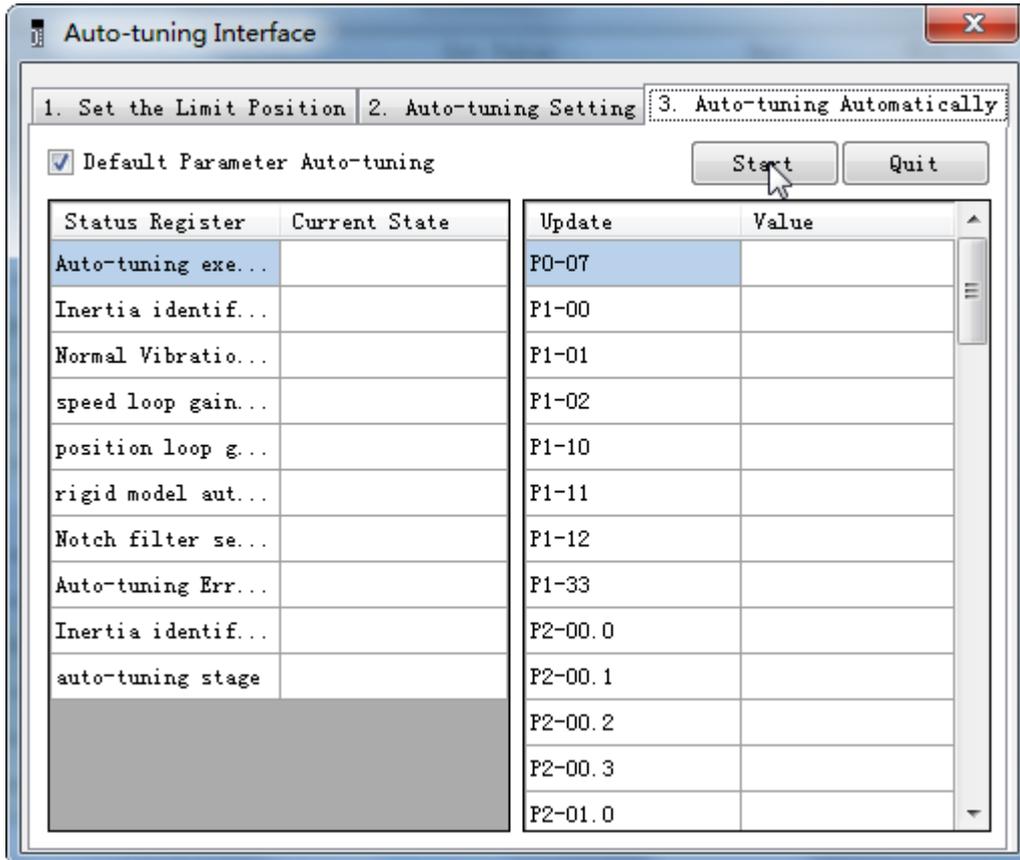
7. Wait for the end of the auto-tuning
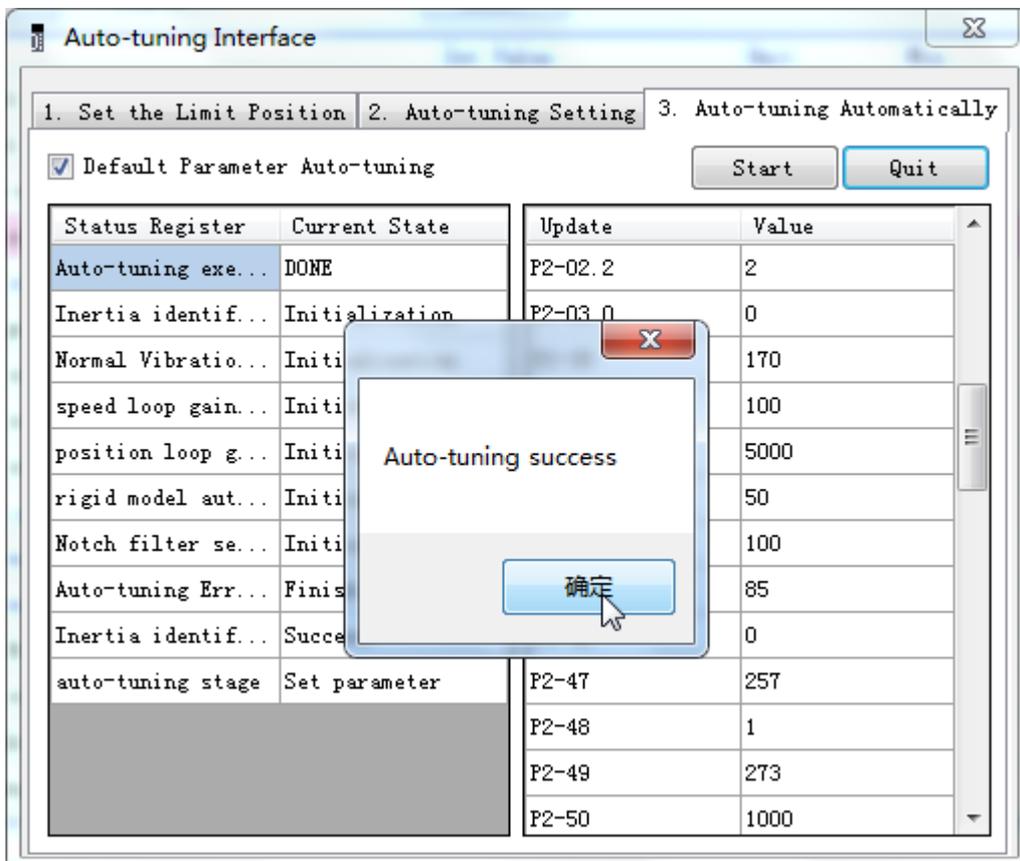
6.5.5 External instruction auto-tuning steps

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 (6.3.4 operation step)
2. Shut down adaptive function (P2-01.0 sets to 0), power on again
3. Enter parameter F0-08, it will show Eat-（Exteral Refrence Auto-tuning）

$$EAt-$$

4. Press ENTER, if the enabler is not open, the panel displays Son and flickers, waiting for the enabler to open, if the enabler has been opened, skip this step;

$$Son$$

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

$$tunE$$

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

$$donE$$

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

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

■ Panel error alarm in auto-tuning process

Error code	Meaning	Reasons
Err-1	Failure to search for optimal gain	Too large inertia ratio; too weak rigidity of mechanism
Err-2	①Overrun/alarm occurs during auto-tuning ②External instruction auto-tuning/Vibration suppression mode: servo shut down the enabler during auto-tuning	Please make sure that there is no overrun and alarm before auto-tuning. Make sure that the enable 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
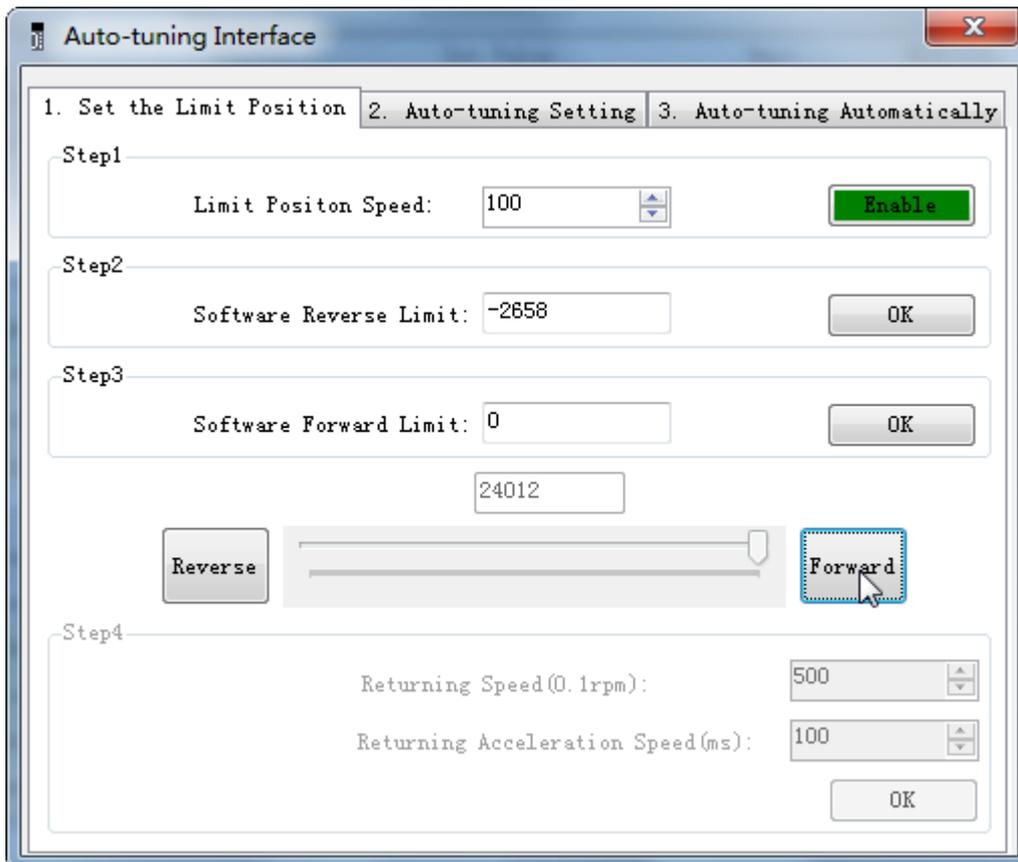
2. Select jog or manual setting to configure the trip of inertia identification.

3. Set the auto-tuning interface
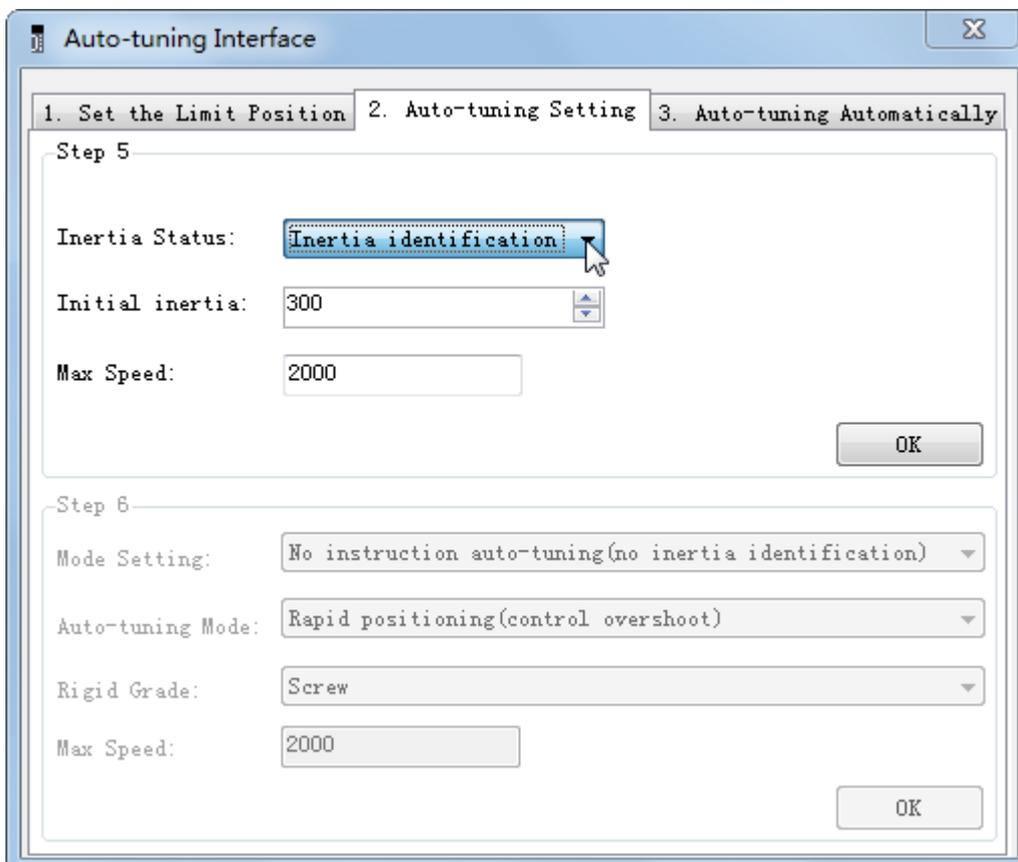
4. Click ok to start the inertia identification.
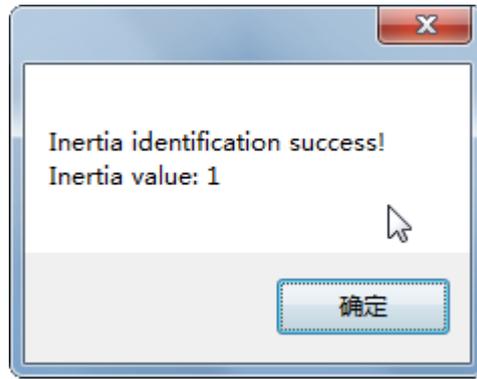
5. Configure the auto-tuning parameters

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.

Selection of auto-tuning mode:

(1) Soft (P2-02.0=1):

This method does not open the gain of the model loop and runs softly. It is suitable for the occasion where mechanical rigidity is insufficient and the responsiveness requirement is not high.

(2) Rapid localization (P2-02.0=2):

This method has the fastest response of tuning parameters, but has no special suppression to overshoot.

(3) Rapid positioning (control overshoot) (P2-02.0=3):

This method has the faster response of tuning parameters and restrain overshoot.

6. Start auto-tune
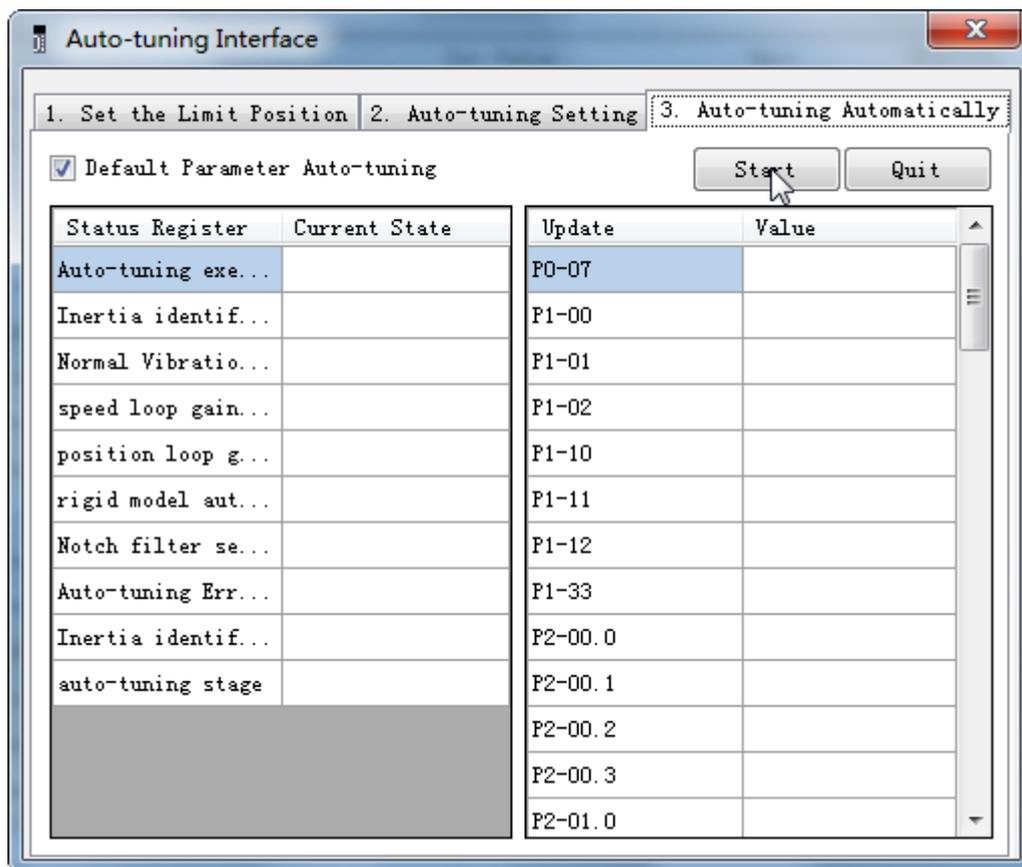
7. Open the servo enable, then click ok.
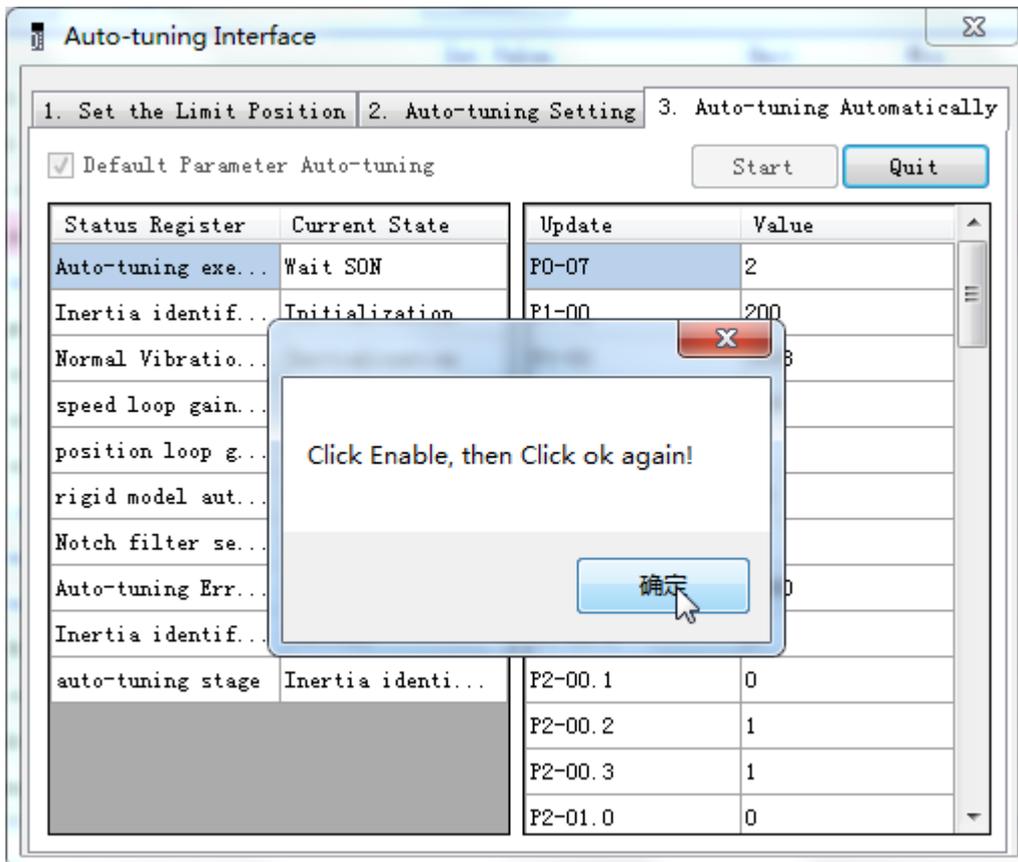
8. The upper device starts to send pulses, wait the completion of auto-tuning.

9. Auto-tuning is finished, click ok.
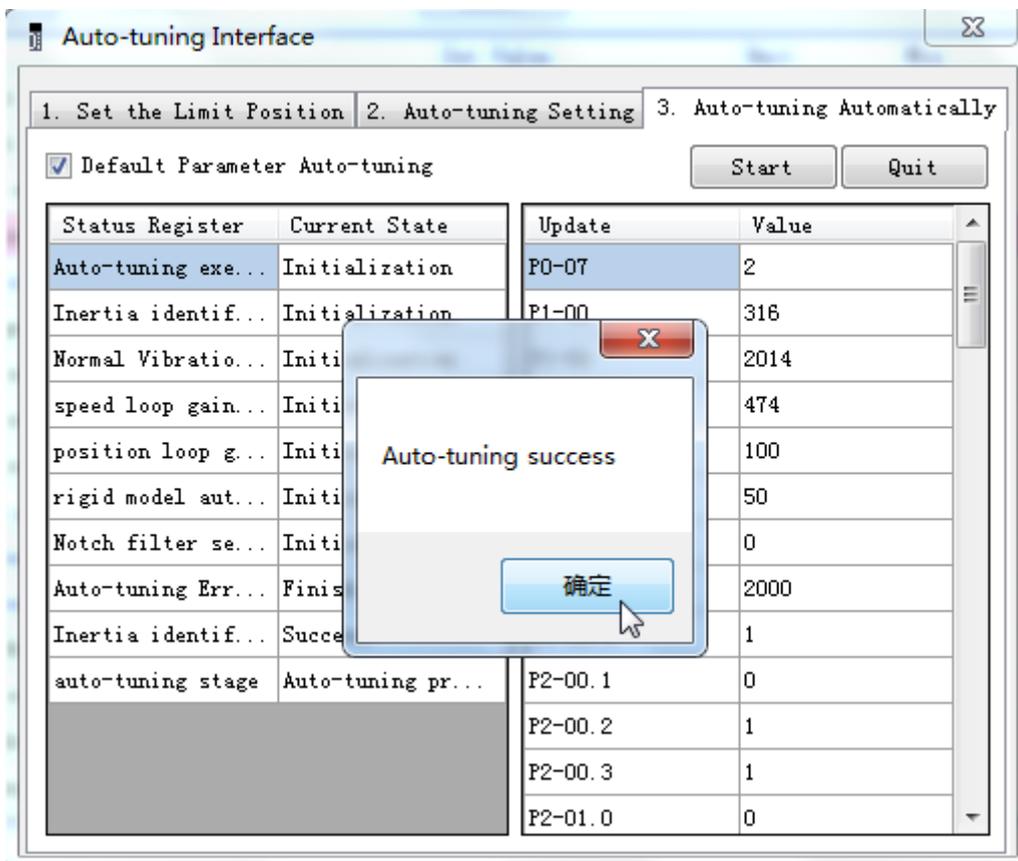
6.5.6 Related parameters

The following parameters may be modified during auto-tuning. Do not 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		
P2-69.0	First notch switch		
P2-69.1	Second notch switch		
P2-71	First notch frequency		
P2-72	First notch attenuation		
P2-73	First notch band width		
P2-74	Second notch frequency		
P2-75	Second notch attenuation		
P2-76	Second notch band width		
P2-17	Inertia identification and internal instruction auto-tuning max speed	Auto-tuning setting parameters	No
P2-86	auto-tuning jog mode		
P2-87	auto-tuning min limit position		
P2-88	auto-tuning max limit position		
P2-89	auto-tuning max speed		
P2-90	auto-tuning acceleration/deceleration time		

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

6.6 Manual adjustment

6.6.1 Overview
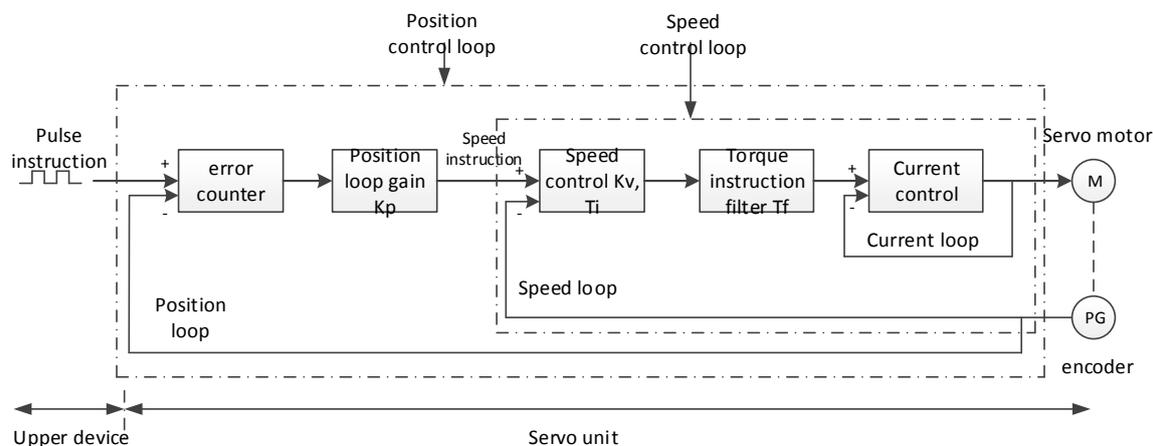
Position control loop diagram (shut down the model loop)
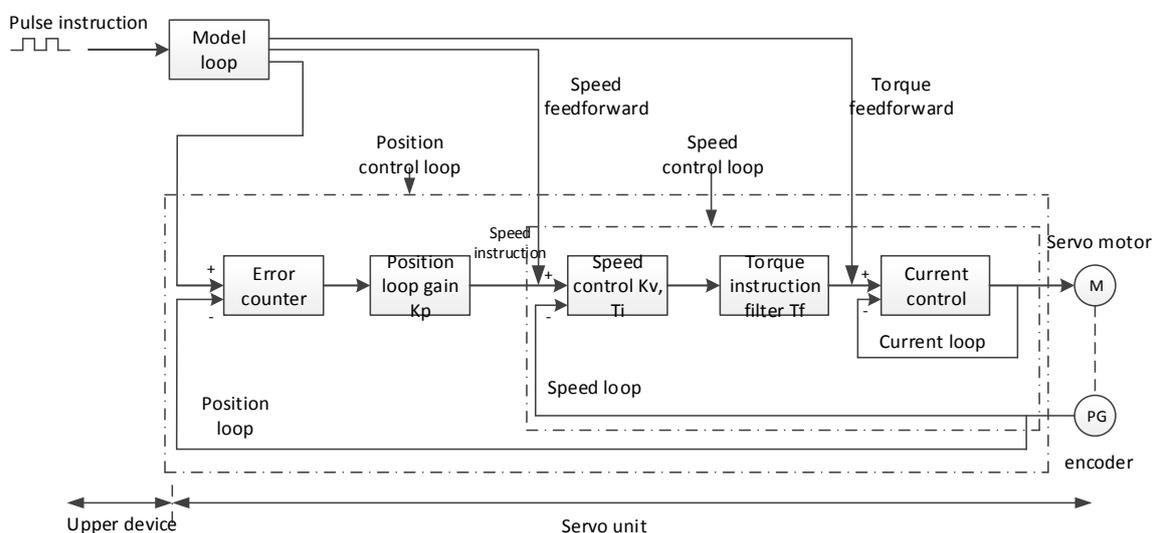
Position control loop diagram (turn on the model loop)

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 do not need to adjust.

Please use manual adjustment in the following occasions:

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

6.6.2 Adjustment steps

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

Increasing response time
1. Reducing the filter time constant of torque instruction (P2-35)
2. Increasing Speed Loop Gain (P1-00)

3. Reducing Integral Time Parameter of Speed Loop (P1-01)
4. Increasing the gain of position loop (P1-02)
5. Improving Model Loop Gain (P2-49)

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

6.6.3 Gain parameters for adjustment

The gain parameters that need to be adjusted:
P1-00 Speed Loop Gain
P1-01 Integral Time Constant of Speed Loop
P1-02 position loop gain
P2-35 Torque Instruction Filtering Time Constant
P2-49 Model Loop Gain

■ **Speed loop gain**

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

Parameter	Name	Default setting	Unit	Range	Modification	Effective
P1-00	Speed loop gain	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:

$$P1\text{-}00 \times P1\text{-}01 = 636620$$

Parameter	Name	Default setting	Unit	Range	Modification	Effective
P1-01	integral time constant of speed loop	3300	0.01ms	15～51200	Anytime	At once

■ **Gain of position loop**

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	Modification	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	Modification	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	Modification	Effective
P2-49	Model loop gain	500	0.1Hz	10～20000	Anytime	At once

6.7 Vibration suppression

6.7.1 Overview

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

Note:

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

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

6.7.2 Operation tools

Adjustment mode	Operation tools	Control mode	Operation steps	Limitation
Adaptive mode	XinJeServo Mechanical Characteristic Analysis	Position mode	6.7.4 Vibration Suppression (PC Software)	All versions of PC software support
Auto-tuning mode	Panel vibration suppression		6.7.3 Vibration Suppression (Panel)	Driver firmware requires version 3700 or higher
	XinJeServo Mechanical Characteristic Analysis		6.7.4 Vibration Suppression (PC Software)	All versions of PC software support

Auto-tuning /adaptive mode	Panel vibration suppression		6.7.7 vibration suppression (easyFFT)	Driver firmware requires version 3730 or higher

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

6.7.3 Vibration suppression(panel)

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

■ Difference between Two Kinds of Vibration Suppression

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

The operation steps:

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

    Ⅵ Ib- ╎ or Ⅵ Ib-2

2. Press ENTER, panel shows Son and flashes, turn on the enabler by manual;

    Son

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

    tunE

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

    donE

5. Press STA/ESC to exit

6. Vibration suppression parameters are automatically written into the second and first notches (the second notches are preferred when there is only one vibration point). The related parameters are detailed in 6.7.6 notch filter.

■ Fault alarm of panel in vibration suppression process

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

6.7.4 Vibration suppression (PC software)

1. open XinJeServo software, click mechanical properties;
2. click measure;
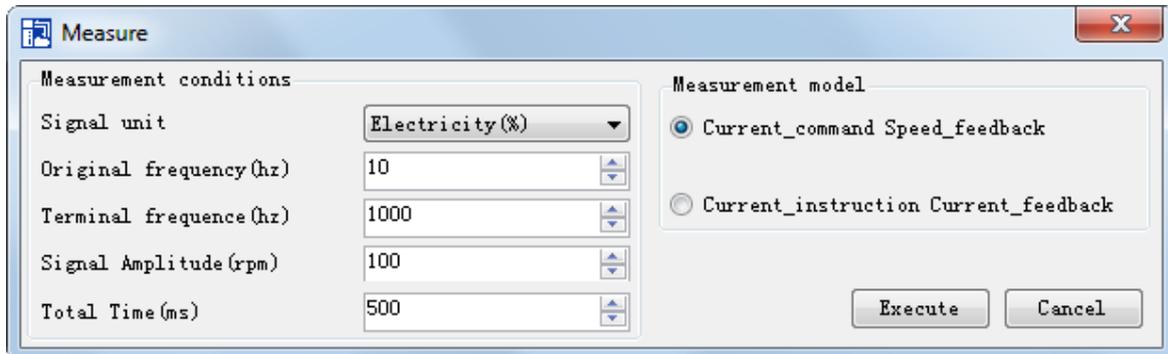
3. set the measure conditions, then click execute;
4. select amplitude and phase;
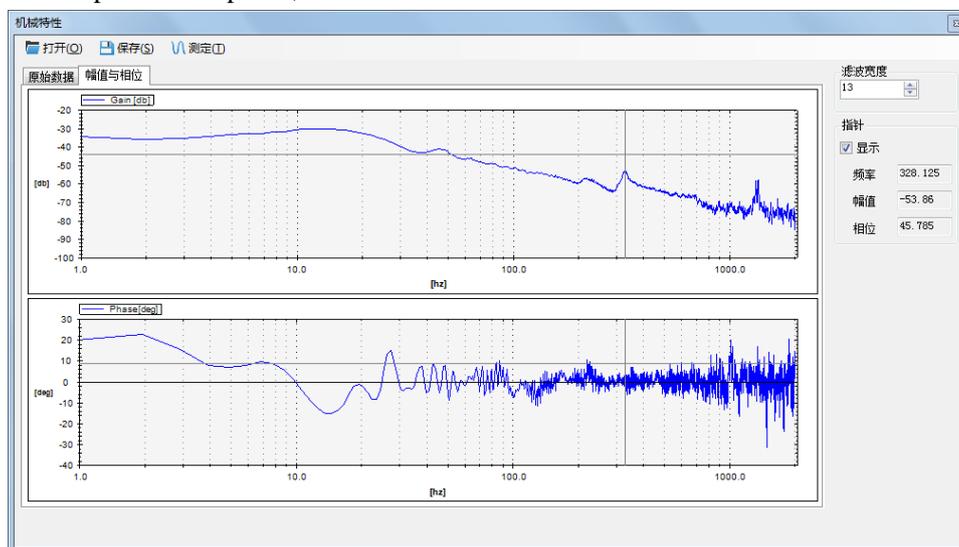
5. set the filter width (to see resonance frequencies clearly), find the resonance frequency;
6. Notch parameters need to be set manually. Refer to 6.7.6 notch filter for details.

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

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

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

6.7.5 Vibration suppression (manual setting)

If the resonance frequency of the mechanical system is known, the vibration can be eliminated by setting the vibration frequency manually. Please configure the third to fifth notches. The related parameters are detailed in 6.7.6 notch filter.

6.7.6 Notch filter

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

The principle diagram of notch filter is as follows:

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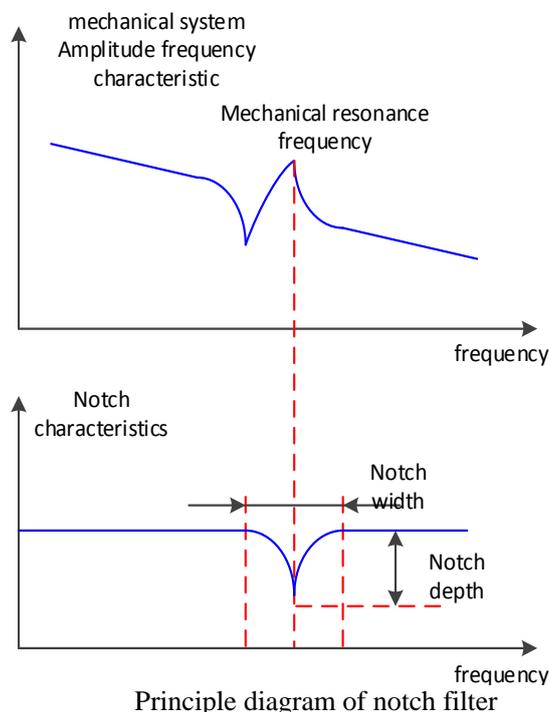
The servo driver has five sets of notch filters, each with three parameters, notch frequency, notch attenuation and notch bandwidth. The first and second notches are set automatically, and the third, fourth and fifth are set manually.

The torque instruction filter and notch filter are in series in the system. As shown in the figure below, the switch of the notch filter is controlled by P2-69 and P2-70.
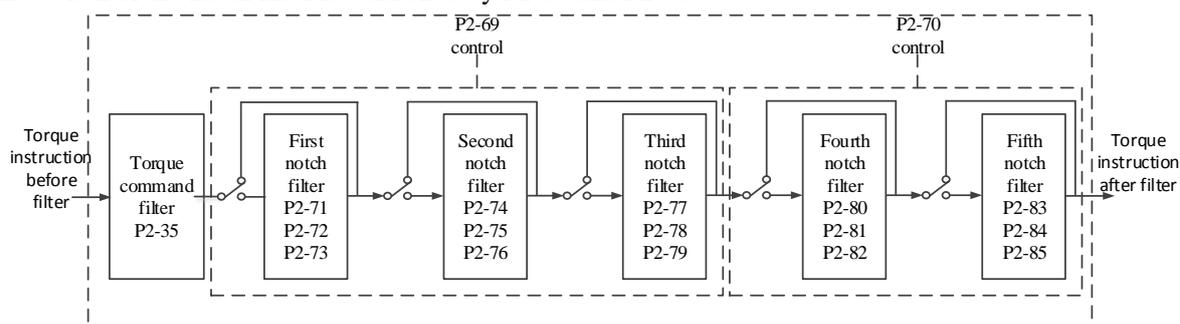
Parameter		Meaning	Default setting	Change	Effective
P2-69	n.□□□0	First notch off	n.□□□0	Anytime	At once
	n.□□□1	First notch on			
	n.□□0□	Second notch off	n.□□0□	Anytime	At once
	n.□□1□	Second notch on			
	n.0□□□	Third notch off	n.0□□□	Anytime	At once
	n.1□□□	Third notch on			
P2-70	n.□□□0	Fourth notch off	n.□□□0	Anytime	At once

	n.□□□1	Fourth notch on			
	n.□□0□	Fifth notch off	n.□□0□	Anytime	At once
	n.□□1□	Fifth notch on			

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

Note:

1. In the adaptive mode, if the vibration is detected, the second notch filter will be automatically configured.

2. In the auto-tuning mode, the second and first notches will be automatically configured if the vibration is detected (the second notches will be preferentially opened when there is only one vibration point).

3. Whether in self-adaptive or auto-tuning mode, if the mechanical characteristic analysis is sued, it belongs to manual setting of notches, please configure the third to fifth notches.

6.7.7 Vibration suppression (easyFFT)

This function can be used to analyze the mechanical characteristics through F0-12 parameters on the servo operation panel, find out the mechanical resonance frequency and achieve vibration suppression. The steps are as following:
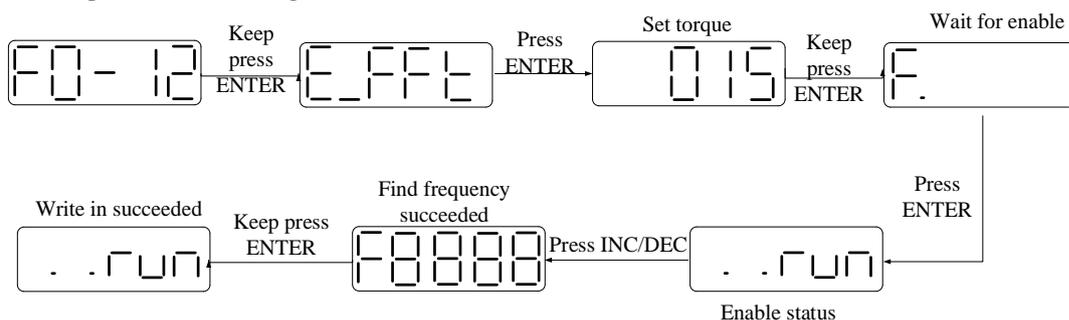
1. F0-12, keep press ENTER to enter easyFFT function, it will show E_FFt.

```
E_FFt
```
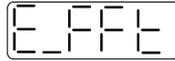
2. Press ENTER to enter torque setting interface, it will show current torque which is P6-89, press INC and DEC to change the torque, please increase it slowly to prevent from serious vibration.

```
015
```

3. Keep press ENTER to enter ready enable status, it will show F.

```
F.
```

4. Press ENTER, enable, it will show ..run

```
..run
```

5. press INC and DEC to run forward and reverse, find the resonance frequency. E_FFt will twinkle, if the resonance frequency is found, it will show Fxxxx, xxxx is resonance frequency. If it is failure, it will show F----.

```
F0000
```
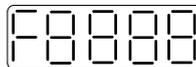
6. Whatever it shows Fxxxx or F----, user can press INC or DEC to find the resonance frequency again. if the resonance frequency is found, keep press ENTER to set this value in driver notch filter.

```
..run
```
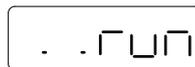
Note: for each step, press STA/ESC to return to last step, press STA to exit.

6.8 Gain adjustment correlation

6.8.1 Load shaking

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

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

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

6.8.2 Vibration

The following causes cause machine vibration:
(1) Vibration due to inappropriate servo gain
Countermeasure: Reduce gain
(2) Mechanical resonance point
Countermeasure: Setting notch parameters manually or through mechanical characteristic analysis

6.8.3 Noise

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

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

Automatic Adjustment Mode: Reducing Model Loop Gain P2-49
(1) Noise due to mechanical resonance
Countermeasure: Refer to 6.8.2 vibration.

7 Alarm

7.1 Alarm code list

Effective time: "√" means record the historical alarm, "empty" means not record,
"○" means can clear the alarm, "empty" means power-off clear the alarm.

Alarm code type		Code	Description	Property		Servo status when alarming
				Historical records	Can be cleared	
EEEE	1	EEEE1	Communication error between panel and CPU			
	2	EEEE2				
	3	EEEE3				
	4	EEEE4				
01	0	E-010	Firmware version mismatch			
	2	E-012	System Loading Error			
	3	E-013	FPGA Loading Error			
	4	E-014	FPGA Access error			
	5	E-015	Program running error			
	6	E-016	Processor Running Error			
	7	E-017	Processor Running Timeout			
	8	E-018	FPGA running timeout			
	9	E-019	System password error			

02	0	E-020	Parameter loading error				
	1	E-021	Parameter range beyond limit			○	
	2	E-022	Parameter conflict		√	○	
	3	E-023	Sampling channel setting error				
	4	E-024	parameter lost		√	○	
	5	E-025	Erase FLASH error		√	○	
	6	E-026	Initialization FLASH error		√	○	
03	0	E-030	Bus voltage U0-05 is higher than the actual preset threshold, and lasts for P0-83 setting time to alarm. 220V Power Supply Machine (U0-05≥390V) 380V Power Supply Machine (U0-05≥50V)	There are two possibilities of bus undervoltage: (1) the low voltage of power grid, (2) the undervoltage of bus voltage caused by power failure of driver. The former can be remembered, while the latter can not.		○	Servo OFF
04	0	E-040	Bus voltage U0-05 is lower than the actual preset threshold. 220V power supply machine (U0-05 ≤ 150V) 380V power supply machine (U0-05 ≤ 350V)		√	○	
	1	E-041	Driver power down			○	
	3	E-043	Bus Voltage Charging Failure		√		Servo OFF
06	0	E-060	Module temperature is too high (Module temperature U-06 ≥ 90℃ alarm, U-06 ≥ 70℃ Warning)		√	○	
08	0	E-080	Overspeed (actual speed ≥ P3-21/P3-22) The maximum forward speed is P3-21 and the maximum reverse speed is P3-22.		√	○	
09	2	E-092	Analog Tref Zero-Calibration Over limit		√	○	
	3	E-093	Analog Vref Zero-Calibration Over limit		√	○	
10	0	E-100	Excessive position deviation		√	○	
11	0	E-110	External UVW Short Circuit Discovered in Self-Inspection		√	○	Servo OFF
12	0	E-120	Abnormal Current Sensor		√	○	Servo OFF
	1	E-121	Abnormal Zero Value of U Phase Current Sampling		√	○	Servo OFF
	2	E-122	Abnormal Zero Value of V Phase Current Sampling		√	○	Servo OFF
13	0	E-150	Power cable disconnection		√	○	Servo OFF
	1	E-161	Driver thermal power overload		√	○	
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).			
20	0	E-200	Regenerative resistance overload	√	○	
22	0	E-220	Communication error of absolute servo encoder	√	○	Servo OFF
	2	E-222	Absolute value servo encoder battery low voltage alarm (can shield this alarm)	√	○	Servo OFF
	3	E-223	Absolute value servo encoder data access alarm	√	○	Servo OFF
	8	E-228	Absolute Servo Encoder Value Overflow	√	○	Servo OFF
26	0	E-260	Over range alarm	√	○	
	1	E-261	Overrun signal connection error	√	○	
	2	E-262	Control stop timeout	√	○	Servo OFF
	4	E-264	Excessive vibration	√	○	
28	0	E-280	read motor code inside encoder error	√	○	Servo OFF
31	0	E-310	motor code error	√		Servo OFF
	1	E-311	motor code lost	√	○	Servo OFF
	4	E-314	The motor code does not match the software version	√	○	Servo OFF

7.2 Analysis of alarm types

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

Type		Code	Description	Reasons	Solutions
EE EE	1	EEEE1	Communication error between panel and CPU	(1) Voltage fluctuation of power supply is large, and low voltage leads to failure of panel refresh; (2) Damage of panel program	(1) Stable power supply to ensure the stability of power supply voltage. (2) after repower on the driver, if the alarm cannot be removed, please contact the agent or the manufacturer.
	2	EEEE2			
	3	EEEE3			
	4	EEEE4			
01	0	E-010	Firmware version mismatch	Downloaded firmware version error	please contact the agent or the manufacturer
	2	E-012	System Loading Error	Program damage	please contact the agent or the manufacturer
	3	E-013	FPGA Loading Error	(1) Program damage (2) Device damage	please contact the agent or the manufacturer
	4	E-014	FPGA Access error	(1) Program damage (2) Device damage (3) serious external interference	please contact the agent or the manufacturer
	5	E-015	Program running error	Program damage	please contact the agent or the manufacturer
	6	E-016	Processor Running Error	Hardware damage	please contact the agent or the manufacturer
	7	E-017	Processor Running Timeout	Program damage	please contact the agent or the manufacturer
	8	E-018	FPGA 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	Failure of parameter	Re-energizing can restore default

			error	self-checking	parameters, if there are repeated problems, please contact the agent or manufacturer.
	1	E-021	Parameter range beyond limit	Setting values are not within the prescribed range	Check parameters and reset them
	2	E-022	Parameter conflict	Conflict of TREF or VREF Function Settings	P0-01=4, P3-00 set to 1 will alarm
	3	E-023	Sampling channel setting error	Error setting of custom output trigger channel or data monitoring channel	Check that the settings are correct
	4	E-024	parameter lost	Low voltage of power grid	(1) If it is single-phase 220V power supply, please connect L1 and L3. (2) show E-024 immediately after power failure (3) Resetting parameters
	5	E-025	Erase FLASH error	Abnormal parameter preservation during power failure	please contact the agent or the manufacturer
	6	E-026	Initialization FLASH error	Power supply instability of FLASH chip	please contact the agent or the manufacturer
03	0	E-030	Bus voltage U0-05 is higher than the actual preset threshold, and lasts for P0-83 setting time to alarm. 220V Power Supply Machine (U0-05≥390V) 380V Power Supply Machine (U0-05≥50V)	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 = 380 discharge starts, U-05 = 350 discharge ends; 380V: U-05 = 700 discharge starts, U-05 = 660 discharge ends;) (2) Increasing Acceleration and Deceleration Time (3) Reducing load inertia (4) Reduce start-stop frequency (5) Replacement of larger power drivers and motors
				Brake resistance damage or excessive resistance value	Check the regenerative resistor and replace the external resistor with the appropriate resistance value. See chapter 1.4.1 for the selection of the external resistor.
				Acceleration and deceleration time is too short	Extending Acceleration and Deceleration Time
				Hardware Fault of Driver Internal Sampling Circuit	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%),

04	0	E-040	Bus voltage U0-05 is lower than the actual preset threshold. 220V power supply machine (U0-05 ≤ 150V) 380V power supply machine (U0-05 ≤ 350V)		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 and needs to be sent back for repair.
				low voltage of power grid when normal power on	(1) Check the fluctuation of power grid. The normal voltage range of 220V driver is 200V~240V. If the voltage fluctuation is large, the voltage regulator is recommended. (2) Replacement of larger capacity transformers
				Instantaneous power failure	Re-energize after voltage stabilization
				Hardware Fault of Driver Internal Sampling Circuit	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 and needs to be sent back for repair.
	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.
6	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
08	0	E-080	Overspeed (actual speed ≥ P3-21/P3-22) The maximum forward speed is P3-21 and the	Motor code not match	Check if the driver P0-33 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.

				maximum reverse speed is P3-22.	UVW wiring error	Inspection of motor UVW wiring, need to be connected in phase sequence.
					Motor speed too fast	(1) The maximum speed limit value P3-21/P3-22 was reduced. (2) To confirm whether the external force makes the motor rotate too fast, whether the pulse input frequency is too high, and whether the electronic gear ratio is too large.
					Encoder fault	(1) Check the encoder cable or change a new one (2) Set the servo driver to BB state and the driver to U-10. Rotate the motor shaft slowly by hand to see if the value of U-10 changes normally, increasing in one direction and decreasing in one direction (0-9999 cycle display).
					Parameter setting	When the actual speed is greater than the value of P3-21/P3-22, the alarm will be given.
		E-092	Analog Tref Zero-Calibration Over limit		Analog Zero Calibration Operation Error	Please correct zero without analog voltage
		E-093	Analog Vref Zero-Calibration Over limit		Analog Zero Calibration Operation Error	Please correct zero without analog voltage
10	0	E-100	Position offset too large		In position control, the difference between the given position and the actual position exceeds the limit value.	(1) Observe whether the motor is blocked or not. (2) Reducing the given speed of position; (3) Increase the deviation pulse limit P0-23.
11	0	E-110	External UVW Short Circuit Discovered in Self-Inspection		Not match the motor code	Check if the driver P0-33 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.
					UVW wiring error	Inspection of motor UVW wiring, need to be in phase sequence (brown U, black V, blue W)
					Driver UVW Output Short Circuit or Motor Failure	(1) Measure whether the UVW phase resistance of the motor is balanced. If the phase resistance is unbalanced, replace the motor. (2) Measure whether there is short circuit between UVW and PE of the motor. If there is short circuit, replace the motor. (3) Measure the driver side UVW output through multimeter (diode gear), black pen P+, red pen to measure UVW; red pen P-, black pen to measure UVW; if anyone is 0 in 6 groups of value, replace the driver.
					Load part is blocked	It is suggested that the motor should

					be operated on an empty shaft to eliminate the load problem.
				High-speed start-stop instantaneous alarm	Increasing Acceleration and Deceleration Time
				Encoder problem	(1) Check the encoder cable or change a new one (2) Set the servo driver to BB state and the driver to U-10. Rotate the motor shaft slowly by hand to see if the value of U-10 changes normally, increasing in one direction and decreasing in one direction (0-9999 cycle display).
12	0	E-120	Abnormal Current Sensor	Current Sensor Damage or External Interference too serious	Check whether grounding is normal or not. If alarm cannot be ruled out, please contact the agent or manufacturer.
	1	E-121	Abnormal Zero Value of U Phase Current Sampling	Current Sensor Damage or External Interference too serious	Check whether grounding is normal or not. If alarm cannot be ruled out, please contact the agent or manufacturer.
	2	E-122	Abnormal Zero Value of V Phase Current Sampling	Current Sensor Damage or External Interference too serious	Check whether grounding is normal or not. If alarm cannot be ruled out, please contact the agent or manufacturer.
13	0	E-150	Power cable disconnection	Any phase in UVW of driver, cable or motor broken	Disconnect the power supply of the driver and check the connection of the power cable. It is suggested that the multimeter be used to test the condition. After eliminating the errors, the driver should be re-energized.
16	1	E-161	Driver thermal power overload	Not match the motor code	Check if the driver P0-33 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	Eliminate mechanical distortion. Reduce load

20	0	E-200			distorted.
				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 connection of motor cable to other shafts leads to incorrect wiring.	Detection of servo wiring, the motor cable, encoder cable are correctly connected to the corresponding shaft.
				Poor gain adjustment results in motor vibration, back and forth swing and abnormal noise.	Readjustment of gain parameters
				Driver or motor hardware failure;	There are servo cross test or motor empty shaft on site, F1-01 trial operation, F1-00 jog run can not rotate uniformly; Replace the new driver or motor and send the malfunction machine back to the manufacturer for repair.
	5	E-165	Anti-blocking alarm Judging that the current motor output torque is greater than P3-28/P3-29 (internal forward/reverse torque limit), and the time reaches P0-74 (unit ms), and the speed is lower than P0-75 (unit 1 rpm).	(1) Machinery is impacted, suddenly becomes heavier and distorted; (2) When the brake of the motor 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.
20	0	E-200	Regenerative resistance overload	High Voltage Fluctuation in Power Grid	Stable the input voltage
				Selection of regenerative	Replacement of higher power regenerative resistors (refer to

				resistance is too small	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 error), then the servo driver is faulty and needs to be sent back for repair.
22	0	E-220	Communication error of absolute servo encoder Absolute value servo encoder battery low voltage alarm (can shield this alarm) Absolute value servo encoder data access alarm	Motor matching error	Check if the motor matches correctly
				Unconnected encoder cable or poor contact	Disconnect the power supply of the driver, check the connection of the encoder cable, if there is cable loosening, it is recommended to use the multimeter to test the conduction condition; after eliminating errors, power on again Hot plugging is strictly prohibited, and special cables are required for tank chains.
				Received encoder data errors, and the number of errors exceeds the number of error retries of encoder registers P0-56	Encoder wire and strong power do not 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
	2	E-222	Absolute Servo Encoder Value Overflow Communication error of absolute servo encoder	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 not 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	Absolute value servo encoder battery low voltage alarm (can shield this alarm)	Usually the problem of the encoder itself, or the power supply of the encoder is unstable.	In the absence of batteries, this alarm may occur when the encoder cable is disconnected.
	8	E-228	Absolute value servo encoder data access alarm	Motor continues to run in one direction, encoder data value is too large, overflow	(1) F1-06=1 is used to clear cycles of the absolute value encoder (2) The alarm can be shielded by P0-79=1.
26	0	E-260	Over range alarm	Overrun signal was detected and the overrun processing mode was configured to alarm	If you do not 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.
	4	E-264	Excessive vibration	(1) Oscillation caused by external forces (2) Load inertia is large and the setting of load inertia ratio is wrong or the gain is too small, which leads to the oscillation of positioning.	(1) Check the source of external force to see if there are any problems in mechanical installation; (2) Increase the servo gain to improve the anti-disturbance ability; (3) Acquisition speed curve analysis; When the first three peaks are convergenced after pulse instruction completed (0.8* | first peak | > | second peak | and 0.8* | second peak | > | third peak |), the driver should not alarm, which can adjust the relevant threshold. When the first three peaks speed are not less than 300 rpm for three consecutive times after the completion of the pulse instruction, the driver will alarm. (4) Contact manufacturers for technical support
28	0	E-280	read motor code inside encoder error	Encoder cable disconnected	Check the encoder cable
30	0	E-300	motor code error	Motion bus communication abnormal	Check the motion bus wiring

31	0	E-310	motor code lost	Motor code is error	Set correct motor code and power on again
	1	E-311	The motor code does not match the software version	Not set motor code	Set the motor code in P0-33
	4	E-314	Over range alarm	Update the motor parameters or software version	Contact the manufacturers

8 Appendix

Appendix 1. PX-XX parameters list

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.

"Δ" means modifying anytime and take effect when the motor doesn't rotate.

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:

PX-XX=n. x x x x

             └→ PX-XX.0
           → PX-XX.1
        → PX-XX.2
      → PX-XX.3
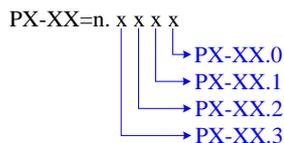
P0-XX：

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P0-01	**Control mode 1** 1-Internal Torque Mode 2-External Analog Torque Mode 3-Internal speed Model 4-External Analog speed Mode 5-Internal Location Mode 6-External Pulse	-	6	1~10	○	1|2|3|4|5|6|7|10	5.1

	Position Mode 7-External Pulse speed Mode 8-XNET Bus Torque Mode 9-XNET Bus Speed Mode 10-XNET Bus Location Mode						
P0-02	**Control mode 2** (ditto)	-	6	1~10	○	1|2|3|4|5|6|7|10	<u>5.1</u>
P0-03	**Enabling mode** 0-not enabled 1-IO enable 2-Software Enablation 3-XNET Bus Enablation	-	1	0~3	○	1|2|3|4|5|6|7|10	<u>5.2.1</u>
P0-04	Rigidity grade	-	20P1：0 20P2/20P4/20P7：15 >=21P5：10	0~63	△	1|2|3|4|5|6|7|10	<u>6.4</u>
P0-05	**Definition of rotation direction** 0- positive mode 1- negative mode	-	0	0~1	●	1|2|3|4|5|6|7|10	<u>5.2.2</u>
P0-07	First inertia ratio	1%	20P1：800 >20P1：200	0~50000	√	1|2|3|4|5|6|7|10	-
P0-09.0	Forward Direction of Input Pulse Instruction 0-Forward Pulse Counting 1-Reverse Pulse Counting	-	0	0~1	○	6|7	<u>5.3.2</u>
P0-09.2	Input pulse command filter time	-	F	0~F	●	6|7	<u>5.3.2</u>
P0-09.3	Predistribution of input pulse command filter	-	0	0~7	●	6|7	<u>5.3.2</u>
P0-10.0	0-CW/CCW 1-AB 2-P+D	-	2	0~2	○	6|7	<u>5.3.2</u>
P0-11～P0-12	Number of instruction pulses per cycle 0: Electronic gear ratio Non-0: Number of command pulses required for motor rotation	1 pul	10000	0~99999999	○	5|6	<u>5.3.3</u>

P0-13	Electronic Gear Numerator	-	1	0~65535	○	5|6	5.3.3
P0-14	Denominator of Electronic Gear	-	1	0~65535	○	5|6	5.3.3
P0-15	pulse frequency corresponding to rated speed	100Hz	1000	1~10000	○	7	5.7.3
P0-16	speed command pulse filter time	0.01ms	100	0~10000	○	7	5.7.4
P0-23	pulse offset limit	0.01 circles	2000	0~65535	√	5|6|10	5.3.9
P0-24	Version 3640 and before this parameter is the choice of discharge resistance type 0: built in 1: external Version 3700 and later this parameter is invalid, the software automatically determines the built-in and external	-	0	0~1	○	1|2|3|4|5|6|7|10	1.4.1
P0-25	Power Value of Discharge Resistance	W	20P7：50 Others：100 80(set as driver model)	1~65535	○	1|2|3|4|5|6|7|10	1.4.1
P0-26	Discharge resistance value	Ω	50(set as driver model)	1~500	○	1|2|3|4|5|6|7|10	1.4.1
P0-27	Servo shutdown the enable stop mode 0-Inertial Operation Stop 2-deceleration stop	-	0	0~5	○	1|2|3|4|5|6|7|10	5.2.3
P0-28	Servo Overrun Stop Mode 0-deceleration stop 1 1-Inertial Stop 2-deceleration stop 2 3-Alarm Stop	-	2	0~3	○	1|2|3|4|5|6|7|10	5.2.3
P0-29	Servo Alarm Stop Mode 0-Inertial	-	2	0~2	○	1|2|3|4|5|6|7|10	5.2.3

	Operation Stop 2-deceleration stop						
P0-30	stop timeout time	1ms	20000	0~65535	○	1|2|3|4|5|6|7|10	5.2.3
P0-31	Deceleration stop time	1ms	25	0~5000	○	1|2|3|4|5|6|7|10	5.2.3
P0-33	Set the motor code	-	0	0~ffff	●	1|2|3|4|5|6|7|10	4.7
P0-53	Read motor parameter alarm shield bit 0-not shield alarm 1-shield alarm	-	0	0~1	●	1|2|3|4|5|6|7|8|9|10	-
P0-69	Fan switch Turn on the fan when the temperature greater than 45℃ and turn off the fan when less than 42℃ (hysteresis 3℃) 1 - Turn on the fan after enabling, turn off the fan when not enabling	-	1	0~1	√	1|2|3|4|5|6|7|10	-
P0-74	Blocking alarm time	ms	0	0~65535	√	1|2|3|4|5|6|7|10	5.2.7
P0-75	Blocking alarm speed	rpm	50	5~9999	√	1|2|3|4|5|6|7|10	5.2.7
P0-79	Absolute Encoder Battery Undervoltage Alarm Switch (firmware version 20160304 and later) 0-Battery Undervoltage Alarm Effective 1-Shielded Battery Undervoltage Alarm	-	1	0~1	●	1|2|3|4|5|6|7|10	5.11.1
P0-80	Thermal Power Protection of Motor 0-current protection 1-Average Thermal Power Protection 2-Analog Thermal Power Protection	-	2	0~2	●	1|2|3|4|5|6|7|10	-

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P0-92～ P0-93	32-bit electronic gear ratio numerator. take effect when P0-11～P0-14 is 0. P0-92*1 + P0-93 *10000	-	1	1~9999 / 1~65535	○	5|6	5.3.3
P0-94～ P0-95	32-bit electronic gear ratio denominator. take effect when P0-11～P0-14 is 0. P0-94*1 + P0-95 *10000	-	1	1~9999 / 1~65535	○	5|6	5.3.3

P1-XX：

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P1-00	First speed loop gain	0.1Hz	20P1：400 Others：200	10~20000	√	1|2|3|4|5|6|7|10	6.1
P1-01	Integral Time Constant of the First Speed Loop	0.01ms	20P1：1650 Others：3300	15~51200	√	1|2|3|4|5|6|7|10	6.1
P1-02	First position loop gain	0.1/s	20P1：400 Others：200	10~20000	√	1|2|3|4|5|6|7|10	6.1
P1-10	Speed feedforward gain	1%	0	0~300	√	5|6|7|10	6.1
P1-11	Speed feedforward filter time	0.01ms	50	0~10000	√	5|6|7|10	6.1
P1-22	Speed Instruction Filter Selection 0-first order low pass filter 1-Smooth Average Filter	-	0	0~1	○	3|4|7	5.6
P1-23	speed instruction filter time	0.1ms	0	0~65535	○	3|4|7	5.6
P1-24	position instruction first order low pass filter time	0.1ms	0	0~65535	△	5|6|10	5.3
P1-25	position instruction smooth filter time	0.1ms	0	0~65535	△	5|6|10	5.3

P2-XX：

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P2-00.0	Disturbance observer switch 0- OFF 1- ON	-	0	0~1	○	1|2|3|4|5|6|7|10	6.1

P2-01.0	Adaptive mode switch 0-OFF 1-ON	-	20P1：0 Others：1	0~1	●	1|2|3|4|5|6|7|10	6.1
P2-01.1	Adaptive level 0-high response 1-low noise	-	20P2/20P4/ 20P7/21P5：1 Others：0	0~1	●	1|2|3|4|5|6|7|10	-
P2-02.0	Auto-tuning mode 1-soft 2-fast positioning 3-fast positioning, control the overshoot	-	3	1~3	√	1|2|3|4|5|6|7|10	6.5
P2-02.2	Load type (valid only during auto-tuning) 1- synchronous belt 2- screw rod 3-Rigid Connection	-	2	1~3	√	1|2|3|4|5|6|7|10	6.5.4
P2-03.3	Adaptive load type 0-Small Inertia Mode 1-Large Inertia Mode	-	0	0~1	●	1|2|3|4|5|6|7|10	6.3
P2-05	Adaptive mode speed loop gain (standard)	0.1Hz	20P1/20P2/ 20P4/20P7： 400 >=21P5：200	1~65535	○	1|2|3|4|5|6|7|10	6.1
P2-07	Adaptive mode inertia ratio (standard)	%	0	0~10000	○	1|2|3|4|5|6|7|10	6.1
P2-08	Gain of adaptive mode speed observer (standard)	Hz	20P1/20P2/ 20P4/20P7： 60 >=21P5：40	10~1000	○	1|2|3|4|5|6|7|10	6.1
P2-12	Maximum Inertia Ratio of Adaptive Mode (Standard)	-	30	1~10000	○	1|2|3|4|5|6|7|10	6.1
P2-15	Inertia Identification and Internal Instruction Auto-tuning Maximum Travel	0.01r	100	1~3000	√	1|2|3|4|5|6|7|10	6.3
P2-17	Maximum Speed of Inertia Identification and Internal Instruction Auto-tuning	-	0	0~65535	√	1|2|3|4|5|6|7|10	6.3
P2-18	Initial Inertia Ratio of Inertia Identification	%	500	1~20000	√	1|2|3|4|5|6|7|10	6.3
P2-19	Adaptive mode bandwidth	%	20P1：100 20P2，20P4：	1~100	○	1|2|3|4|5|6|7|10	6.2

			70 >=20P7：50				
P2-35	Torque Instruction Filtering Time Constant 1	0.01ms	100	0~65535	√	1|2|3|4|5|6|7|10	6.1
P2-36	Torque Instruction Filtering Time Constant 2	0.01ms	100	0~65535	√	1|2|3|4|5|6|7|10	-
P2-41	Disturbance Torque Compensation Coefficient (Non-adaptive Mode Effective)	%	99	0~100	√	1|2|3|4|5|6|7|10	6.1
P2-47.0	Model Loop Switch 0-OFF 1-ON	-	0	0~f	√	3|4|5|6|7|10	6.1
P2-49	Model loop gain	0.1Hz	500	10~20000	√	3|4|5|6|7|10	6.1
P2-60.0	Active Vibration Suppression Switch 0-OFF 1-ON	-	0	0~1	√	3|4|5|6|7|10	6.5
P2-60.1	Active Suppression Auto-tuning Switch 0-Active Vibration Suppression is not Configured in auto-tuning 1- configure the Active Vibration Suppression when auto-tuning	-	1	0~1	√	3|4|5|6|7|10	6.5
P2-61	Active Vibration Suppression frequency	0.1Hz	10000	10~20000	√	1|2|3|4|5|6|7|10	6.5
P2-62	Active Vibration Suppression gain	%	100	1~1000	√	1|2|3|4|5|6|7|10	6.5
P2-63	Active Vibration Suppression damping	%	100	0~300	√	1|2|3|4|5|6|7|10	6.5
P2-64	Active Vibration Suppression frequency 1	-	0	-10000~10000	√	1|2|3|4|5|6|7|10	-
P2-65	Active Vibration Suppression frequency 2	-	0	-10000~10000	√	1|2|3|4|5|6|7|10	-
P2-69.0	Notch filter 1 switch	-	0	0~1	√	1|2|3|4|5|6|7|10	6.5
P2-69.1	Notch filter 2 switch	-	0	0~1	√	1|2|3|4|5|6|7|10	6.5
P2-69.3	Notch filter 3 switch	-	0	0~1	√	1|2|3|4|5|6|7|10	-
P2-70.0	Notch filter 4 switch	-	0	0~1	√	1|2|3|4|5|6|7|10	-
P2-70.1	Notch filter 5 switch	-	0	0~1	√	1|2|3|4|5|6|7|10	-
P2-71	First notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7|10	6.5
P2-72	First notch	0.1dB	70	50~1000	√	1|2|3|4|5|6|7|10	6.5

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
	attenuation						
P2-73	First notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7|10	6.5
P2-74	Second notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7|10	6.5
P2-75	Second notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7|10	6.5
P2-76	Second notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7|10	6.5
P2-77	Third notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7|10	6.7
P2-78	Third notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7|10	6.7
P2-79	Third notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7|10	6.7
P2-80	Fourth notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7|10	6.7
P2-81	Fourth notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7|10	6.7
P2-82	Fourth notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7|10	6.7
P2-83	Fifth notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7|10	6.7
P2-84	Fifth notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7|10	6.7
P2-85	Fifth notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7|10	6.7

P3-XX：

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P3-00	V-REF Function Allocation 0-V-REF as Speed Instruction Input 1-V-REF will be used as input reference value of external speed limit. The actual speed limit depends on the speed limit of external analog quantity. 2-Speed Feedforward	-	0	0~2	○	1|2|4	5.5
P3-01	Analog voltage corresponding to rated speed (5E/5L not support)	0.001V	10000	1500~30000	○	1|2|4	5.5
P3-02	Analog voltage speed	0.01ms	0	0~10000	√	1|2|4	5.5

	filter (5E/5L not support)					
P3-03	Speed instruction input dead zone voltage (5E/5L not support)	0.001v	0	0~500	√	1|2|4	5.5
P3-04	V-REF analog speed direction(5E/5L not support)	-	0	0~1	√	1|2|4	5.5
P3-05	Preset speed 1	rpm	0	-9999~9999	√	3	5.6.2
P3-06	Preset speed 2	rpm	0	-9999~9999	√	3	5.6.2
P3-07	Preset speed 3	rpm	0	-9999~9999	√	3	5.6.2
P3-09	Acceleration time	ms	0	0~65535	○	3|4|7	5.6.3
P3-10	Deceleration time	ms	0	0~65535	○	3|4|7	5.6.3
P3-12	Zero-speed clamping mode	-	0	0~3	○	3|4|7	5.6.6
P3-13	Zero-speed clamping speed	rpm	10	0~300	○	3|4|7	5.6.6
P3-14	Forward Maximum Speed Instruction Limit	rpm	4000	0~10000	○	1|2|3|4|5|6|7|10	5.6.5
P3-15	Reverse Maximum Speed Instruction Limit	rpm	4000	0~10000	○	1|2|3|4|5|6|7|10	5.6.5
P3-16	Internal Forward Speed Limitation in Torque Control	rpm	2000	5~10000	√	1|2	5.9.3
P3-17	Internal Reverse Speed Limitation in Torque Control	rpm	2000	5~10000	√	1|2	5.9.3
P3-18	Jogging speed	rpm	100	0~1000	○	1|2|3|4|5|6|7|10	4.4.2
P3-19	forward warning speed	rpm	3000	0~10000	○	1|2|3|4|5|6|7|10	5.12.2
P3-20	reverse warning speed	rpm	3000	0~10000	○	1|2|3|4|5|6|7|10	5.12.2
P3-21	forward alarming speed	rpm	4000	0~10000	○	1|2|3|4|5|6|7|10	5.6.10
P3-22	reverse alarming speed	rpm	4000	0~10000	○	1|2|3|4|5|6|7|10	5.6.10
P3-23	T-REF Function Allocation 0 - Input as Torque Instruction 1 - As a necessary condition for limiting input of external torque, the minimum value is valid compared with P3-28/P3-29.	-	0	0~2	○	2|3|4|5|6|7|10	5.5/5.8

	2-Torque Feedforward						
P3-24	analog value corresponding to rated torque (5E/5L not support)	0.001V	10000	1500~30000	○	2|3|4|5|6|7|10	5.8
P3-25	Analog Voltage Torque Filtering Time(5E/5L not support)	0.01ms	0	0~10000	√	2|3|4|5|6|7|10	5.8
P3-26	Torque instruction input dead-zone voltage (5E/5L not support)	0.001V	0	0~500	√	2|3|4|5|6|7|10	5.8
P3-27	Analog Torque Forward Direction (5E/5L not support) 0-forward 1-reverse	-	0	0~1	○	2|3|4|5|6|7|10	-
P3-28	Internal forward torque limit	%	300	0~1000	√	1|2|3|4|5|6|7|10	5.6.7
P3-29	Internal reverse torque limit	%	300	0~1000	√	1|2|3|4|5|6|7|10	5.6.7
P3-30	external forward torque limit	%	300	0~1000	√	1|2|3|4|5|6|7|10	5.6.7
P3-31	external reverse torque limit	%	300	0~1000	√	1|2|3|4|5|6|7|10	5.6.7
P3-32	Brake torque	1%	300	0~1000	√	1|2|3|4|5|6|7|10	5.2.3
P3-33	Preset torque	%	0	-1000~1000	√	1	5.9.2
P3-45	Torque mode switching delay	ms	40	0~9999	√	1|2	-

P4-XX：

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P4-00.0	Z phase signal numbers The Z phase signal numbers after leaving the limit switch (note: stop when N+1 Z phase signal reached)	pcs	2	0~f	○	5|6|10	5.4.7
P4-00.1	Search the origin function 0-OFF 1-ON	-	0	0~1	○	5|6|10	5.4.7
P4-00.2	return to zero overrun prohibition 0-not prohibit 1-prohibit	-	0	0~1	○	5|6|10	5.4.7
P4-01	Speed of hitting the proximity switch	rpm	600	0~65535	○	5|6|10	5.4.7
P4-02	Speed of leaving proximity switch	rpm	100	0~65535	○	5|6|10	5.4.7
P4-03.0	Internal Location Given Mode Sets	-	0	0~1	○	5	5.4.2

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
	Location Mode 0-relative positioning 1-Absolute positioning						
P4-03.1	Internal Position-Given Mode Sets Step Change Mode 0-step-changing when signal is ON, recyclable 1-change step at signal rising edge, single step execution 2-starting at Signal rising edge, sequential execution of all, no cycle 3-set segment no. through communication 4-/CHSTP dual edge triggerring 5-choose segment no. through the terminal PREFA(P5-57)/PREFB(P5-58)/PREFC(P5-59), can choose 3 segments	-	0	0~5	○	5	5.4.2
P4-03.2	Internal position mode sets waiting mode 0-wait positioning completion 1-not wait positioning completion	-	0	0~1	○	5	5.4.2
P4-04	Valid segment number	-	0	0~35	○	5	5.4.3
P4-10～P4-11	First segment pulse	1pul	0	-327689999~327679999	√	5	5.4.3
P4-12	First segment speed	0.1rpm	0	0~65535	√	5	5.4.3
P4-13	First segment acceleration time	1ms	0	0~65535	√	5	5.4.3
P4-14	First segment deceleration time	1ms	0	0~65535	√	5	5.4.3
P4-16	Adjusting time	1ms	0	0~65535	√	5	5.4.3
P4-10+(n-1)*7 ~ P4-16+(n-1)*7	segment 1 to 35 pulse parameters (n is segment number)	-	-	-	√	5	5.4.3

P5-XX：

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P5-00	Positioning completion width/COIN	Command unit	11	1~65535	√	5|6|10	5.3.6
P5-01	Location Completion Detection Mode	-	0	0~3	√	5|6|10	5.3.6
P5-02	Location completion retention time	ms	0	0~65535	√	5|6|10	5.3.6
P5-03	Rotation Detection Speed	rpm	50	0~10000	√	1|2|3|4|5|6|7|10	5.12.3

P5-04	Same speed detection speed	rpm	50	0~10000	√	1|2|3|4|5|6|7|10	5.6.8
P5-05	Reached detection speed	rpm	1000	0~10000	√	1|2|3|4|5|6|7|10	5.6.9
P5-06	Positioning near output width	Command unit	50	0~65535	√	5|6|10	5.3.7
P5-07	Servo OFF delay time	ms	500	0~65535	○	1|2|3|4|5|6|7|10	5.2.5
P5-08	Brake instruction output speed	rpm	30	20~10000	○	1|2|3|4|5|6|7|10	5.2.5
P5-09	Brake instruction waiting time	ms	500	0~65535	○	1|2|3|4|5|6|7|10	5.2.5
P5-10	user-defined output 1 trigger condition	-	0	0~ffff	√	1|2|3|4|5|6|7|10	5.12.6
P5-11	Set a value that compares with the trigger condition of custom output 1	Relating to trigger condition	0	-9999~9999	√	1|2|3|4|5|6|7|10	5.12.6
P5-12	Select custom output 1 mode	-	0	0~3	√	1|2|3|4|5|6|7|10	5.12.6
P5-13	Setting custom output 1 hysteresis	Relating to trigger condition	0	0~65535	√	1|2|3|4|5|6|7|10	5.12.6
P5-14	Custom Output 2 Trigger Condition	-	0	0~ffff	√	1|2|3|4|5|6|7|10	5.12.6
P5-15	Set a value that compares with the trigger condition of custom output 2	Relating to trigger condition	0	-9999~9999	√	1|2|3|4|5|6|7|10	5.12.6
P5-16	Select custom output 2 mode	-	0	0~3	√	1|2|3|4|5|6|7|10	5.12.6
P5-17	Setting custom output 2 hysteresis	Relating to trigger condition	0	0~65535	√	1|2|3|4|5|6|7|10	5.12.6
P5-18	IO Filtering time multiple	-	1	0~10000	√	1|2|3|4|5|6|7|10	5.12.8
P5-19	Z phase output maintain time	ms	2	1~65535	√	1|2|3|4|5|6|7|10	5.12.5
P5-20.0~1	/S-ON: servo signal 00: Set the signal to be invalid all the time. 01: Input positive signal from SI1 terminal. 02: Input positive signal from SI2 terminal. 03: Input positive signal from SI3 terminal. 04: Input positive	-	01	0~ff	√	1|2|3|4|5|6|7|10	5.2.1

	signal from SI4 terminal. 10: Set the signal to always be "valid". 11: Inverse signal is input from SI1 terminal. 12: Inverse signal is input from SI2 terminal. 13: Inverse signal is input from SI3 terminal. 14: Inverse signal is input from SI4 terminal.						
P5-20.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-21.0~1	/P-CON proportion action instruction	-	00	0~ff	√	1|2|3|4|5|6|7|10	5.6.12
P5-21.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-22.0~1	/P-OT: Forbidden forward driving	-	03	0~ff	√	1|2|3|4|5|6|7|10	5.2.4
P5-22.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-23.0~1	/N-OT: forbidden reverse driving	-	04	0~ff	√	1|2|3|4|5|6|7|10	5.2.4
P5-23.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-24.0~1	/ALM-RST: alarm clear	-	02	0~ff	√	1|2|3|4|5|6|7|10	5.12.1
P5-24.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-25.0~1	/P-CL：External Torque Limitation at Forward Rotation Side	-	00	0~ff	√	1|2|3|4|5|6|7|10	5.6.7
P5-25.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-26.0~1	/N-CL：External Torque Limitation at Reverse Rotation Side	-	00	0~ff	√	1|2|3|4|5|6|7|10	5.6.7
P5-26.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-27.0~1	/SPD-D: Internal Speed Direction Selection	-	00	0~ff	√	1|2|3|4|7	5.6.4
P5-27.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|7	-
P5-28.0~1	/SPD-A: Internal Setting Speed Selection	-	00	0~ff	√	3|5	5.6.4
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	5.6.4

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	√	1|2|3|4|5|6|7|10	5.1.2
P5-30.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-31.0~1	/ZCLAMP: zero position clamping	-	00	0~ff	√	3|4|7	5.6.6
P5-31.2	SI terminal filtering time	ms	0	0~f	√	3|4|7	-
P5-32.0~1	/INHIBIT: Instruction pulse prohibition	-	00	0~ff	√	5|6|7	5.3.8
P5-32.2	SI terminal filtering time	ms	0	0~f	√	5|6|7	-
P5-33.0~1	/G-SEL: gain switching	-	00	0~ff	√	1|2|3|4|5|6|7|10	6.2.7
P5-33.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-34.0~1	/CLR: pulse offset clear	-	00	0~ff	√	5|6|10	5.3.5
P5-34.2	SI terminal filtering time	ms	0	0~f	√	5|6|10	-
P5-35.0~1	/CHGSTP: internal position mode change step signal	-	00	0~ff	√	5	5.4.4
P5-35.2	SI terminal filtering time	ms	0	0~f	√	5	-
P5-36.0~1	/I-SEL: inertia ratio switching	-	00	0~ff	√	1|2|3|4|5|6|7|10	6.2.7
P5-36.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7|10	-
P5-37	/COIN_HD: Location Completion Maintenance 00: No output to terminal 01: Output positive signal from SO1 terminal 02: Output positive signal from SO2 terminal 03: Output positive signal from SO3 terminal 11: Output reverse signal from SO1 terminal 12: Output reverse signal from SO2 terminal. 13: Output reverse Signal from SO3 terminal	-	0000	0~ffff	√	5|6|10	5.3.6
P5-38	/COIN: positioning completion	-	0001	0~ffff	√	5|6|10	5.3.6

P5-39	/V-CMP: same speed detection	-	0000	0~ffff	√	3|4|7	5.6.8
P5-40	/TGON: rotation detection	-	0000	0~ffff	√	1|2|3|4|5|6|7|10	5.12.3
P5-41	/S-RDY: ready	-	0000	0~ffff	√	1|2|3|4|5|6|7|10	5.12.4
P5-42	/CLT: torque limit	-	0000	0~ffff	√	1|2|3|4|5|6|7|10	5.6.7
P5-43	/VLT: speed limit detection	-	0000	0~ffff	√	1|2	5.9.4
P5-44	/BK: brake locking	-	0000	0~ffff	○	1|2|3|4|5|6|7|10	5.2.5
P5-45	/WARN: warning	-	0000	0~ffff	√	1|2|3|4|5|6|7|10	5.12.2
P5-46	/NEAR: near	-	0000	0~ffff	√	5|6|10	5.3.7
P5-47	/ALM: alarm	-	0002	0~ffff	√	1|2|3|4|5|6|7|10	5.2.6
P5-48	/Z: encoder Z phase signal output	-	0000	0~ffff	√	1|2|3|4|5|6|7|10	5.12.5
P5-49	/XNETERR: Xnet error signal	-	0	0~ffff	√	10	-
P5-50	/MRUN: internal position mode motion starting signal	-	0000	0~ffff	√	5	5.4.9
P5-51	/V-RDY: speed reached	-	0000	0~ffff	√	3|4|7	5.6.9
P5-52	/USER1: user-defined output 1	-	0000	0~ffff	√	1|2|3|4|5|6|7|10	5.12.6
P5-53	/USER2: user-defined output 2	-	0000	0~ffff	√	1|2|3|4|5|6|7|10	5.12.6
P5-57.0~1	/PREFA: intenral position selection signal A	-	00	0~ff	√	5	5.4.2
P5-57.2	SI terminal filtering time	ms	0	0~f	√	5	-
P5-58.0~1	/PREFB: intenral position selection signal B	-	00	0~ff	√	5	5.4.2
P5-58.2	SI terminal filtering time	ms	0	0~f	√	5	-
P5-59.0~1	/PREFC: internal position selection signal C	-	00	0~ff	√	5	5.4.2
P5-59.2	SI terminal filtering time	ms	0	f~f	√	5	-
P5-60.0~1	/SYNC：(Modbus analog motion bus) update instruction	-	00	0~ff	√	5	-
P5-60.2	SI terminal filtering time	ms	0	0~f	√	5	-
P5-61.0~1	/TRAJ-START: Motion start trigger signal	-	00	0~ff	√	5	-
P5-61.2	SI terminal filtering time	ms	0	0~f	√	5	-
P5-70	/SRDY: Output Conditions Selection 0: This terminal is turned on after initialization of the	-	0	0~1	√	1|2|3|4|5|6|7|10	5.12.4

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
	driver is completed 1: This terminal will not turn on until enabled.						
P5-71	Function Selection of Directional Terminal of Pulse Speed Mode	-	0	0~1	√	7	-

P6-XX：

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P6-05	Adaptive Mode Speed Loop Gain (Large Inertia)	0.1Hz	200	1~65535	○	1|2|3|4|5|6|7|10	6.2.4
P6-07	Adaptive mode inertia ratio (Large inertia)	%	50	0~10000	○	1|2|3|4|5|6|7|10	6.2.4
P6-08	Gain of adaptive mode speed observer (large inertia)	Hz	40	10~1000	○	1|2|3|4|5|6|7|10	6.2.4
P6-12	Maximum Inertia Ratio of Adaptive Mode (Large Inertia)	-	50	1~10000	○	1|2|3|4|5|6|7|10	6.2.4

P7-XX：

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode	Reference chapter
P7-00	RS485 station no.	-	1	0~100	○	1|2|3|4|5|6|7|10	3.1.4
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	Baud rate	06	0~16	○	1|2|3|4|5|6|7|10	-

	12：2M 13：3M 14：4M 15：5M 16：6M						
P7-01.2	RS485 stop bit 0：2 bits 2：1 bit	Stop bit	2	0~2	○	1|2|3|4|5|6|7|10	-
P7-01.3	RS485 parity bit 0-no parity 1-odd parity 2-even parity	Parity bit	2	0~2	○	1|2|3|4|5|6|7|10	-
P7-02	RS485 communication protocol 1-Modbus Rtu protocol 2-Xnet bus protocol 3-read Xnet bus torque	-	1	1~255	○	1|2|3|4|5|6|7|10	<u>5.10</u>
P7-03	Xnet Synchronized sampling time	1ms	9	1~500	○	10	<u>5.10</u>
P7-04	Xnet slave station data	-	15	1~500	○	10	<u>5.10</u>
P7-05	Xnet slave station numbers	-	10	1~20	○	10	<u>5.10</u>
P7-06	Number of communication overtime retries	times	10	1~500	○	10	<u>5.10</u>
P7-07	Bus instruction refresh cycle	1us	3000	1~65535	○	10	<u>5.10</u>
P7-08	Compensation Threshold of Position Deviation	-	0	0~0	○	10	<u>5.10</u>
P7-09	Compensation times for Position Deviation	-	0	0~0	○	10	<u>5.10</u>
P7-10	RS232 station no.	-	1	0~100	○	1|2|3|4|5|6|7|10	-
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	Baud rate	06	0~16	○	1|2|3|4|5|6|7|10	-

	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						
P7-11.2	RS232 stop bit 0：2-bit 2：1 bit	Stop bit	2	0~2	○	1|2|3|4|5|6|7|10	-
P7-11.3	RS232 parity bit 0-no parity 1-odd parity 2-even parity	Parity bit	2	0~2	○	1|2|3|4|5|6|7|10	-
P7-20	Return to zero direction (bus)	-	1	-9999~99999	○	10	5.10
P7-21	Filtering time after return to zero(bus)	ScanA Cycle	400	1~65535	○	10	5.10

Appendix 2. UX-XX monitoring parameters

U0-XX：

Code	Contents		Unit
U0-00	servo motor speed		Rpm
U0-01	Input speed instruction		Rpm
U0-02	Torque instruction		% rated
U0-03	Mechanical angle		1 °
U0-04	Electric angle		1 °
U0-05	Bus voltage		V
U0-06	IPM temperature		℃
U0-07	Torque feedback		% rated
U0-08	pulse offset	(0000～9999)*1	Instruction pulse
U0-09		(0000～65535)*10000	
U0-10	Encoder feedback	(0000～9999)*1	Encoder pulse
U0-11		(0000～65535)*10000	
U0-12	input instruction pulse numbers	(0000～9999)*1	Instruction

U0-13		(0000～65535)*10000	pulse
U0-14	position feedback	(0000～9999)*1	Instruction pulse
U0-15		(0000～65535)*10000	
U0-16	encoder accumulated position	(0000～9999)*1	Encoder pulse
U0-17		(0000～65535)*10000	
U0-18	Torque current		0.01A
U0-19	Analog input V-REF value		0.01V
U0-20	Analog input T-REF value		0.01V
U0-21	Input signal status 1		
U0-22	Input signal status 2		
U0-23	output signal status 1		
U0-24	ouput signal status 2		
U0-25	Input pulse frequency	(0000～9999)*1	1Hz
U0-26		(0000～9999)*10000	
U0-37	VREF AD Raw value		
U0-38	TREF AD Raw value		
U0-41	Instantaneous output power		1W
U0-42	Average output power		1W
U0-43	Instantaneous thermal power		1W
U0-44	average thermal power		1W
U0-49	position feedforward		1 command unit
U0-50	speed feedforward		rpm
U0-51	torque feedforward		% rated
U0-52	Instantaneous Bus Capacitor Power		1W
U0-53	Average Bus Capacitor Power		1W
U0-55	Discharge power of instantaneous regenerative braking		1W
U0-56	Average regenerative brake discharge power		1W
U0-57	Absolute encoder present position feedback low 32-bit	(0000～65536)*1	Encoder pulse
U0-58		(0000～65536)*10000	
U0-59	Absolute encoder present position feedback high 32-bit	(0000～65536)*1	Encoder pulse
U0-60		(0000～65536)*10000	
U0-61	Xnet communication error amounts		
U0-62	Xnet Communication Waiting Synchronization Frame State Interference		
U0-63	Xnet Communication Waiting for Synchronization Frame State Receiving Data Frame		
U0-64	Xnet Communication Waiting Data Frame State Interference		
U0-65	Xnet Communication Waiting for Data Frame Status Receive Synchronized Frame		
U0-66	Xnet communication CRC parity error		
U0-67	Xnet communication UART error		
U0-68	Xnet communication timeout counting		
U0-69	communication encoder timeout counting		
U0-89	Real-time speed feedback (displaying range -99.99~99.99rpm)		0.01rpm
U0-91	Multi-circle absolute motor circles		
U0-94	Encoder feedback position after calibration	（0000～65536）*1	Encoder pulses
U0-95		（0000～65536）*2^{16}	

U0-96		$（0000\sim65536）*2^{32}$	
U0-97		$（0000\sim65536）$	

U1-XX：

Code	Contents	Unit
U1-00	present alarm code	
U1-01	present warning code	
U1-02	U phase current when alarming	0.01A
U1-03	V phase current when alarming	0.01A
U1-04	bus voltage when alarming	V
U1-05	IGBT temperature when alarming	℃
U1-06	torque current when alarming	0.01A
U1-07	excitation current when alarming	A
U1-08	position offset when alarming	Instruction pulse
U1-09	speed when alarming	rpm
U1-10	Seconds(low 16-bit) when alarming, cumulated seconds from the first time power-on	s
U1-11	Seconds(high 16-bit) when alarming, cumulated seconds from the first time power-on	s
U1-12	this time running error numbers, counting after power on this time	
U1-13	this time operation warning numbers, counting after power on this time	
U1-14	historical alarm amounts	
U1-15	historical warning amounts	
U1-16	Recent 2nd alarm code	
U1-17	Recent 3rd alarm code	
U1-18	Recent 4th alarm code	
U1-19	Recent 5th alarm code	
U1-20	Recent 6th alarm code	
U1-21	Recent 2nd warning code	
U1-22	Recent 3rd warning code	
U1-23	Recent 4th warning code	
U1-24	Recent 5th warning code	
U1-25	Recent 6th warning code	

U2-XX：

Code	Contents	Unit
U2-00	Power on times	
U2-01	series	
U2-02	Model (low 16-bit)	
U2-03	Model (high 16-bit)	
U2-04	out of factory date: year	
U2-05	out of factory date: month	
U2-06	out of factory date: day	
U2-07	Firmware version	
U2-08	Hardware version	
U2-09	Total running time (from the first time power on)	hour
U2-10	Total running time (from the first time power on)	minute
U2-11	Total running time (from the first time power on)	second
U2-12	This time running time (from this time power on)	hour

U2-13	This time running time (from this time power on)	minute
U2-14	This time running time (from this time power on)	second
U2-15	Average output power (from the first time enabled, average power in the process of enabling)	1W
U2-16	Average thermal power (from the first time enabled, average power in the process of enabling)	1W
U2-17	Average bus capacitor filter power (from the first time power on, average power in the process of power on)	1W
U2-20	Device serial no.: low 16-bit	
U2-21	Device serial no.: high 16-bit	
U2-22	Firmware generation date: year	
U2-23	Firmware generation date:month/day	
U2-24	Firmware generation date: hour/minute	

Appendix 3. FX-XX auxiliary function parameters

Code	Contents	Effective	Refrence chapter
F0-00	Clear the alarm	Servo OFF	4.4.1
F0-01	Restore to out of factory settings	Servo OFF	4.4.1
F0-02	clear the position offset	Servo OFF	4.4.1
F1-00	Jog run	Servo OFF	4.4.2
F1-01	Test run	Servo OFF	4.4.2
F1-02	Current Sampling Zero-correction	Servo OFF	4.4.2
F1-03	Vref (speed analog) zero-correction	Servo OFF	4.4.2
F1-04	Tref (torque analog) zero-correction	Servo OFF	4.4.2
F1-05	software enable	Servo OFF	4.4.2
F1-06	Clear multi-turn data, clear alarm	Servo OFF	5.11.4

Appendix 4. Modbus address list

Parameter	Modbus address	Notes
P0-00~P0-xx	0x0000~0x0063	Modbus address is added 1 in turn from 0x0000, for example, Modbus address of P0-23 is 0x0017
P1-00~P1-xx	0x0100~0x0163	Modbus address is added 1 in turn from 0x0100, for example, Modbus address of P1-10 is 0x010A
P2-15~P2-xx	0x020F~0x0263	Modbus address is added 1 in turn from 0x020F, for example, Modbus address of P2-16 is 0x0210
P3-00~P3-xx	0x0300~0x0363	Modbus address is added 1 in turn from 0x0300, for example, Modbus address of P3-13 is 0x030D
P4-00~P4-xx	0x0400~0x0463	Modbus address is added 1 in turn from 0x0400, for example, Modbus address of P4-25 is 0x0419
P5-00~P5-xx	0x0500~0x0563	Modbus address is added 1 in turn from 0x0500, for example, Modbus address of P5-20 is 0x0514
P6-00~P6-xx	0x0600~0x0663	Modbus address is added 1 in turn from 0x0600, for example, Modbus address of P6-05 is 0x0605
P7-00~P7-xx	0x0700~0x0763	Modbus address is added 1 in turn from 0x0700, for

		example, Modbus address of P7-11 is 0x070B
U0-00~U0-xx	0x1000~0x1063	Modbus address is added 1 in turn from 0x1000, for example, Modbus address of U0-05 is 0x1005
U1-00~U1-xx	0x1100~0x1163	Modbus address is added 1 in turn from 0x1100, for example, Modbus address of U1-14 is 0x110E
U2-00~U2-xx	0x1200~0x1263	Modbus address is added 1 in turn from 0x1200, for example, Modbus address of U2-08 is 0x1208
F0-00~F0-xx	0x2000~0x2063	Modbus address is added 1 in turn from 0x2000, for example, Modbus address of F0-01 is 0x2001
F1-00~F1-xx	0x2100~0x2163	Modbus address is added 1 in turn from 0x2100, for example, Modbus address of F1-03 is 0x2103

■ **Group P parameters**

parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P0-00	0x0000	0	P0-17	0x0011	17
P0-01	0x0001	1	P0-18	0x0012	18
P0-02	0x0002	2	P0-19	0x0013	19
P0-03	0x0003	3	P0-20	0x0014	20
P0-04	0x0004	4	P0-21	0x0015	21
P0-05	0x0005	5	P0-22	0x0016	22
P0-06	0x0006	6	P0-23	0x0017	23
P0-07	0x0007	7	P0-24	0x0018	24
P0-08	0x0008	8	P0-25	0x0019	25
P0-09	0x0009	9	P0-26	0x001A	26
P0-10	0x000A	10	P0-27	0x001B	27
P0-11	0x000B	11	P0-28	0x001C	28
P0-12	0x000C	12	P0-29	0x001D	29
P0-13	0x000D	13	P0-30	0x001E	30
P0-14	0x000E	14	P0-31	0x001F	31
P0-15	0x000F	15	P0-32	0x0020	32
P0-16	0x0010	16	P0-33	0x0021	33

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P1-00	0x0100	256	P1-15	0x010F	271
P1-01	0x0101	257	P1-16	0x0110	272
P1-02	0x0102	258	P1-17	0x0111	273
P1-03	0x0103	259	P1-18	0x0112	274
P1-04	0x0104	260	P1-19	0x0113	275
P1-05	0x0105	261	P1-20	0x0114	276
P1-06	0x0106	262	P1-21	0x0115	277
P1-07	0x0107	263	P1-22	0x0116	278
P1-08	0x0108	264	P1-23	0x0117	279
P1-09	0x0109	265	P1-24	0x0118	280
P1-10	0x010A	266	P1-25	0x0119	281
P1-11	0x010B	267	P1-26	0x011A	282
P1-12	0x010C	268	P1-27	0x011B	283

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P1-13	0x010D	269	P1-28	0x011C	284
P1-14	0x010E	270			

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P2-00	0x0200	512	P2-15	0x20F	527
P2-01	0x0201	513	P2-16	0x210	528

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P3-00	0x0300	768	P3-19	0x0313	787
P3-01	0x0301	769	P3-20	0x0314	788
P3-02	0x0302	770	P3-21	0x0315	789
P3-03	0x0303	771	P3-22	0x0316	790
P3-04	0x0304	772	P3-23	0x0317	791
P3-05	0x0305	773	P3-24	0x0318	792
P3-06	0x0306	774	P3-25	0x0319	793
P3-07	0x0307	775	P3-26	0x031A	794
P3-08	0x0308	776	P3-27	0x031B	795
P3-09	0x0309	777	P3-28	0x031C	796
P3-10	0x030A	778	P3-29	0x031D	797
P3-11	0x030B	779	P3-30	0x031E	798
P3-12	0x030C	780	P3-31	0x031F	799
P3-13	0x030D	781	P3-32	0x0320	800
P3-14	0x030E	782	P3-33	0x0321	801
P3-15	0x030F	783	P3-34	0x0322	802
P3-16	0x0310	784	P3-35	0x0323	803
P3-17	0x0311	785	P3-36	0x0324	804
P3-18	0x0312	786			

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P4-00	0x0400	1024	P4-15	0x040F	1039
P4-01	0x0401	1025	P4-16	0x0410	1040

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P5-00	0x0500	1280	P5-27	0x051B	1307
P5-01	0x0501	1281	P5-28	0x051C	1308
P5-02	0x0502	1282	P5-29	0x051D	1309
P5-03	0x0503	1283	P5-30	0x051E	1310
P5-04	0x0504	1284	P5-31	0x051F	1311
P5-05	0x0505	1285	P5-32	0x0520	1312
P5-06	0x0506	1286	P5-33	0x0521	1313
P5-07	0x0507	1287	P5-34	0x0522	1314
P5-08	0x0508	1288	P5-35	0x0523	1315
P5-09	0x0509	1289	P5-36	0x0524	1316
P5-10	0x050A	1290	P5-37	0x0525	1317
P5-11	0x050B	1291	P5-38	0x0526	1318

Parameter	Modbus address Hex	Decimal	Parameter	Modbus address Hex	Decimal
P5-12	0x050C	1292	P5-39	0x0527	1319
P5-13	0x050D	1293	P5-40	0x0528	1320
P5-14	0x050E	1294	P5-41	0x0529	1321
P5-15	0x050F	1295	P5-42	0x052A	1322
P5-16	0x0510	1296	P5-43	0x052B	1323
P5-17	0x0511	1297	P5-44	0x052C	1324
P5-18	0x0512	1298	P5-45	0x052D	1325
P5-19	0x0513	1299	P5-46	0x052E	1326
P5-20	0x0514	1300	P5-47	0x052F	1327
P5-21	0x0515	1301	P5-48	0x0530	1328
P5-22	0x0516	1302	P5-49	0x0531	1329
P5-23	0x0517	1303	P5-50	0x0532	1330
P5-24	0x0518	1304	P5-51	0x0533	1331
P5-25	0x0519	1305	P5-52	0x0534	1332
P5-26	0x051A	1306	P5-53	0x0535	1333

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P6-00	0x0600	1536	P6-10	0x060A	1546
P6-01	0x0601	1537	P6-11	0x060B	1547

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
P7-00	0x0700	1792	P7-10	0x070A	1802
P7-01	0x0701	1793			

■ **Group U monitoring parameters**

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
U0-00	0x1000	4096	U0-28	0x101C	4124
U0-01	0x1001	4097	U0-29	0x101D	4125
U0-02	0x1002	4098	U0-30	0x101E	4126
U0-03	0x1003	4099	U0-31	0x101F	4127
U0-04	0x1004	4100	U0-32	0x1020	4128
U0-05	0x1005	4101	U0-33	0x1021	4129
U0-06	0x1006	4102	U0-34	0x1022	4130
U0-07	0x1007	4103	U0-35	0x1023	4131
U0-08	0x1008	4104	U0-36	0x1024	4132
U0-09	0x1009	4105	U0-37	0x1025	4133
U0-10	0x100A	4106	U0-38	0x1026	4134
U0-11	0x100B	4107	U0-39	0x1027	4135
U0-12	0x100C	4108	U0-40	0x1028	4136
U0-13	0x100D	4109	U0-41	0x1029	4137
U0-14	0x100E	4110	U0-42	0x102A	4138
U0-15	0x100F	4111	U0-43	0x102B	4139
U0-16	0x1010	4112	U0-44	0x102C	4140
U0-17	0x1011	4113	U0-45	0x102D	4141
U0-18	0x1012	4114	U0-46	0x102E	4142

U0-19	0x1013	4115	U0-47	0x102F	4143
U0-20	0x1014	4116	U0-48	0x1030	4144
U0-21	0x1015	4117	U0-49	0x1031	4145
U0-22	0x1016	4118	U0-50	0x1032	4146
U0-23	0x1017	4119	U0-51	0x1033	4147
U0-24	0x1018	4120	U0-52	0x1034	4148
U0-25	0x1019	4121	U0-53	0x1035	4149
U0-26	0x101A	4122	U0-57	0x1039	4153
U0-27	0x101B	4123	U0-58	0x103A	4154

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
U1-00	0x1100	4352	U2-00	0x1200	4608
U1-01	0x1101	4353	U2-01	0x1201	4609
U1-02	0x1102	4354	U2-02	0x1202	4610
U1-03	0x1103	4355	U2-03	0x1203	4611
U1-04	0x1104	4356	U2-04	0x1204	4612
U1-05	0x1105	4357	U2-05	0x1205	4613
U1-06	0x1106	4358	U2-06	0x1206	4614
U1-07	0x1107	4359	U2-07	0x1207	4615
U1-08	0x1108	4360	U2-08	0x1208	4616
U1-09	0x1109	4361	U2-09	0x1209	4617
U1-10	0x110A	4362	U2-10	0x120A	4618
U1-11	0x110B	4363	U2-11	0x120B	4619
U1-12	0x110C	4364	U2-12	0x120C	4620
U1-13	0x110D	4365	U2-13	0x120D	4621
U1-14	0x110E	4366	U2-14	0x120E	4622
U1-15	0x110F	4367	U2-15	0x120F	4623
U1-16	0x1110	4368	U2-16	0x1210	4624
U1-17	0x1111	4369	U2-17	0x1211	4625
U1-18	0x1112	4370	U2-20	0x1214	4628
U1-19	0x1113	4371			
U1-20	0x1114	4372			
U1-21	0x1115	4373			
U1-22	0x1116	4374			
U1-23	0x1117	4375			
U1-24	0x1118	4376			
U1-25	0x1119	4377			

Parameter	Modbus address		Parameter	Modbus address	
	Hex	Decimal		Hex	Decimal
F0-00	0x2000	8192	F1-00	0x2100	8448
F0-01	0x2001	8193	F1-01	0x2101	8449
F0-02	0x2002	8194	F1-02	0x2102	8450
F2-09	0x2209	8713	F1-03	0x2103	8451
			F1-04	0x2104	8452
			F1-05	0x2105	8453
			F1-06	0x2106	8454

Appendix 5. Q&A

Q1: What is BB and run on the panel?
1. BB standby state, without enabling, the motor is in the state of power failure.
2. Run running state, with enabling, the motor is in the power on state.

Q2: How to check and set the parameters?
Refer to chapter 4.6

Q3: How to change the parameters in enabled status?
P5-20=0000, enabling is invalid, P5-20=0010, enabling when power on, no need to power on again.
The default value is 0001, which means input signal from SI1, SI1 connects to low voltage, +24V
connects to high voltage (refer to chapter 3.2.2)
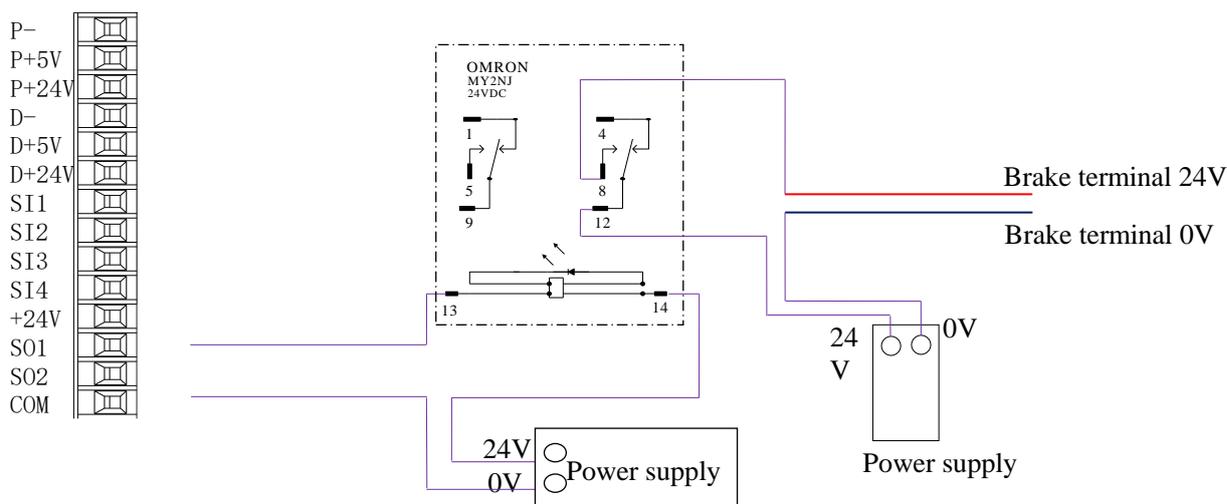
Q4: How to restore out of factory settings?
P5-20=0000 enabling is invalid, F0-01=1.

Q5: Which model supports bus mode?
DS3E series supports XNET communication (max 20-axis)
DS5C series supports EtherCAT communication (max 32-axis)

Q6: How to wiring for brake motor? How to modify parameters for slight slip of brake motor after
power failure?

1. P5-44 defines the terminal of the brake output signal. As shown in the figure above, the SO1 controls
brake, that is, P5-44 = 0001.
2. Extend the delay time of servo OFF P5-07 (default 500ms), and the waiting time of braking
instruction P5-09 is set to 0, which can be responded.

Q7: The initial direction 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-energizing. (For mode 2, 4, 6, 7 only). If the internal speed mode (mode 3) is used, the positive and
negative values of the speed setting can be changed.

Q8: How do the two modes switch to each other?
Both P0-01 main mode and P0-02 sub-mode set the required mode. P5-30=0002 and SI2 are defined as
mode switching terminals. When the SI2 terminal has no signal, it runs according to the set mode in the
main mode P0-01. When the SI2 terminal has signal input, it runs according to the set mode in the
sub-mode P0-02.
Note: SI2 terminal signal can be switched only if it is a constant ON signal.

Q9: What is the connection mode between PLC and servo?
1. NPN low-level output PLC: Y0 pulse connects P-, Y1 direction connects D-, +24V connects P+24, D+24. (Xinje PLC as an example)
PNP high-level output PLC: Q0.0 pulse connects P+24, Q0.2 direction connects D+24, 0V connects P-, D-. (Siemens PLC as an example) as follows:
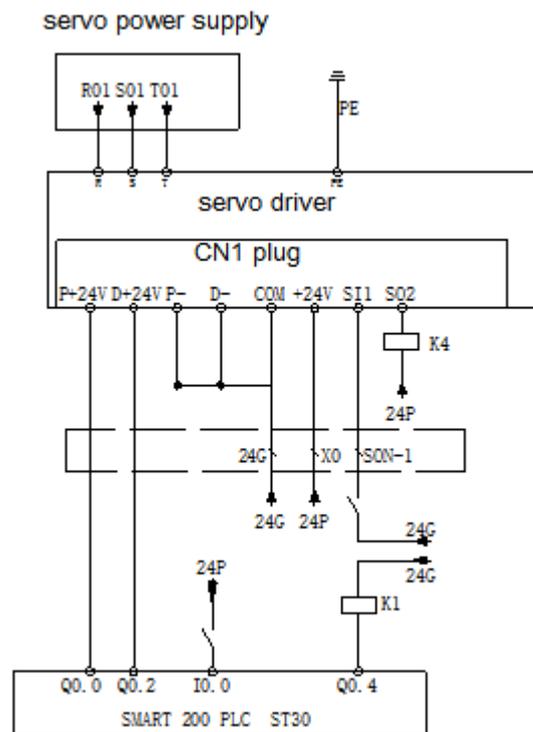
Q10: What is the external connection method and parameter setting of regenerative resistance?
There are P+, D, C terminals on the servo interface. There are short connectors between P+ and C (using built-in resistor). When the built-in resistor specifications are insufficient, the external resistor should be replaced. The specifications of the external regenerative resistor please refer to chapter 1.4.1.
(1) P+, D, C interface model: Remove the short joint between P+, D, and connect the external regenerative resistance to P+, C.
(2) P+, PB interface model: connect external regenerative resistance to P+, PB.
(3) Version number parameter U2-07 < 3700, set P0-24 = 1, P0-25 = power value, P0-26 = resistance value.
(4) Version number parameter U2-07 ≥ 3700, P0-24 need not be set, P0-25 = power value, P0-26 = resistance value.
Note: Before 3700 version, P0-24 should be set. Value 0 is for built-in resistance and value 1 is for external resistance.

Q11: The service life of tank chain?
The bending resistance is 5 million times and the bending radius is 50 mm.

Q12: How to connect bus control BD board and JA-NE-L?
A-A1, B-B1, SG-SG when one axis running; the PLC BD board and the terminal resistor of the last JA-NE-L board of electrical connection should be ON when multi-axis running; and the terminal resistance of JA-NE-L board in the middle should be OFF.

axis 1 JA-NE-L   axis 2 JA-NE-L   axis 10 JA-NE-L
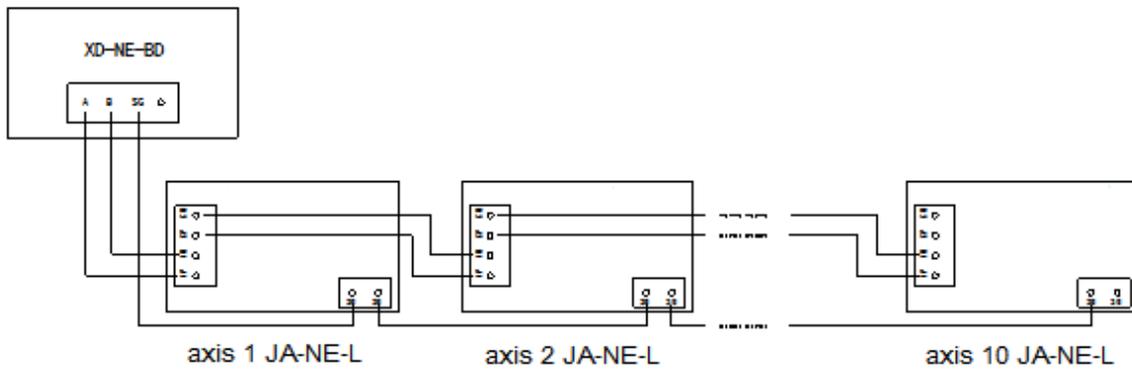
Appendix 6. General debugging steps

1. Motor empty shaft, preliminary debugging

A. Connect the cable correctly. Pay attention to the one-to-one connection of U, V, W and PE terminals, and the phase sequence can not be crossed.

B. Open-loop test run: The test run mainly checks the power cable and the encoder feedback cable to determine whether the connection is normal. According to the following operation, the motor can normally achieve positive and negative rotation. If the motor shaft shakes or prompts the alarm, it needs to cut off the power supply immediately, and re-check the wiring situation.
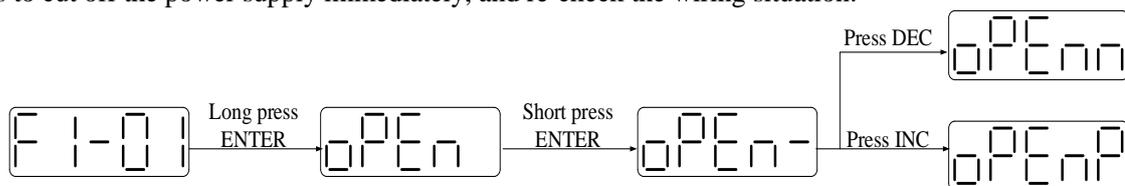
C. jog run: Enter F1-00.

Short press ENTER to enable the motor. In the enabled status, press INC for run forward, press DEC to run reverse. Press STATUS/ESC to exit.

Four status when jog running:

| status	Panel display	status	Panel display
Idle		Forward run	
enabled		Reverse run	

2. Debug the motor with the machine

A. Observe the operating direction of the machine head. If it is contrary to the actual need, after the servo OFF, set the parameter P0-05 to 1, and then re-energize to make the change effective.

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

Appendix 7. Application examples

Mode 6: Pulse instruction position mode
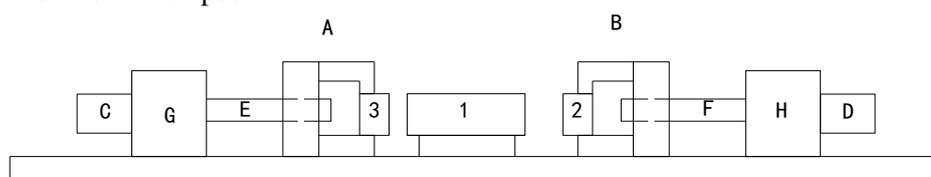
Equipment introduction:
This is a welder. Workpiece 1, 2, 3 are the object to be operated. 2 and 3 is fixed on B and A individually. A and B can whole move and be pushed by ball screw E and F. The screw pitch is 5mm. C and D is servo motor. G and H is reducer. The deceleration ratio is 40.
It needs to adjust the machine with standard dimension workpiece and find the origin of A and B.
Workpiece 1 lies on the worktable and moves left and right. Its dimension is positive tolerance, cannot shorter than standard workpiece. The process to put the workpiece is random. It requires that the left and right soldering is symmetrical.
A and B move toward 1 with 3 and 2 at the same speed. Whatever the position of 1, 2 or 3 will touch 1 at first and push 1 to another side until 2 and 3 all touch 1. The result is the motor torque will increase. At this time, 1 will at the symmetrical position.
A and B will return to the origin position after soldering is finished.

Analysis
1. Make sure the work mode: 6
2. It needs to judge whether 2 and 3 touch 1 when finding the symmetrical point first time. The sign is servo output torque will increase. It needs to use torque limit (P3-28, P3-29) and torque limit output signal /CLT.
3. As the dimension of workpiece 1 is larger than standard, offset pulse will remain in servo when the symmetrical point is found. /CLR signal can clear the pulse. The servo motor running distance is different from PLC pulse number. If it needs to know the actual distance, servo encoder feedback /A+, /A-, /B+, /B- and AB phase count are needed.
4. The machine motion direction of A and B.

Signal and terminal
/COIN positioning finished signal: SO1
/CLT torque up to upper limit output: SO2
/CLR pulse offset clear input: SI1
Encoder feedback signal /A+, /A-, /B+, /B-

Calculate the electronic gear ratio

Step	Explanation	Ball screw
	P: pitch $$1 \text{ rotation} = \frac{P}{\text{Command unit}}$$	
1	Confirm the mechanical specification	Ball screw pitch: 5mm Reduction ratio: 40/1
2	Confirm the encoder pulse number	131072
3	Decide the command unit	1 command unit: 0.001mm
4	Calculate the motion value of load shaft rotate 1 circle	5mm/0.001mm=5000
5	Calculate the electronic gear ratio	$\dfrac{B}{A} = \dfrac{2^{17}}{5000} = \dfrac{16384}{625}$
6	Set the user parameters	P0-13=16384 P0-14=625

Parameter setting
Running mode: P0-01=6
Pulse command state: P0-10=2
Electronic gear ratio: P0-11=0   P0-12=0   P0-13=16384   P0-14=625
Forward torque limit: P3-28=150
Reverse torque limit: P3-29=150
Positioning finished width: P5-00=7
/S-ON: P5-20=0010
/CLR: P5-34=0001
/COIN: P5-38=0001
/CLT: P5-42=0002

Appendix 8. Model list

Motor model	Matched driver	Encoder cable	Power cable	Brake cable
MS5S-40ST□-CS00330B-20P1-S01	DS5E/L/C/F-20P1-PTA	CP(T)-SP-M-length	CM(T)-P07-M-length	
MS5S-40ST□-CM00330B-20P1-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	
MS5S-40ST□-CS00330BZ-20P1-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5S-40ST□-CM00330BZ-20P1-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5S-60ST□-CS00630B-20P2-S01	DS5E/L/C/F-20P2-PTA	CP(T)-SP-M-length	CM(T)-P07-M-length	
MS5S-60ST□-CM00630B-20P2-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	
MS5S-60ST□-CS00630BZ-20P2-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5S-60ST□-CM00630BZ-20P2-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5H-60ST□-CS0O630B-20P2-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	
MS5H-60ST□-CM0O630B-20P2-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	
MS5H-60ST□-CS00630BZ-20P2-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5H-60ST□-CM00630BZ-20P2-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5S-60ST□-CS01330B-20P4-S01	DS5E/L/C/F-20P4-PTA	CP(T)-SP-M-length	CM(T)-P07-M-length	
MS5S-60ST□-CM01330B-20P4-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	
MS5S-60ST□-CS01330BZ-20P4-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5S-60ST□-CM01330BZ-20P4-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5H-60ST□-CS01330B-20P4-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	
MS5H-60ST□-CM01330B-20P4-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	
MS5H-60ST□-CS01330BZ-20P4-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5H-60ST□-CM01330BZ-20P4-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length
MS-60ST□-T01330B□-20P4-D01		CP(T)-SP-B-length	CM(T)-P07-length	

Motor model	Matched driver	Encoder cable	Power cable	Brake cable
MS5S-80ST□-CS02430B-20P7-S01	DS5E/L/C/F-20P7-PTA	CP(T)-SP-M-length	CM(T)-P07-M-length	
MS5S-80ST□-CM02430B-20P7-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	
MS5S-80ST□-CS02430BZ-20P7-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5S-80ST□-CM02430BZ-20P7-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length

Motor model	Matched driver	Encoder cable	Power cable	Brake cable
MS5H-80ST□-CS02430B-20P7-S01	DS5E/L/C/F-20P7-PTA	CP(T)-SP-M-length	CM(T)-P07-M-length	
MS5H-80ST□-CM02430B-20P7-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	
MS5H-80ST□-CS02430BZ-20P7-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5H-80ST□-CM02430BZ-20P7-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length
MS-80ST□-T02430B□-20P7		CP(T)-SP-B-length	CM(T)-P07-length	
MS-80ST□-T03520B□-20P7		CP(T)-SP-B-length	CM(T)-P07-length	
MS5G-130STE-CS05415B-20P8-S01		CP(T)-SC-M-length	CMT-L15A-length	
MS5G-130STE-CM05415B-20P8-S01		CP(T)-SC-B-length	CM(T)-L15A-length	
MS5G-130STE-CS05415BZ-20P8-S01		CP(T)-SC-M-length	CMB(T)-L15A-length	
MS5G-130STE-TL05415B-20P8-S01		CP(T)-SC-B-length	CM(T)-L15A-length	
MS5G-130STE-TL05415BZ-20P8-S01		CP(T)-SC-B-length	CMB(T)-L15A-length	
MS5S-80ST□-CS03230B□-21P0-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5S-80ST□-CM03230B□-21P0-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5H-80ST□-CS03230B□-21P0-S01		CP(T)-SP-M-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5H-80ST□-CM03230B□-21P0-S01		CP(T)-SP-BM-length	CM(T)-P07-M-length	CB(T)-P03-length
MS5S-110STE-CS03230B□-21P0-S01	DS5E/L/C/F-21P5-PTA	CP(T)-SL-M-length	CM(T)-L15-length	
MS5S-110STE-CM03230B□-21P0-S01		CP(T)-SL-B-length	CM(T)-L15-length	
MS5S-110STE-TL03230B□-21P0		CP(T)-SL-B-length	CM(T)-L15-length	
MS-110ST□-T04030B□-21P2		CP(T)-SL-B-length	CM(T)-L15-length	
MS-110ST□-T05030B□-21P5		CP(T)-SL-B-length	CM(T)-L15-length	
MS5S-110STE-CS04830B□-21P5		CP(T)-SL-M-length	CM(T)-L15-length	
MS5S-110STE-CM04830B□-21P5		CP(T)-SL-B-length	CM(T)-L15-length	
MS5S-110STE-TL04830B□-21P5		CP(T)-SL-B-length	CM(T)-L15-length	
MS-130ST-T06025B□-21P5		CP(T)-SL-B-length	CM(T)-L15-length	
MS-130ST-T10015B□-21P5		CP(T)-SL-B-length	CM(T)-L15-length	
MS5G-130STE-CS07220B-21P5-S01		CP(T)-SC-M-length	CM(T)-L15-length	

Motor model	Matched driver	Encoder cable	Power cable	Brake cable
MS5G-130STE-CS07220BZ-21P5-S01		CP(T)-SC-M-length	CMB(T)-L15-length	
MS5G-130STE-TL07220B-21P5-S01		CP(T)-SC-B-length	CM(T)-L15-length	
MS5G-130STE-TL07220BZ-21P5-S01		CP(T)-SC-B-length	CMB(T)-L15-length	

Motor model	Matched driver	Encoder cable	Power cable	Brake cable
MS5G-130STE-CS11515B-21P8-S01	DS5E/L/C/F-22P3-PTA	CP(T)-SC-M-length	CM(T)-L15-length	
MS5G-130STE-CS11515BZ-21P8-S01		CP(T)-SC-M-length	CMB(T)-L15-length	
MS5G-130STE-TL11515B-21P8-S01		CP(T)-SC-B-length	CM(T)-L15-length	
MS5G-130STE-TL11515BZ-21P8-S01		CP(T)-SC-B-length	CMB(T)-L15-length	
MS5S-110STE-TL06030B□-21P8		CP(T)-SL-B-length	CM(T)-L15-length	
MS5S-110STE-CS06030B□-21P8		CP(T)-SL-M-length	CM(T)-L15-length	
MS5S-110STE-CM06030B□-21P8		CP(T)-SL-B-length	CM(T)-L15-length	
MS5G-130STE-CS14615B-22P3-S01		CP(T)-SC-M-length	CM(T)-L15-length	
MS5G-130STE-CS14615BZ-22P3-S01		CP(T)-SC-M-length	CMB(T)-L15-length	
MS5G-130STE-TL14615B-22P3-S01		CP(T)-SC-B-length	CM(T)-L15-length	
MS5G-130STE-TL14615BZ-22P3-S01		CP(T)-SC-B-length	CMB(T)-L15-length	
MS-130ST-T15015GB□-22P3		CP(T)-SL-B-length	CM(T)-L15-length	
MS-130ST-TL15015GB-22P3		CP(T)-SL-B-length	CM(T)-L15-length	
MS-130STE-TL15015GB-22P3-F		CP(T)-SL-B-length	CM(T)-L15-length	
MS-130STE-T07730B□-22P4		CP(T)-SL-B-length	CM(T)-L15-length	
MS-130STE-T07730B□-22P4	DS5E/L/C/F-22P6-PTA	CP(T)-SL-B-length	CM(T)-L15-length	
MS-130ST-TL10025B□-22P6		CP(T)-SL-B-length	CM(T)-L15-length	
MS5G-130STE-CS11515B□-41P8-S01	DS5E-41P5-PTA	CP(T)-SC-M-length	CM(T)-L15-length	
MS5G-130STE-TL11515B□-41P8-S01		CP(T)-SC-B-length	CM(T)-L15-length	
MS5G-130ST-CS14615B□-42P3-S01	DS5E/C/F-43P0-PTA	CP(T)-SC-M-length	CM(T)-L15-length	
MS5G-130ST-TL14615B□-42P3-S01		CP(T)-SC-B-length	CM(T)-L15-length	
MS5G-180STE-TL19015B□-42P9		CP(T)-SL-B-length	CM(T)-XL25-length	
MS-130ST-TL10030B(Z)-43P0		CP(T)-SL-B-length	CM(T)-L15-length	
MS5G-180STE-TL28015B□-44P4	DS5E/C/F-45P5-PTA	CP(T)-SL-B-length	CM(T)-XL60-length	
MS5G-180STE-TL35015B□-45P5		CP(T)-SL-B-length	CM(T)-XL60-length	
MS5G-180STE-TL48015B□-47P5	DS5E/C/F-47P5-PTA	CP(T)-SL-B-length	CM(T)-XL60-length	
MS-220STE-TL96015B□-415P0-XJ	DS5E-415P0-PTA	CP(T)-SL-B-length	CM(T)-D60-length	

Suffix S02 Series

Motor model	Matched driver	Encoder cable	Power cable	Brake cable
MS5S-40ST□-CS00330B-20P1-S02	DS5E/L/C/F-20P1-PTA	CPT-SW-M-length	CMT-W07-M-length	
MS5S-40ST□-CM00330B-20P1-S02		CPT-SW-BM-length	CMT-W07-M-length	
MS5S-40ST□-CS00330BZ-20P1-S02		CPT-SW-M-length	CMBT-W07-M-length	
MS5S-40ST□-CM00330BZ-20P1-S02		CPT-SW-BM-length	CMBT-W07-M-length	
MS5S-60ST□-CS00630B-20P2-S02	DS5E/L/C/F-20P2-PTA	CPT-SW-M-length	CMT-W07-M-length	
MS5S-60ST□-CM00630B-20P2-S02		CPT-SW-BM-length	CMT-W07-M-length	
MS5S-60ST□-CS00630BZ-20P2-S02		CPT-SW-M-length	CMBT-W07-M-length	
MS5S-60ST□-CM00630BZ-20P2-S02		CPT-SW-BM-length	CMBT-W07-M-length	
MS5H-60ST□-CS00630B-20P2-S02		CPT-SW-M-length	CMT-W07-M-length	
MS5H-60ST□-CM00630B-20P2-S02		CPT-SW-BM-length	CMT-W07-M-length	
MS5H-60ST□-CS0O630BZ-20P2-S02		CPT-SW-M-length	CMBT-W07-M-length	
MS5H-60ST□-CM0O630BZ-20P2-S02		CPT-SW-BM-length	CMBT-W07-M-length	
MS5S-60ST□-CS01330B-20P4-S02	DS5E/L/C/F-20P4-PTA	CPT-SW-M-length	CMT-W07-M-length	
MS5S-60ST□-CM01330B-20P4-S02		CPT-SW-BM-length	CMT-W07-M-length	
MS5S-60ST□-CS01330BZ-20P4-S02		CPT-SW-M-length	CMBT-W07-M-length	
MS5S-60ST□-CM01330BZ-20P4-S02		CPT-SW-BM-length	CMBT-W07-M-length	
MS5H-60ST□-CS01330B-20P4-S02		CPT-SW-M-length	CMT-W07-M-length	
MS5H-60ST□-CM01330B-20P4-S02		CPT-SW-BM-length	CMT-W07-M-length	
MS5H-60ST□-CS01330BZ-20P4-S02		CPT-SW-M-length	CMBT-W07-M-length	
MS5H-60ST□-CM01330BZ-20P4-S02		CPT-SW-BM-length	CMBT-W07-M-length	
MS5S-80ST□-CS02430B-20P7-S02	DS5E/L/C/F-20P7-PTA	CPT-SW-M-length	CMT-W07-M-length	
MS5S-80ST□-CM02430B-20P7-S02		CPT-SW-BM-length	CMT-W07-M-length	
MS5S-80ST□-CS02430BZ-20P7-S02		CPT-SW-M-length	CMBT-W07-M-length	
MS5S-80ST□-CM02430BZ-20P7-S02		CPT-SW-BM-length	CMBT-W07-M-length	
MS5H-80ST□-CS02430B-20P7-S02		CPT-SW-M-length	CMT-W07-M-length	
MS5H-80ST□-CM02430B-20P7-S02		CPT-SW-BM-length	CMT-W07-M-length	
MS5H-80ST□-CS02430BZ-20P7-S02		CPT-SW-M-length	CMBT-W07-M-length	
MS5H-80ST□-CM02430BZ-20P7-S02		CPT-SW-BM-length	CMBT-W07-M-length	
MS5S-80ST(E)-CS03230B(Z)-21P0-S02		CPT-SW-M-length	CM(B)T-W07-M-length	
MS5S-80ST(E)-CM03230B(Z)-21P0-S02		CPT-SW-BM-length	CM(B)T-W07-M-length	
MS5H-80ST(E)-CS03230B(Z)-21P0-S02		CPT-SW-M-length	CM(B)T-W07-M-length	
MS5H-80ST(E)-CM03230B(Z)-21P0-S02		CPT-SW-BM-length	CM(B)T-W07-M-length	