XINJE

DS5C series servo driver

Fast manual

This manual is suitable for the following users

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

Declaration of liability

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

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Catalog

►► Confirmation on product arrival

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

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

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

►► Safety precautions

◆ Confirmation when getting the product

   ✓ Do not install damaged drives, drives with missing parts, or drives with unqualified models.

◆ Product installation

   ✓ Be sure to disconnect all external power before installing the drive.

◆ Product wiring

   ✓ Be sure to disconnect all external power before wiring the drive.

   ✓ Please connect the AC power supply correctly to the special power terminal of the drive.

   ✓ Do not connect the output terminals U, V and W of the driver to the three-phase power supply.

   ✓ Please use 2mm^2 wire to ground the ground terminal of the driver.

   ✓ Please ensure that the encoder line and power line are loose and not tight to avoid cable damage.

◆ Operation and maintenance of products

   ✓ When powered on, be sure to install the panel shield.

   ✓ Do not touch the terminal within 10 minutes after disconnecting the power supply.

   ✓ During commissioning, do not connect the motor to the machinery.

   ✓ After connecting the machine, please set appropriate parameters of energy consumption before operation.

   ✓ Do not change the wiring when live.

   ✓ Do not touch the radiator during operation.

1. Servo system

1-1.Servo driver

1-1-1.Part description

Power supply

Motor wiring

Signal terminal

RJ45 port

Encoder port

1-1-2. Naming rule

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

Display	Product name
DS	Servo driver

Display	Product series
5C	EtherCAT

Display	Rated input voltage
2	AC220V
4	AC380V

Display	Driver type
-	Normal
H	Enhanced

Display	Encoder type
T	Communication

Display	Rated output power
0P1	100W
0P7	750W
1P0	1.0KW
1P5	1.5KW
2P6	2.6KW

1-1-3. Performance

Servo unit		DS5C series 220V
Suitable encoder		Standard: 17bit/ 23bit encoder
Input power supply		DS5C-2□P□-PTA: single phase AC200~240V, 50/60Hz
		[below 1.5KW (except 1.5KW) can use single phase AC200~240V 50/60Hz; 1.5KW and up please use single phase or 3-phase AC200~240V 50/60Hz. (for single phase power supply, please connect R, T, otherwise it will affect the power-off memory)]
		DS5C-4□P□-PTA: 3-phase AC380～440V, 50/60Hz
Control method		3-phase full wave rectifier IPM PWM control sine current driving mode
Using codition	Using temperature	-10～+40 ℃
	Storage temperature	-20～+60 ℃
	Humidity	Below 90% RH (no condensation)
	Resistance to vibration and impact strength	$4.9 m/s^2$ / $19.6 m/s^2$
Structure		Base installation

1-2. Servo motor

1-2-1. Part description

Encoder part   Frame

Flange

Output (transmission) shaft
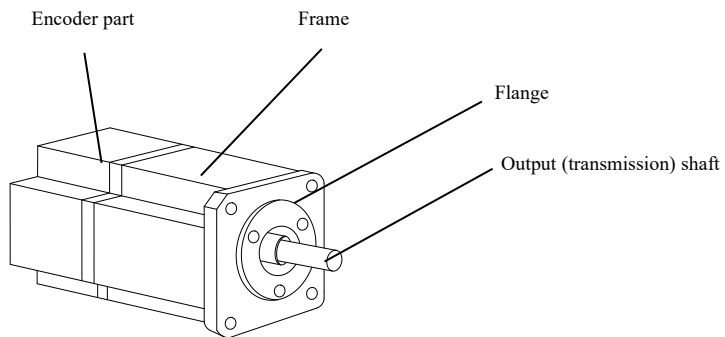
1-2-2. Naming rule

■   MS5 series motor

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

Name	inertia
MS5S	Low inertia
MS5G	Middle inertia
MS5H	High inertia

Name	Base no.
60	60 base
80	80 base

Name	Product name
ST	Sine driven motor

Name	Oil seal
–	–
E	with oil seal

Name	Encoder type
C	Magnetic
T	Optical

Name	Encoder precision
S	Single rotate 17 bits
M	Multi-rotate 17 bits
U	Single rotate 23 bits
L	Multi-rotate 23 bits

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

Name	Design no.
S01	standard

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

Name	Voltage level
2	220V
4	380V

Name	Power-off brake
–	–
Z	with

Name	Shaft
A	No key
B	With key

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■ MS6 series motor

MS6S – 60 C S 30 B Z 1 – 2 0P4

Display	Inertia
MS6S	Low inertia
MS6H	High inertia

Display	Base no.
40	Base 40
60	Base 60
80	Base 80
100	Base 100
130	Base 130
180	Base 180

Display	Encoder type
C	Magnetic Encoder
T	Photoelectric encoder

Display	Encoder resolution
S	Single turn 17-bit
M	Multi-turn 17-bit
U	Single turn 23-bit
L	Multi-turn 23-bit

Display	Rated power	Display	Rated power
0P1	100W	1P8	1.8KW
0P2	200W	2P3	2.3KW
0P4	400W	3P0	3.0KW
0P7	750W	4P4	4.4KW
0P8	850W	5P5	5.5KW
1P5	1.5KW	7P5	7.5KW

Display	Voltage level
2	220V
4	380V

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

Display	Brake
-	No brake
Z	With brake

Display	Motor shaft
A	Key, no oil seal, threaded hole
B	Key, oil seal, threaded hole
C	No key, no oil seal, threaded hole
D	No key, oil seal, threaded hole
E	Special shaft (length, shaft diameter)

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

Note: at present, the type selection of encoder is only the combination of CS, CM, TL and T!

Standard type 1 is an amp connector for 80 and below flange.

Standard type 2 is a small aviation plug connector for 80 and below flange.

1-3. Cables

1-3-1. Cable configuration

■ Encoder cable

CP-SL-□□-03

Display	Cable type
CP	Normal
CPT	High flexible

Display	Connector type
SP	AMP plug
SW	7-core aviation plug
SL	15-core aviation plug
SC	10-core small aviation plug

Display	Battery box
M	Without
B	With
BM	With

Display	Length (m)
03	3
05	5
08	8
12	12
16	16
20	20

■ Power cable

CM – P 07 – M – 03

Display	Cable type
CM	Normal
CMT	High flexible
CMBT	High flexible with brake aviation plug

Display	Connector type
P	Small power 4-core amp plug
W	6-core waterproof aviation plug
L	4-core small aviation plug
XL	4-core medium aviation plug
V	4-core waterproof aviation plug
D	O type terminal

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

Display	Length (m)
03	3
05	5
08	8

Display	Cable type
M	White amp
-	Black amp

■ Brake cable

◆ Applicable to motors 80 and below with suffix S01, brake cable model shall be selected: CB-P03-length (ordinary material) / CBT-P03-length (high flexible material).

◆ Suitable for 750W and below power motors with suffix S02: CMBT-W07-M-length.

◆ For MS5G 130 flange medium inertia holding brake motor, the cable shall select power cable and brake cable in one unit.

◆ The standard wiring length of Xinje includes 2m, 3m, 5m, 8m, 10m, 12m, 16m and 20m, among which the non high flexible encoder cable and non high flexible power cable applicable to motors with suffix S01 of 80 and below have specifications of 25m and 30m.
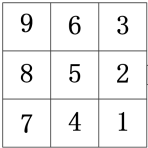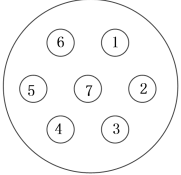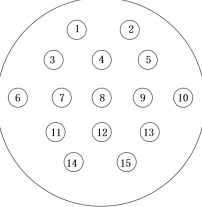
1-3-2. Cable terminal definition
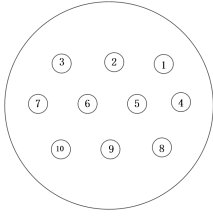
■ Encoder cable

(1) Encoder terminal defintion on servo driver side (flange 220 and below)
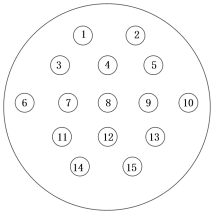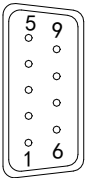
Connector	Pin definition	
	No.	Name
	1	5V
	2	GND
	3	/
	4	/
	5	485-A
	6	485-B

(2) Encoder cable connection on motor side (flange 220 and below)

Connector	Pin definition		Suitable model
	No.	Name	
	1	Battery +	Suitable for MS5-40, 60, 80 flange S01 motor Suitable for MS6-40, 60, 80 flange B1 motor
	2	Battery -	
	3	Shield cable	
	4	485-A	
	5	485-B	
	6	/	
	7	5V	
	8	GND	
	9	/	
	No.	Name	
	1	Shield cable	Suitable for MS5-40, 60, 80 flange S02 motor Suitable for MS6-40, 60, 80 flange B2 motor
	2	Battery +	
	3	Battery -	
	4	485-A	
	5	485-B	
	6	5V	
	7	GND	
	No.	Name	
	1	Shield cable	Suitable for 110 and above flange (exclude 130 flange medium inertia, flange 220)
	2	/	
	3	485-B	
	4	485-A	
	5	/	
	6	GND	
	7	Battery -	
	8	5V	
	9	Battery +	

No.	Name	
1	/	
2	5V	
3	GND	
4	485-A	Suitable for 130 flange
5	485-B	medium inertia motor
6	Battery +	
7	Battery -	
8, 9	/	
10	Shield cable	

(3) Flange 220 encoder cable two sides connection

Motor side			Driver side	
Appearance	No.	Name	No.	Appearance
	1	Shield cable	5	
	2	/	/	
	3	485-B	3	
	4	485-A	4	
	5	/	/	
	6	GND	6	
	7	Battery -	/	
	8	5V	8	
	9	Battery +	/	
	14	Temperature sensor	1	
	15	Temperature sensor	2	

Description of battery box:

(1) The above encoder contains the pins of battery+, battery- and the cables defined are used for absolute value motor, and the cables of non absolute value motor do not have this pin.

(2) Only the absolute value motor is equipped with a cable external battery box. The battery box has a 3.6V/2.7Ah high-capacity battery, and has the function of power-off battery replacement. The service time is more than 2 years.
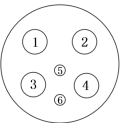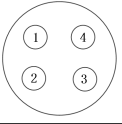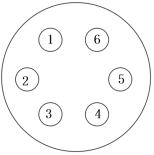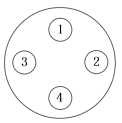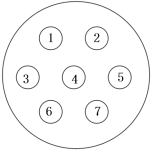
■   Power cable

(1) Power cable pin definition on servo driver side

Connector	Pin definition	
	Color	Definition
	Brown	U
	Black	V
	Blue	W

	Yellow green	PE

(2) Power cable connection on motor side

Connector	Pin definition		Suitable model
	No.	Name	
4 2 3 1	1	U	Suitable for 40, 60, 80 flange motor
	2	W	
	3	V	
	4	PE	
1 2	1	BK+	Suitable for 40, 60, 80 flange motor brake
	2	BK-	
① ② ③ ⑤ ④ ⑥	1	PE	Suitable for 750W and below small aviation plug motor
	2	U	
	3	V	
	4	W	
	5	BK+	
	6	BK-	
① ④ ② ③	1	U	Suitable for 40, 60, 80 flange B2 motor
	2	W	
	3	V	
	4	PE	
① ⑥ ② ⑤ ③ ④	1	U	Suitable for 40, 60, 80 flange B2 brake motor
	2	W	
	3	V	
	4	PE	
	5	BK+	
	6	BK-	
① ③ ② ④	1	PE	Suitable for 110 and above motor (include 130 flange medium inertia non brake motor)
	2	U	
	3	V	
	4	W	
① ② ③ ④ ⑤ ⑥ ⑦	1	PE	Suitable for 130 flange medium inertia brake motor
	2	U	
	3	V	
	4	W	
	5	BK+	
	6	BK-	
	7	/	

Holding brake pin description:
The above cable with the definition of BK + and BK - pins is used for the motor with brake. The cable without brake motor has no such pin and is an empty terminal.

■ EtherCAT communication cable

$$JC - C A - 1$$

Display	Name
JC	Cable name

Display	Name
C	CAT

Display	Length (m)
0P1	0.1
0P3	0.3
1	1
3	3

Display	Type
A	CAT5e cable
B	CAT6 cable
C	CAT6e cable
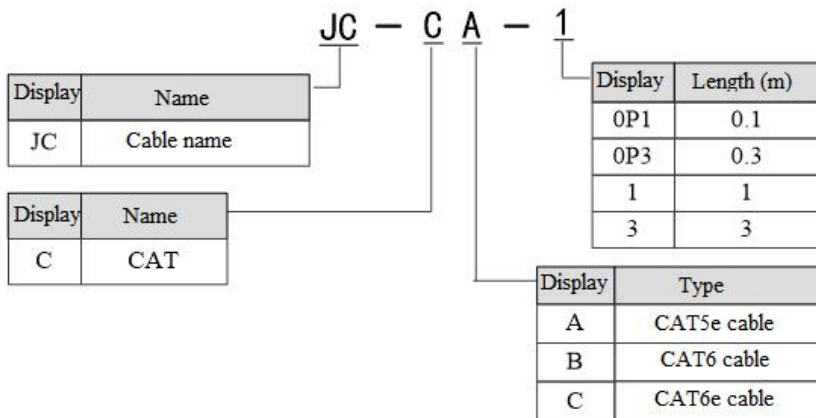
1-4. Selection of regenerative resistance

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
DS5C-□□P□-PTA	(1) Using built-in regenerative resistance, short P + and D terminals, P + and C are disconnected. (2) Use external regenerative resistance for 5.5kw and below drivers, connect regenerative resistance to P + and C terminals, remove P + and D short wiring, P0-25 = power value, P0-26 = resistance value.

<table>
<tr><td></td><td>(3) Use external regenerative resistance for 5.5kw~11kw drivers, connect regenerative resistance to P + and PB terminals, P0-25 = power value, P0-26 = resistance value.

(4) For 22kw servo drivers, connect regenerative resistance to the brake unit.

Note: if software version U2-07 < 3700, the parameter P0-24 should be set. The firmware version U2-07 ≥ 3700, P0-24 does not need to be set and can be kept as the default.</td></tr>
</table>

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

Servo driver model	Built-in brake unit	Rmin (Not less than this value)	External regenerative resistance (Recommended resistance value)	External regenerative resistance (Recommended power values)
DS5C-20P1-PTA	Built-in	50Ω	50Ω—100Ω	Above 200W
DS5C-20P2-PTA				
DS5C-20P4-PTA		40Ω	40Ω—100Ω	Above 500W
DS5C-20P7-PTA				
DS5C-21P0-PTA		25Ω	25Ω—50Ω	Above 1000W
DS5C-21P5-PTA				
DS5C-22P3-PTA				
DS5C-22P6-PTA				
DS5C-41P0-PTA		75Ω	75Ω—100Ω	Above 1000W
DS5C-41P5-PTA		55Ω	55Ω—100Ω	Above 1000W
DS5C-43P0-PTA		55Ω	55Ω—75Ω	Above 1000W
DS5C-43P0-PTA-H		55Ω	55Ω—75Ω	Above 1200W
DS5C-45P5-PTA		25Ω	25Ω—65Ω	Above 2000W
DS5C-45P5-PTA-H				
DS5C-47P5-PTA		25Ω	25Ω—50Ω	Above 2000W
DS5C-47P5-PTA-H		22Ω	22Ω—45Ω	Above 3000W
DS5C-411P0-PTA		20Ω	20Ω—45Ω	Above 3000W
DS5C-415P0-PTA				
DS5C-422P0-PTA	-	20Ω	20Ω—30Ω	Above 3000W
DS5C-432P0-PTA	-	15Ω	15Ω—25Ω	Above 7000W~8000W

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.

(3) 22kw servo driver DS5E-422P0-PTA has no built-in brake unit, the external brake unit is optional part. The model is DBM-4110.

1-4-2. Brake unit (DBM-4110) specification

■　Pin definition

DC-　DC+　R1　R2　PE
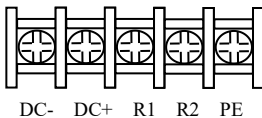
Pin name	Description
DC-	Connect to DC bus -
DC+	Connect to DC bus +
R1	Connect to one terminal of brake unit
R2	Connect to another terminal of brake unit
PE	Connect to the ground

■ Wiring diagram

Single driver wiring   Multi-driver wiring

14
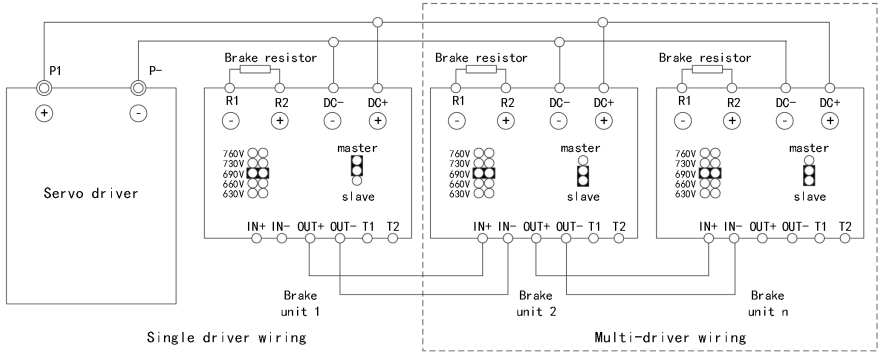
2. Servo driver and motor installation

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℃ (no freezing)
Use ambient humidity	20%~90%RH (no condensation)
Storage temperature	-20℃~60℃
Storage humidity	20%~90%RH (no condensation)
Vibration resistance	≤ 4.9m/s^2
Altitude	No more than 1000m, please derate to use when it is higher than 1000m (derate 1% for every 100m high)

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").
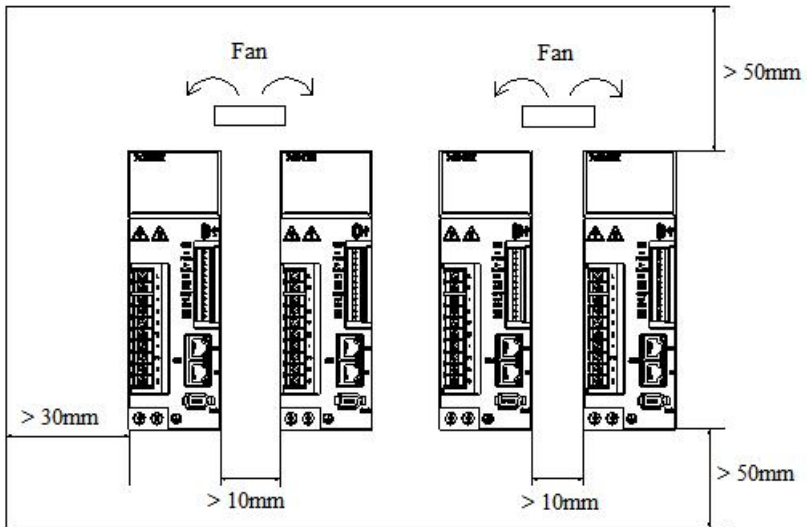
■ **Servo Drive Orientation**

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°C 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.

<table>
<tr><td colspan="2" align="center">⚠ CAUTION</td></tr>
<tr><td>1.</td><td>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.</td></tr>
<tr><td>2.</td><td>Avoid getting thinner on other parts of the servo motor.</td></tr>
<tr><td colspan="2" align="center">
Antirust</td></tr>
</table>
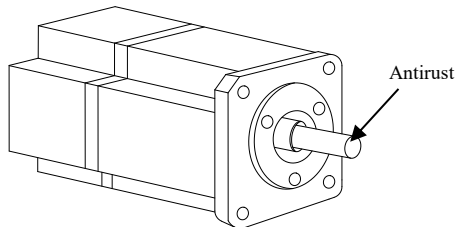
2-2-1. Installation envrionment

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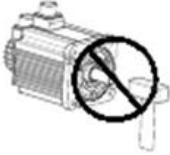
When used in places with water droplets or oil droplets, the protection effect can be achieved through the treatment of motors. However, in order to seal the through part of the shaft, please specify the motor with oil seal. Connectors should be installed downward.

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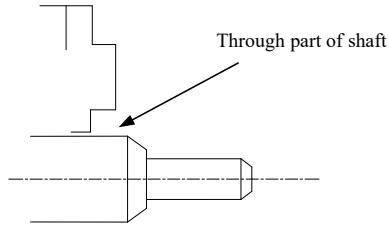
MS series servo motors are for indoor use. Please use them under the following installation conditions:

Item	Description
Use ambient temperature	-10℃~40℃ (no freezing)
Use ambient humidity	20%~90%RH (no condensation)
Storage temperature	-20℃~60℃
Storage humidity	-20%~90%RH (no condensation)
Protection level	IP65(MS5)/IP66 (MS6)

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.
Encoder cautions	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.

2-3. Servo motor dimension

■ 40 series motor installation dimension   Unit: mm

◆ MS5 motor
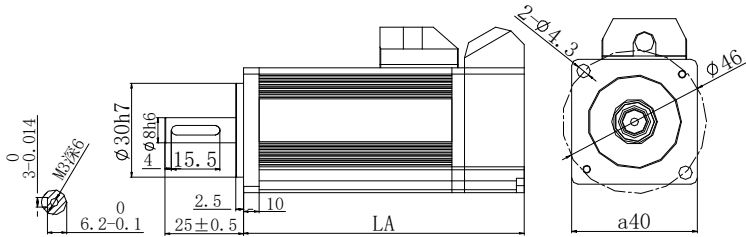
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-40STE-C□0030□□-20P1-S01/S02	89.5	119	Low inertia

◆ MS6 motor
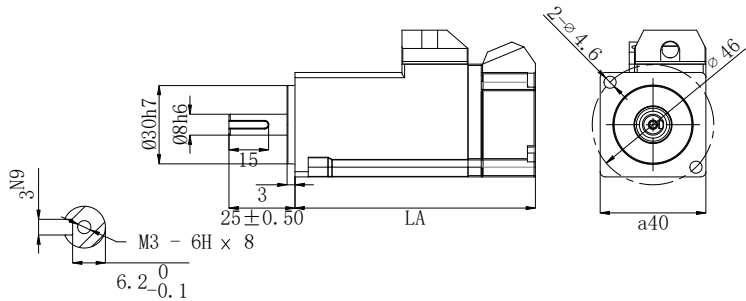
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-40C□30B□1-20P1	91	122.9	High inertia

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- 60 series motor installation dimension　　　　Unit: mm

  ◆　MS5 motor
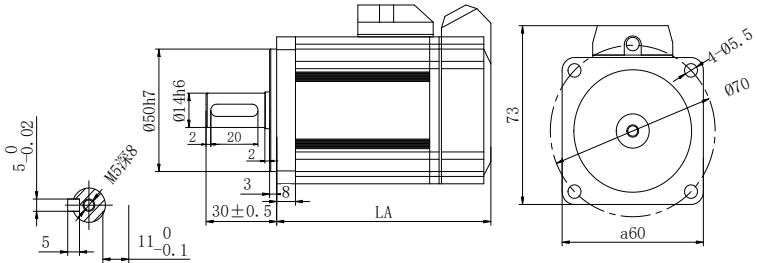
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-60STE-C□00630□□-20P2-S01/S02	79	114	Low inertia
MS5S-60STE-C□01330□□-20P4-S01/S02	99	134	
MS5H-60STE-C□00630□□-20P2-S01/S02	91	126	High inertia
MS5H-60STE-C□01330□□-20P4-S01/S02	111	146	
MS-60STE-T01330-20P4-D01	145	189	-

  ◆　MS6 motor
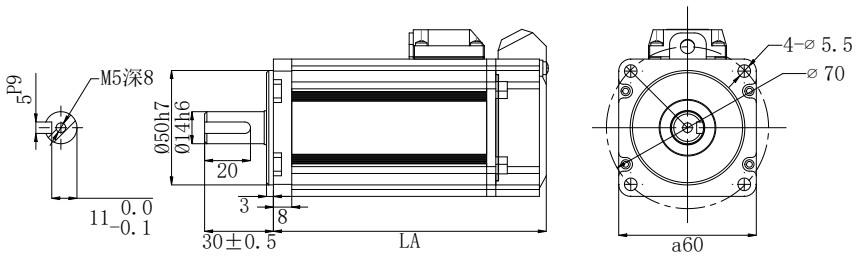
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6S-60C□301B□1-20P4	107	139	Low inertia
MS6H-60C□301B□1-20P4	119	151	High inertia

- 80 series motor installation dimension   Unit: mm

  ◆ MS5 motor
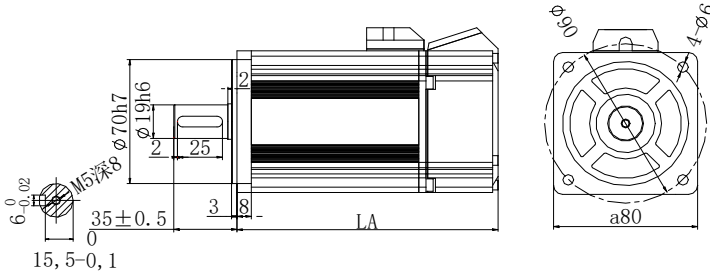
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-80STE-C□02430□□-20P7-S01/S02	107	144	Low inertia
MS5S-80STE-C□03230□□-21P0-S01/S02	128	165	Low inertia
MS5H-80STE-C□02430□□-20P7-S01/S02	119	156	High inertia
MS5H-80STE-C□03230□□-21P0-S01/S02	140	177	High inertia
MS-80ST-T02430□□-20P7	150	199	-
MS-80ST-T03520□□-20P7	179	219	-

  ◆ MS6 motor
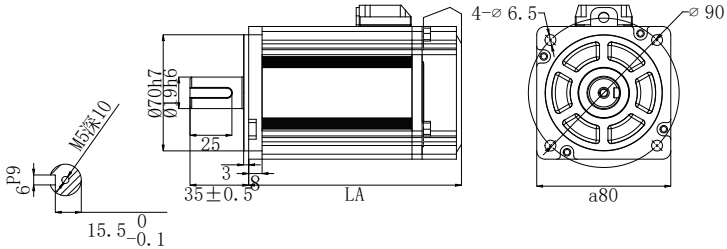
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6S-80C□30B□□-20P7	117	150	Low inertia
MS6S-80C□20B□□-20P7	127	160	Low inertia
MS6H-80C□30B□□-20P7	124	157	High inertia
MS6H-80C□20B□□-20P7	149	182	High inertia

■ 100 series motor installation dimension   Unit: mm
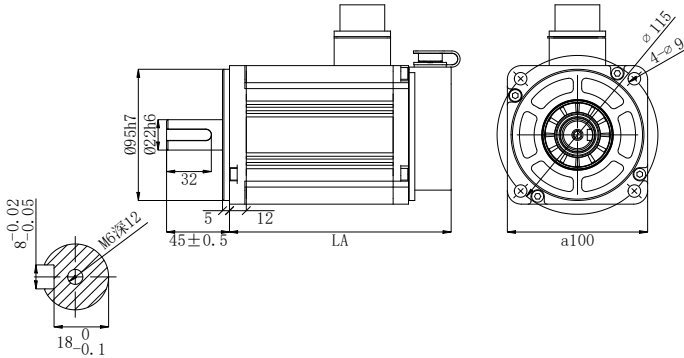
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6S-100C□30B2-21P5	158.5	-	Low inertia

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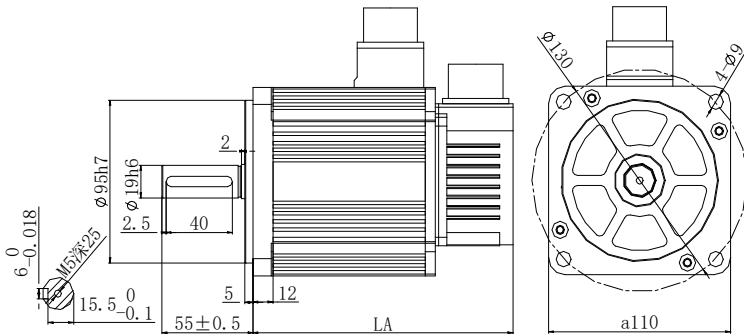
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5S-110ST-C□03230□□-21P0-S01	157	205	
MS5S-110ST-TL03230□□-21P0-S01	157	205	
MS5S-110ST-C□04830□□-21P5-S01	166	214	Low inertia
MS5S-110ST-TL04830□□-21P5-S01	166	214	
MS5S-110ST-C□06030□□-21P8-S01	181	229	

Motor model	LA±1		Inertia level
	Normal	With brake	
MS-110ST-TL06030□□-21P8-S01	181	229	
MS-110ST-T04030B-21P2	157	205	-
MS-110ST-T05030B-21P5	166	214	

■ 130 series motor installation dimension　　　　　Unit: mm

　◆　MS5 motor
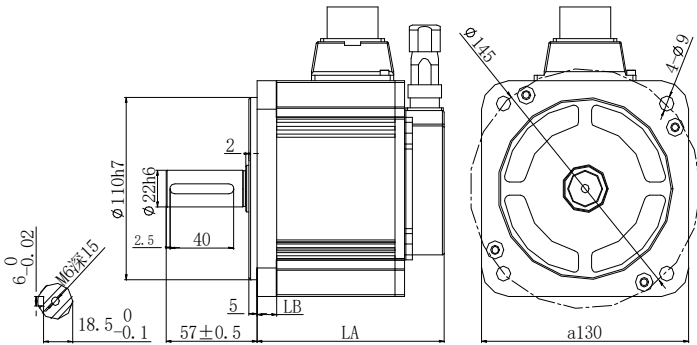
Motor model	LA±1		LB	Inertia level
	Normal	With brake		
MS5G-130STE-C□05415□□-20P8-S01	117.5	147	12.5	Medium inertia
MS5G-130STE-TL05415□□-20P8-S01	134.5	164.5		
MS5G-130STE-C□07220□□-21P5-S01	132.5	162.5		
MS5G-130STE-C□07220□□-41P5-S01	132.5	162.5		
MS5G-130STE-TL07220□□-21P5-S01	149.5	179.5		
MS5G-130STE-TL07220□□-41P5-S01	149.5	179.5		
MS5G-130STE-C□11515□□-21P8-S01	159.5	189.5		
MS5G-130STE-C□11515□□-41P8-S01	159.5	189.5		
MS5G-130STE-TL11515□□-21P8-S01	176.5	206.5		
MS5G-130STE-TL11515□□-41P8-S01	176.5	206.5		
MS5G-130STE-C□14615□□-22P3-S01	180.5	210.5		
MS5G-130STE-C□14615□□-42P3-S01	180.5	210.5		
MS5G-130STE-TL14615□□-22P3-S01	197.5	227.5		

Motor model	LA±1		LB	Inertia level
	Normal	With brake		
MS5G-130STE-TL14615□□-42P3-S01	197.5	227.5		
MS5G-130STE-C□07330□□-22P4-S01	132.5	162.5		
MS5G-130STE-TL07330□□-22P4-S01	149.5	179.5		
MS5G-130STE-C□10025□□-22P6-S01	159.5	189.5		
MS-130ST-T10015□□-21P5	205	264		
MS-130STE-T07730□□-22P4	205	264	14	-
MS-130ST-T10025□□-22P6	209	290		
MS-130ST-TL10030□□-43P0	225	284	15	-
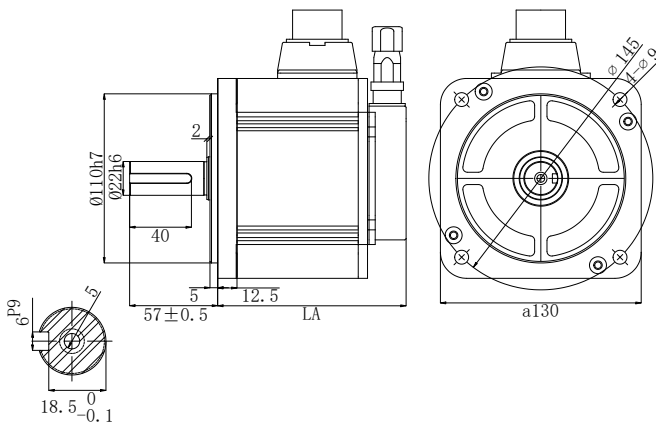
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-130STE-C□06025B□-21P5-S01	122	153.5	Medium inertia
MS5G-130STE-C□10015B□-21P5-S01	145	176.5	

◆ MS6 motor
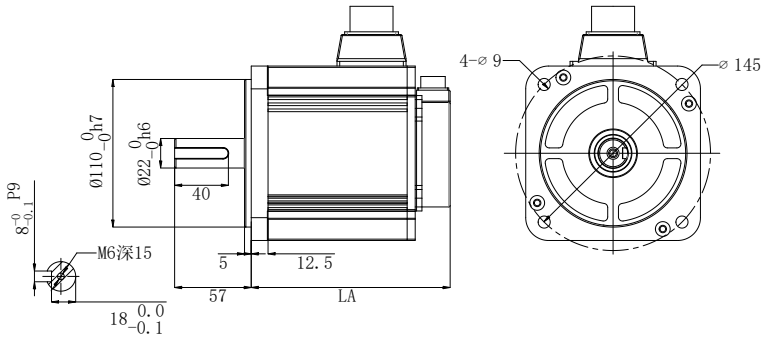
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-130C□15B□2-20P8	126	156	High inertia
MS6H-130C□15B□2-40P8	126	156	
MS6H-130TL15B□2-20P8	142	172	
MS6H-130TL15B□2-40P8	142	172	
MS6H-130C□15B□2-41P3	148	178	
MS6H-130TL15B□2-41P3	164	194	
MS6H-130C□20B□2-21P5	148	178	
MS6H-130TL20B□2-21P5	164	194	
MS6H-130C□15B□2-21P8	175	205	
MS6H-130C□15B□2-41P8	175	205	
MS6H-130TL15B□2-21P8	191	221	
MS6H-130TL15B□2-41P8	191	221	
MS6H-130C□15B□2-22P3	195.6	225.6	
MS6H-130C□15B□2-42P3	195.6	225.6	
MS6H-130TL15B□2-22P3	211.6	241.6	
MS6H-130TL15B□2-42P3	211.6	241.6	

■ 180 series motor installation dimension   Unit: mm

◆ MS5 motor
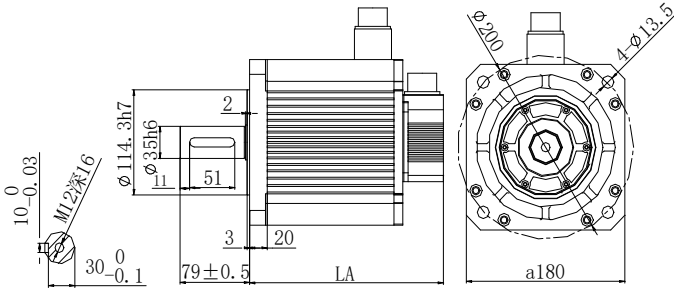
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-180ST-TL19015□□-42P9-S01	221	303	Medium inertia
MS5G-180ST-TL28015□□-44P4-S01	247	329	
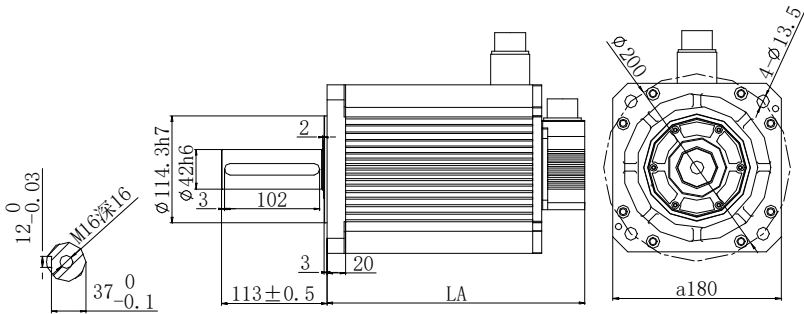
Motor model	LA±1		Inertia level
	Normal	With brake	
MS5G-180ST-TL35015□□-45P5-S01	277	359	Medium inertia
MS5G-180ST-TL48015□□-47P5-S01	318	400	

◆ MS6 motor
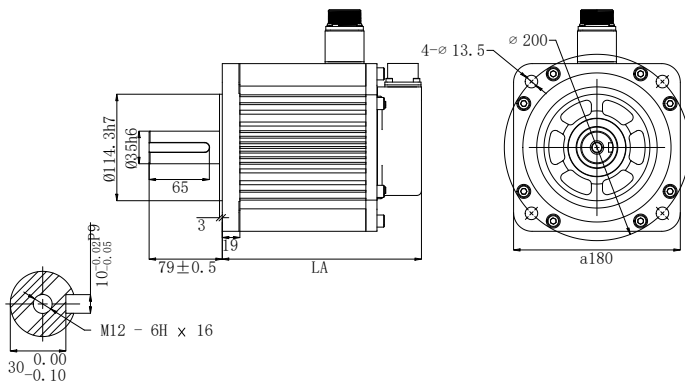
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-180C□15B□2-43P0	215	255	High inertia
MS6H-180TL15B□2-43P0	215	255	
MS6H-180C□15B□2-44P4	247	287	
MS6H-180TL15B□2-44P4	247	287	
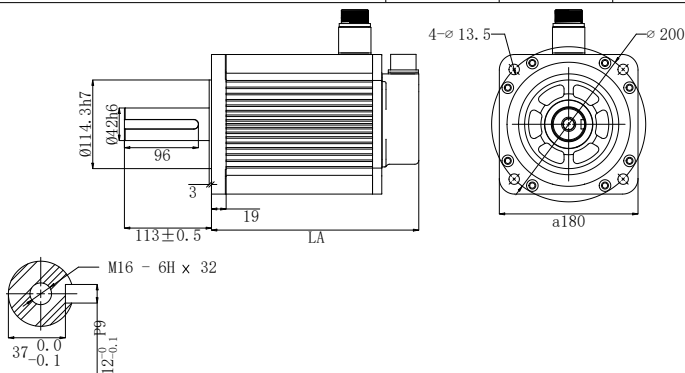
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-180C□15B□2-45P5	269	309	High inertia
MS6H-180TL15B□2-45P5	269	309	
MS6H-180C□15B□2-47P5	325	365	
MS6H-180TL15B□2-47P5	325	365	
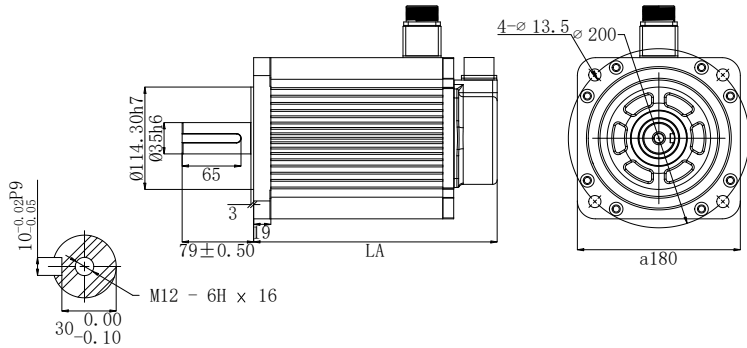
Motor model	LA±1		Inertia level
	Normal	With brake	
MS6H-180CS/CM15E□2-45P5	269	309	High inertia
MS6H-180CS/CM15E□2-47P5	325	365	

■ 220 series motor installation dimension Unit: mm
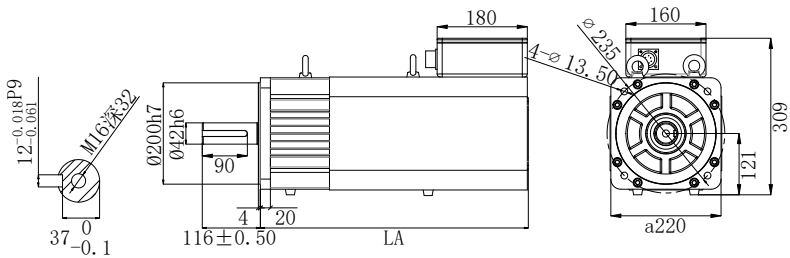
Motor model	LA±1		Inertia level
	Normal	With brake	
MS-220STE-TL70015B-411P0-XJ	454	-	-
MS-220STE-TL96015B-415P0-XJ	507	-	
MS5G-220STE-□□40015B-422P0-S01	535	-	Medium inertia

2-4. Servo driver dimension

■ DS5C-20P1/20P2/20P4-PTA   Unit: mm
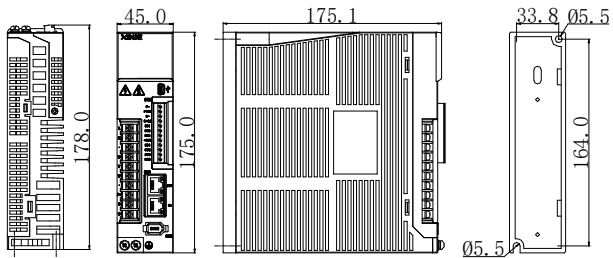
■ DS5C-20P7-PTA   Unit: mm
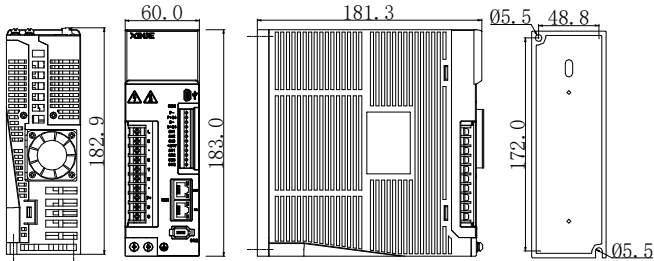
■ DS5C-21P0/21P5/41P5/22P3/22P6-PTA   Unit: mm
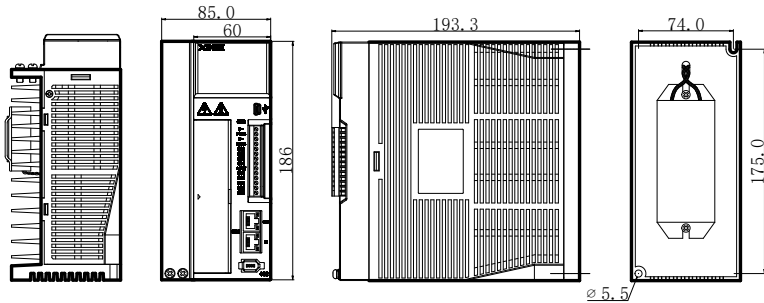
■ DS5C-41P0-PTA   Unit: mm
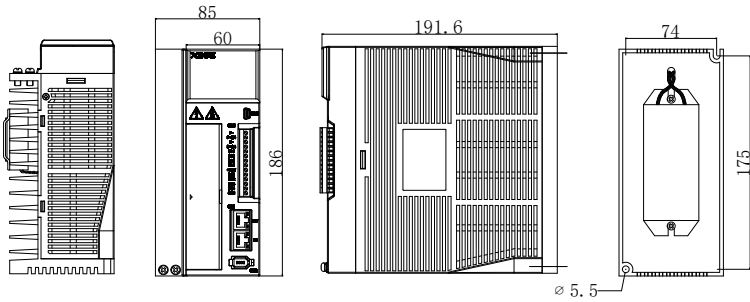
■ DS5C-43P0-PTA/43P0-PTA-H   Unit: mm
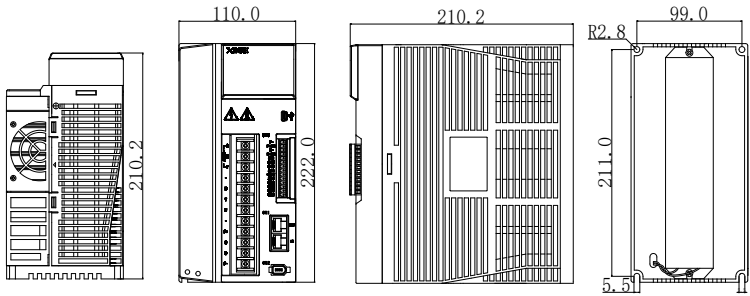
■ DS5C-45P5/47P5-PTA、DS5C-45P5/47P5-PTA-H   Unit: mm
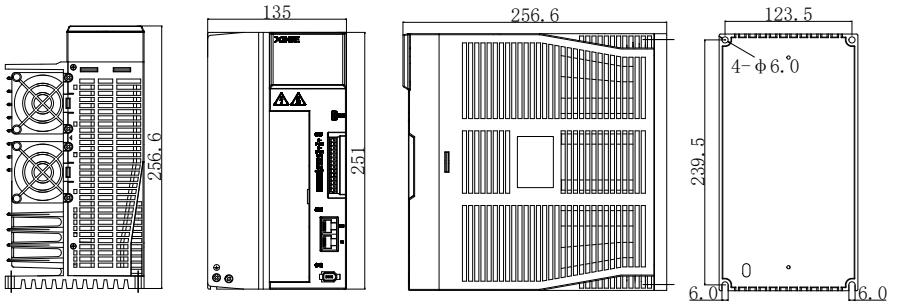
■ DS5C-411P0/415P0-PTA   Unit: mm
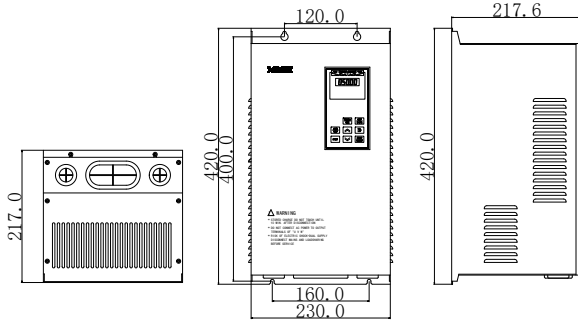
■ DS5C-422P0/432P0-PTA   Unit: mm
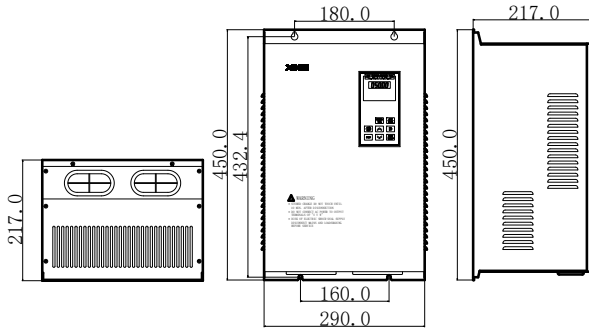
3. Servo system wiring

3-1. Main circuit terminals explanation

■   DS5C-20P1/20P2/20P4/20P7-PTA
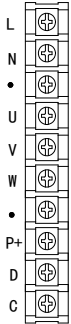
Terminal	Function	Explanation
L/N	Power supply input of main circuit	Single phase AC 200~240V, 50/60Hz
●	Vacant terminal	-
U, V, W	Motor terminals	Connect the motor Note: the ground wire is on the cooling fin, please check it before power on!
P+, D, C	Internal regenerative resistor	Short P+ and D, disconnect P+ and C, set P0-24=0
	External regenerative resistor	Connect regenerative resistor between P+ and C, disconnect P+ and D, P0-25= power value, P0-26= resistor value, P0-24=1

■   DS5C-21P0/21P5/2P3/2P6-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, set P0-24=0
	External regenerative resistor	Connect regenerative resistor between P+ and C, disconnect P+ and D, P0-25= power value, P0-26= resistor value, P0-24=1
⏚	Ground terminal	Connect to ground terminal of motor, then connect to the ground

■ DS5C-41P0-PTA
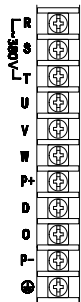
Terminal	Function	Explanation
R, S, T	Power supply input of main circuit	3-phase AC 380~440V, 50/60Hz
U, V, W	Motor terminals	Connect the motor Note: the ground wire is on the cooling fin, please check it before power on!
P+, D, C	Internal regenerative resistor	Short P+ and D, disconnect P+ and C
	External regenerative resistor	Connect regenerative resistor between P+ and C, disconnect P+ and D, P0-25= power value, P0-26= resistor value
P+, P-	Bus terminal	The real-time voltage of the bus can be measured. Please pay attention to the danger
⏚	Ground terminal	Connect to ground terminal of motor, then connect to the ground

■ DS5C-41P5-PTA

Terminal	Function	Explanation
R/S/T	Power supply input of main circuit	3-phase AC 380~440V, 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
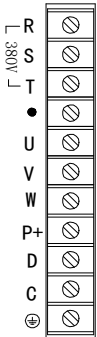
■ DS5C-43P0-PTA, DS5C-43P0-PTA-H

R
S 380V
T
•
U
V
W
P+
D
C
⏚

Terminal	Function	Explanation
R, S, T	Power supply input of main circuit	3-phase AC 380~440V, 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	External regenerative resistor	Connect regenerative resistor between P+ and C, disconnect P+ and D, P0-25= power value, P0-26= resistor value
	Internal regenerative resistor	Short P+ and D, disconnect P+ and C
⏚	Bus terminal	Connect to ground terminal of motor, then connect to the ground
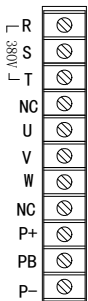
■ DS5C-45P5/47P5-PTA, DS5C-45P5/47P5-PTA-H

R
S 380V
T
NC
U
V
W
NC
P+
PB
P-

Terminal	Function	Explanation
R, S, T	Power supply input of main circuit	3-phase AC 380~440V, 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.
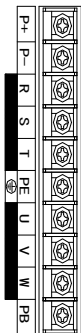
■ DS5C-411P0/415P0-PTA

P+
P-
R
S
T
PE
U
V
W
PB

Terminal	Function	Explanation
R, S, T	Power supply input of main circuit	3-phase AC 380~440V, 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

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P+, P-	Bus terminal	Real-time bus voltage can be measured. Please pay attention to the danger.

■   DS5C-422P0/432P0-PTA

Terminal	Function	Explanation
R, S, T	Power supply input of main circuit	3-phase AC 380~440V, 50/60Hz
PE	Connect to the ground	-
U, V, W	Motor terminals	Connect the motor Note: the ground wire is on the cooling fin, please check it before power on!
P1, P+, P-	P1, P-: external brake unit	It is necessary to select the braking unit and braking resistance. The input terminal of the braking unit is connected to P1 and P -, and the braking resistance is connected to the output of the braking unit
	P1, P+: the terminals are short connected	After removing the short connector, the DC reactor can be connected in series to suppress the high-order harmonic of the power supply and improve the output DC waveform
	P+, P-: bus terminal	The real-time voltage of the bus can be measured. Please pay attention to the danger.

■   Servo motor terminal wiring

Signal	40, 60, 80 series motor	110, 130 series motor
PE	4-yellow green	1-yellow green
U	1-brown	2-brown
V	3-black	3-black
W	2-blue	4-blue

3-2. Control terminal explanation and wiring

The numbers of the following connectors are in the order when looking at the solder patch.

CN0		CN1
Below 1.5KW	1.5KW and up	

Below 1.5KW	1.5KW and up	CN1
P– P+24V D– D+24V SI1 SI2 SI3 +24V SO1 SO2 SO3 COM	P– P+24 D– D+24 SI1 SI2 SI3 SI4 +24V SO1 SO2 SO3 SO4 COM	16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

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

No.	Name	Explanation	No.	Name	Explanation
1	P-	Pulse input PUL-	7	SI3	Input terminal 3
2	P+24V	Open collector input	8	+24V	Input +24V
3	D-	Direction input DIR-	9	SO1	Output terminal 1
4	D+24V	Open collector input	10	SO2	Output terminal 2
5	SI1	Input terminal 1	11	SO3	Output terminal 3
6	SI2	Input terminal 2	12	COM	Output terminal ground

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

No.	Name	Explanation	No.	Name	Explanation
1	P-	Pulse input PUL-	8	SI4	Input terminal 4
2	P+24V	Open collector input	9	+24V	Input +24V
3	D-	Direction input DIR-	10	SO1	Output terminal 1
4	D+24V	Open collector input	11	SO2	Output terminal 2
5	SI1	Input terminal 1	12	SO3	Output terminal 3
6	SI2	Input terminal 2	13	SO4	Output terminal 4
7	SI3	Input terminal 3	14	COM	Output terminal ground

■ CN1 terminal explanation

No.	Name	Explanation	No.	Name	Explanation
1	TX A+	Data send +	9	TX B+	Data send +
2	TX A-	Data send -	10	TX B-	Data send -
3	RX A+	Data receive +	11	RX B+	Data receive +
4	-		12	-	
5	-		13	-	
6	RX A-	Data receive -	14	RX B-	Data receive -
7	-		15	-	
8	-		16	-	

OUT: 16 15 14 13 12 11 10 9

IN: 8 7 6 5 4 3 2 1

Note: the servo motion bus function requires optional bus module, which is inserted into the driver CN1 port to realize the extended bus function. Please note that the module cannot be hot swapped in use. It is recommended to use PROFIBUS standard connecting cable in order to achieve the best communication reliability.

■ CN2 terminal explanation

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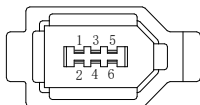
No.	Definition
1	5V
2	GND
5	485-A
6	485-B

1 3 5
2 4 6

4. Before using operation of servo system

4-1. Operate panel display
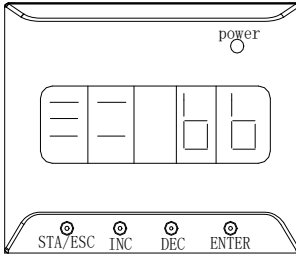
Button	Operation
STA/ESC	Short press: state switch, state return
INC	Short Press: The display data increases Long press: The display data increases continuously
DEC	Short Press: The display data decreases Long press: The display data decreases continuously
ENTER	Short press: shift Long press: Set and view parameters.

By switching the basic state of the panel operator, the operation state display, parameter setting, auxiliary function operation command and other operations can be carried out.

After pressing the STA / ESC key, the States will be switched in the order shown in the figure below.

Status: BB indicates that the servo system is idle; Run indicates that the servo system is running and RST indicates that the servo needs to be powered on again.
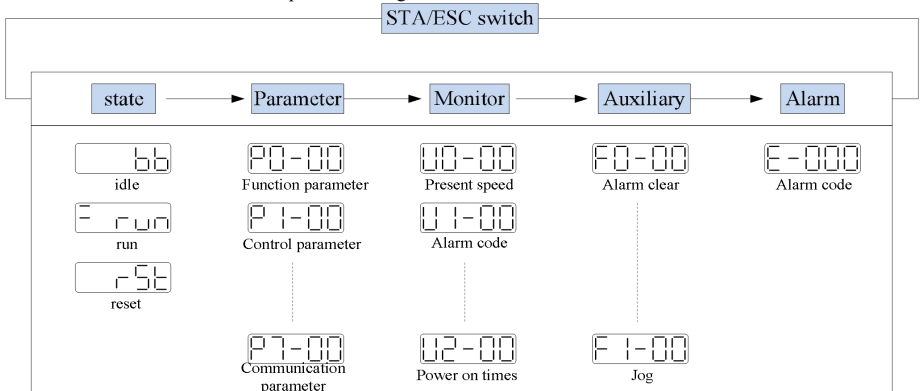
- Parametric setting Px-xx: The first X represents the group number, and the last two X represents the parameter serial number under the group.

- 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

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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.

4-1-1. PX-XX parameters

Refer to the appendix.

4-1-2. UX-XX parameters

■ U0-21 input signal status
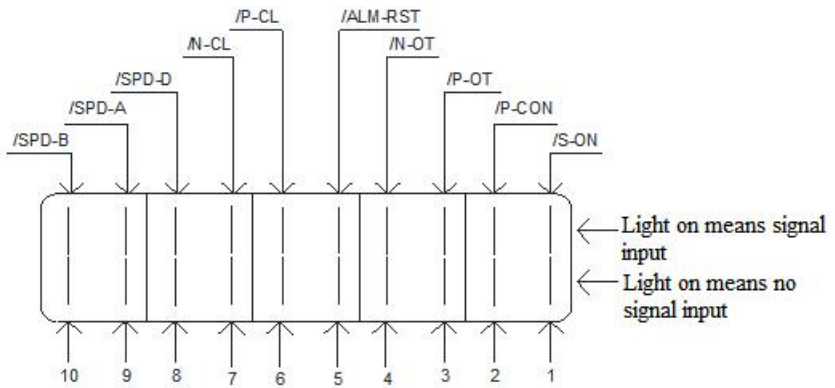
■ U0-21 input signal 1 distribution

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

■ U0-22 input signal status
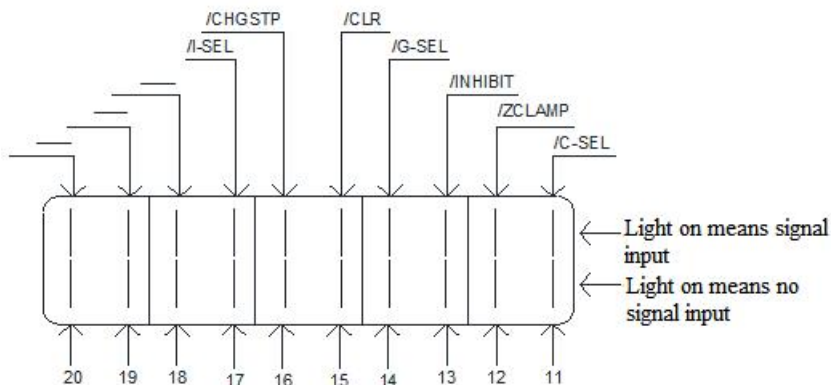
■ U0-22 input signal 2 distribution

Segment code	Description	Segment code	Description
11	/C-SEL control mode selection	12	/ZCLAMP zero clamp
13	/INHIBIT instruction pulse prohibition	14	/G-SEL gain switch
15	/CLR pulse clear	16	/CHGSTP change step
17	/I-SEL inertia switching	18	—
19	—	20	—
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 /I-SEL have input.			

Note: "-" is for reserved display and does not represent any signal. The status bit is always 0.

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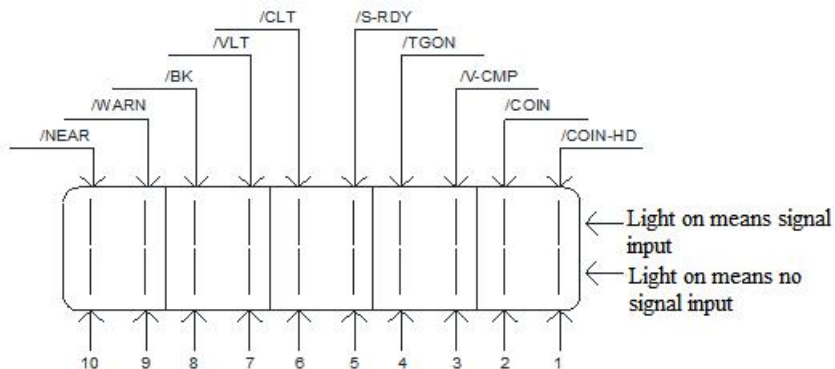
- U0-23 output signal 1 distribution

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

- U0-24 output signal status
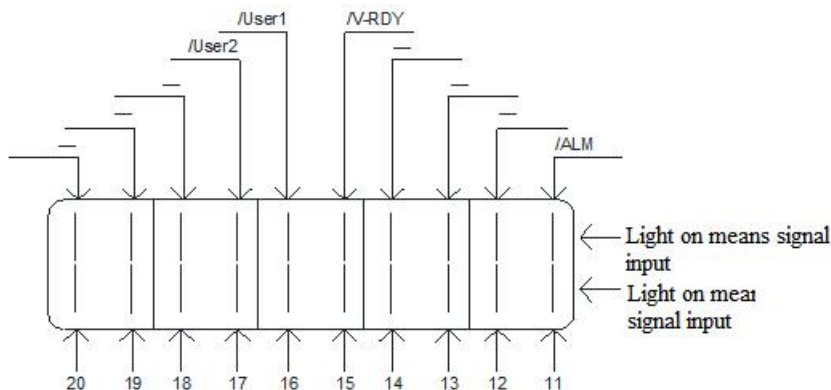
U0-24 output signal distribution

Segment code	Description	Segment code	Description
11	Alarm (/ALM)	12	—
13	—	14	—
15	Speed reach（/V-RDY）	16	Customized output 1
17	Customized output 2	18	—
19	—	20	—
Note: when reading the status through communication, the read binary number corresponds to /ALM and "-" position from right to left. 0 means that the position signal is not output, and 1 means that the position signal is output. Example: 0x0001 indicates that /ALM has output, 0x0041 indicates that /ALM and /custom output 2 have output.			

Note: "-" is for reserved display and does not represent any signal. The status bit is always 0.

4-1-3.FX-XX auxiliary function

■ F0-XX

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

1. Clear alarm (parameter F0-00)

In case of failure, it will automatically jump out of the alarm state of E-xxx and display the alarm number. In

case of no failure, the alarm state will not be visible. In the alarm state, write 1 to F0-00 through panel operation to reset the fault.

In case of servo alarm due to servo power off, it is not necessary to clear the alarm. When an alarm occurs, first eliminate the cause of the alarm, and then clear the alarm.

2. Restore the parameter to the factory value (parameter F0-01)

First turn the servo off, and then restore the factory operation. The operation is as follows:

Set F0-01 = 1, press enter to confirm, then the parameter recovery has been completed, and there is no need to power off again.

3. Clear deviation (parameter F0-02)

Set F0-02 = 1 to clear the deviation.

4. Panel inertia identification (parameter F0-07)

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

If the servo jitters under the adaptive default parameters, please switch to the adaptive large inertia mode (P2-03.3 = 1) to ensure the stable operation of the servo before inertia identification!

When the servo is in BB state, enter the parameter F0-07 display:
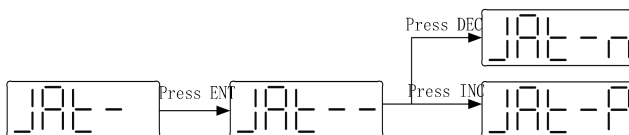
5. Panel external command self-tuning (parameter F0-08)

Refer to section 5-2-1 for detailed steps.

6. Panel internal command self-tuning (parameter F0-09)

Refer to section 5-2-2 for detailed steps.

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

Vibration suppression mode	Display	Changed parameters
Mode 1	vib-1	Only the parameters related to vibration suppression will be changed
Mode 2	Vib-2	The parameters related to vibration suppression and the gain of speed loop will be changed

The operation steps are described below:

(1) In the self-tuning mode, enter the parameter F0-10 and the panel displays vib-1 or enter F0-11 and the panel displays vib-2
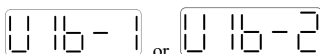
(2) Briefly press the Enter key, and the panel displays Son and flashes. At this time, it needs to be enabled manually

(3) After the servo enable is turned on, the panel displays tune and flashes to enter the setting state

```
 tunE
```

(4) The upper device starts to send pulse command until done is displayed and flashes to complete vibration suppression

```
 donE
```

(5) Short press STA / ESC to exit

The vibration suppression parameters will be automatically written into the second and first notch filters (when there is only one vibration point, the second notch will be opened first). See the user manual for relevant parameters.

8. Panel vibration suppression (fast FFT) (F0-12)

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:
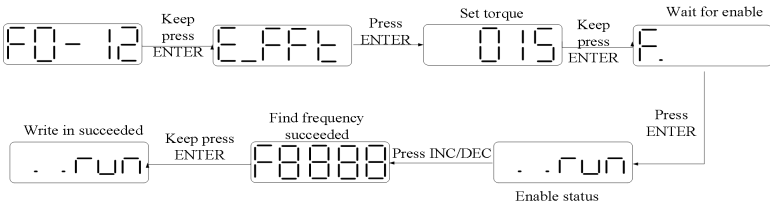
■   F1-XX

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

1.Jog operation (F1-00)

Before entering inching mode, please confirm that the motor shaft is not connected to the machine and the driver is bb idle!

During inching operation, parameters such as gain will participate in the control, and whether the parameter setting is appropriate can be judged according to the operation condition.
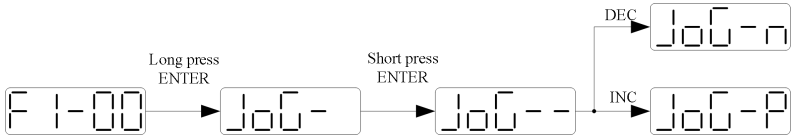
P3-18	JOG speed					
	Unit	Default setting	Setting range	Suitable mode	Modify	Effective
	1rpm	100	0~1000	JOG	Servo OFF	At once

2.Test run (F1-01)

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

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

Test run mainly checks the power cable and the encoder feedback cable to determine whether the connection is normal. According to the following operation, the motor can normally achieve forward and reverse rotation. If the motor shaft shakes or driver alarms, please immediately disconnect the power supply, and re-check the wiring situation.
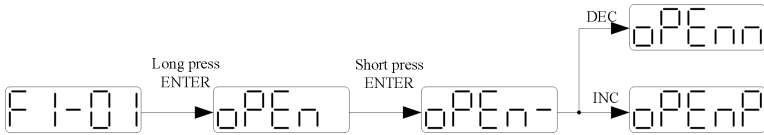
3.Current sampling zero-correction (F1-02)

When the servo 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.
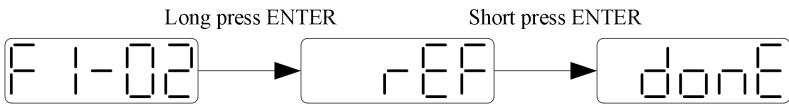
Press STA/ESC to exit, please power on again.

4.Panel enable

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		

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			(F1-05 or communication)		
		3	Fieldbus enable (the model which supports motion bus)		

If P0-03 set to 2,

F1-05 = 0: cancel enable, enter bb status.

F1-05 = 1: forced enable, servo is in RUN status.

Note: after power on again, the forced enable will fail.

If the user wants to enable as soon as the power is on, and it still takes effect after power failure, P5-20 is set to n.0010. (P0-03 = 1 effective)

5.clear the turns of absolute encoder (F1-06)

First turn the servo off, and then clear the turns of the absolute encoder. The operation is as follows:

Write 1 to F1-06 through panel operation to clear the turns of absolute encoder.

Write 1 to 0x2106 hexadecimal address through Modbus RTU to clear the turns (servo bb status takes effect, and write 0 to the address 0x2106 after clearing).

4-2. Panel button operation

Take modifing P3-09 as an example:

Step	Display	Use buttons				Operation
		STA/ESC	INC	DEC	ENTER	
1	bb	◎	◎	◎	◎	No operation
2	P0-00	◎	◎	◎	◎	Press STA/ESC to enter parameter setting
3	P3-00	◎	◎	◎	◎	Press INC to increase by 1, press 3 times to add to 3, it shows P3-00
4	P3-00	◎	◎	◎	◎	Press ENTER, the last "0" will flash
5	P3-09	◎	◎	◎	◎	Press INC to increase to 9
6	P3-09	◎	◎	◎	◎	Long press ENTER to enter P3-09
7	3000	◎	◎	◎	◎	Press INC, DEC, ENTER to increase/decrease and shift bit, after changing, long press ENTER to confirm
8	END					

4-3. Modify the motor code

Note:

(1) 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 commissioning the servo system, please confirm whether the motor code U3-70 matches the motor nameplate label.

(2) If the motor code is set incorrectly, the driver will give an alarm, directly set P0-33 to 0000, power off and power on again.

Driver label
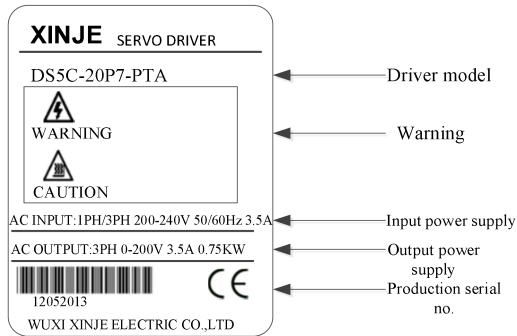
5. Gain adjustment

The new generation DS5C series servo has rigid self-adaptive, self-tuning and manual adjustment functions, without complicated parameter adjustment process, which greatly saves the gain adjustment time.

Adaptive function: adaptive function refers to the function that can obtain stable response through automatic adjustment regardless of the type of machinery and load fluctuation.

Self-tuning function: self-tuning refers to the function that the servo unit automatically adjusts according to the mechanical characteristics when performing automatic operation (forward and reverse reciprocating motion) within the set range or receiving the operation command of the upper device.

Manual adjustment function: manual adjustment is the function of directly setting the rigidity level to obtain stable gain on the basis of setting the load inertia ratio.

5-1. Adaptive function

In the case of low responsiveness requirements, this function can be used quickly by setting the gear ratio and enabling functional parameters, saves the servo adjustment time.

The self-adaption default parameter is defined as the small inertia mode, in which the load inertia does not change within 20 times; P2-03.3 setting to 1 means switch to large inertia mode, which is most suitable for 50-80 times load inertia operation (above take 60/80 flange motor as the example).

In order to ensure safety, the self-adaption operation should be carried out when the enable function can be shut down and servo can be stop urgently at any time.

5-1-1. Self-adaption mode selection switch parameter

Inertia mode selection switch	Self-adaption default parameters	Parameter notes
P2-03.3=0 Small inertia mode	P2-05=400	Adaptive small inertia mode speed loop gain
	P2-11=100	Adaptive small inertia mode position loop gain
	P2-10=500	Adaptive small inertia mode speed loop integral
	P2-07=0	Adaptive small inertia mode inertia ratio
	P2-08=60	Adaptive small inertia mode speed observer gain
	P2-12=30	Adaptive small inertia mode stable max inertia ratio
	P2-19=50	Adaptive small inertia mode control bandwidth
P2-03.3=1 Large inertia mode	P6-05=200	Adaptive large inertia mode speed loop gain
	P2-11=100	Adaptive large inertia mode position loop gain
	P2-10=500	Adaptive large inertia mode speed loop integral
	P6-07=50	Adaptive large inertia mode inertia ratio
	P6-08=40	Adaptive large inertia mode speed observer gain
	P6-12=50	Adaptive large inertia mode stable max inertia ratio
	P2-19=70	Adaptive large inertia mode control bandwidth

Note:

(1) P2-19 default value is different for different power drive.

(2) P2-05 default value is 200 for the drive above 1.5kw.

Parameter	Default value	Range	Effect
P2-05/P6-05	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	0/50	0~200	Increase can greatly improve the inertia capacity, and will not affect the responsiveness, too large is prone to oscillation.

P2-08/P6-08	60/40	30~60	Reducing P2-08 and increasing P2-12 can greatly improve
P2-12/P6-12	30/50	30~60	the inertia capability, but it will reduce the responsiveness, which has a great impact on responsiveness.
P2-10	500	200~larger	Adjust according to need, generally increase
P2-11	100	50~200	Adjust according to need
P2-19	50~70	40~80	Increasing will increase the inertia capacity slightly, and it has little effect on the responsiveness, as an auxiliary parameter.

5-1-2. Recommended inertia ratio under default parameters

Motor flange	Recommended load inertia ratio in small inertia mode	Recommended load inertia ratio in large inertia mode
40	Below 20 times	60 times ~ 80 times
60	Below 20 times	60 times ~ 80 times
80	Below 20 times	60 times ~ 80 times
130	Below 10 times	15 times ~ 20 times
180	Below 5 times	10 times ~ 20 times

If the load inertia is over the recommended value in the table, please change the related parameters of gain.

The method is shown as below:

If the inertia is 20 times to 30 times

Increase P2-07 appropriately, decrease P2-05 if necessary. You can also refer to the following super-large inertia debugging methods.

Super-large debugging experience (50-100 times inertia):

Increase P2-12 (40~50 is recommended), reduce P2-08 (40~50 is recommended), reduce P2-05(100~300 is recommended), increase P2-07(10~50 is recommended). Please flexible adjust according to load inertia.

Application example:

(1) 30-times inertia load gain parameters

When it is default value, please set P2-08=50   P2-12=40   P2-07=50

(2) 80-times inertia load gain parameters

When it is default value, please set P2-08=40   P2-12=50   P2-07=50   P2-05=200   P2-10=1000

5-2. Auto-tuning

Auto-tuning parameter setting is based on the current institution, the parameters after auto-tuning is not applicable to empty shaft and other types of load, the auto-tuning is divided into no instruction auto-tuning

and auto-tuning with instruction, it needs the servo PC software to adjust, detailed usage please refer to PC software manual.

5-3. Manual adjustment

Manual adjustment needs to set load inertia first, then turn off the self-adaption function to use. Servo firmware version 3640 and later supports this function.

5-3-1. Manual adjustment steps

1. Set the load inertia ratio P0-07 (Estimation of inertia by upper computer or known load inertia).
2. Change P2-01.0 to 0, turn off self-adaption function.

After the above two steps, the manual adjustment takes effect. The rigidity level is adjusted by P0-04 (rigidity level parameter). The rigidity gain is divided into 31 levels, and each level corresponds to a set of parameters.

Parameter	Name
P1-00	Speed loop gain
P1-01	Integral time constant of speed loop
P1-02	Position loop gain
P2-49	Model loop gain
P2-35	Torque command filter time constant

Notes for debugging:

(1) Rigidity level generally increases or decreases in the default value. If the rigidity level is not suitable in actual operation, it can be modified by P0-04. The larger the value, the greater the gain and the stronger the rigidity.

(2) Under the current rigidity level, if the requirements are not met, the above five parameters can still be fine-tuned.

(3) If vibration occurs, it is necessary to detect resonance frequency by mechanical characteristic analysis and to configure notch parameters to suppress vibration.

5-3-2. Manual adjustment parameter and function

Parameter	Name	Explanation
P0-07	Load inertia ratio	The ratio of load and rotor inertia, the value can be deduced by the upper device inertia recognition
P1-00	Speed loop gain	In the absence of noise and vibration, increasing this parameter can speed up the positioning time and bring better speed stability and follow-up. In the case of noise and vibration, reduce the setting value of this parameter

P1-01	Speed loop integral	In the absence of noise and vibration, reducing the value can strengthen the integral function and speed up the positioning time. If this value is too high, it will cause the speed loop deviation return to zero become slowly
P1-02	Position loop gain	In the absence of noise and vibration, increasing this parameter can speed up the positioning time
P2-01.0	Auto-tuning switch	0: auto-tuning 1: self-adaption
P2-35	Torque filter time constant	increase this value can reduce the noise, but the velocity fluctuation will become larger and vibration will easily occur. If this value is reduced, the noise will increase, but the velocity fluctuation will decrease. The greater the load inertia, the greater the value
P2-49	Model loop gain	When the value is increased, the rigidity level will be improved and the position curve following features will be improved, but it is easy to overshoot. decreasing this value can reduce the overshoot, but the position curve becomes less traceable

5.4 Gain adjustment application function

5-4-1. Second set of gain adjustment

The following functions are only supported in version 3770 and later.

Parameter		Meaning	Default setting	Modify	Effect
P1-14	n.□□□0	0-SI terminal switching gain is valid (gain switching condition parameters are not valid) 1 - perform gain switching according to gain switching conditions 2 - reserved	0	Servo bb	At once
	n.□□□1	n.□□X□: Gain switching condition selection 0 - 1st gain fixed 1 - switching using external SI terminals 2 - large torque command 3 - high speed command 4 - speed command changes greatly 5 - [reserved] - fixed as the first gain			

Parameter		Meaning	Default setting	Modify	Effect
		6 - large position deviation			
		7 - position command			
		8 - positioning completed			
		9 - high actual speed			
		A - position command + actual speed			
P1-15		Gain switching waiting time	5	Servo bb	At once
P1-16		Gain switching level threshold	50	Servo bb	At once
P1-17		Hysteresis of gain switching level threshold	30	Servo bb	At once
P1-18		Position loop gain switching time	2	Servo bb	At once

Note:

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

(2) The definition of "gain switching level threshold hysteresis" is shown in the following figure:
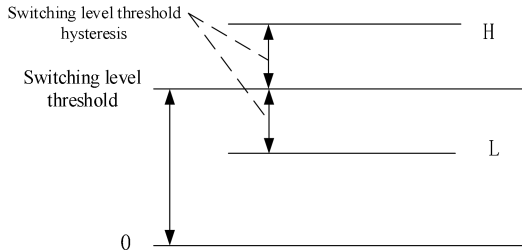
(3) Description of "position gain switching time":
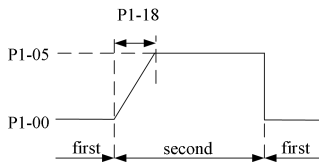
(4) Description of gain switching conditions

Gain switching condition setting			Related parameter		
P1-14.1	condition	Diagram	P1-15 Wait time	P1-16 Grade threshold	P1-17 threshold hysteresis loop
0	First gain fixed	-	Invalid	Invalid	invalid

Gain switching condition setting				Related parameter		
P1-14.1	condition	Diagram		P1-15 Wait time	P1-16 Grade threshold	P1-17 threshold hysteresis loop
1	Terminal switching			Valid	Invalid	Invalid
		Gain switching using G-SEL signal: G-SEL signal is invalid, group 1 gain; G-SEL signal is valid, group 2 gain.				
2	Torque command			Valid	Valid (%)	Valid (%)
		When the absolute value of torque command exceeds (level + hysteresis) [%] at the last first gain, switch to the second gain; In the last second gain, the absolute value of the torque command is less than (level - hysteresis) [%], and then wait until P1-15 remain in this state, return to the first gain.				
3	Speed command			Valid	Valid	Valid
		When the absolute value of the speed command exceeds (level + hysteresis) [RPM] at the last first gain, switch to the second gain; At the last second gain, the absolute value of the speed command is less than (level - hysteresis) [RPM], and then wait until P1-15 remain in this state, return to the first gain.				

Gain switching condition setting				Related parameter		
P1-14.1	condition	Diagram		P1-15 Wait time	P1-16 Grade threshold	P1-17 threshold hysteresis loop
4	speed command changing rate			Valid	Valid (10rpm/s)	Valid (10rpm/s)
		In the last first gain, when the absolute value of the speed command change rate exceeds (level + hysteresis) [10rpm/s], switch to the second gain; At the last second gain, when the absolute value of the speed command change rate is less than (level-hysteresis) [10rpm / s], wait until P1-15 remain in this state, and return to the first gain.				
5	Speed command high and low speed threshold [not supported temporarily]			Invalid	Valid (rpm)	Valid (rpm)
		In the last first gain, when the absolute value of the speed command exceeds (level-hysteresis) [RPM], switch to the second gain, and the gain gradually changes. When the absolute value of the speed command reaches (level + hysteresis) [RPM], the gain completely changes to the second gain; At the last second gain, when the absolute value of the speed command is lower than (level + hysteresis) [RPM], it starts to return to the first gain, and the gain changes gradually. When the absolute value of the speed command reaches (level-hysteresis) [RPM], the gain completely returns to the first gain.				

Gain switching condition setting			Related parameter		
P1-14.1	condition	Diagram	P1-15 Wait time	P1-16 Grade threshold	P1-17 threshold hysteresis loop
6	Position offset		Valid	Valid (encoder unit)	Valid (encoder unit)
		Valid only in position mode (other modes are fixed as the first gain) When the absolute value of position deviation exceeds (level + hysteresis) [encoder unit] at the last first gain, switch to the second gain; In the last second gain, the state when the absolute value of the position deviation is less than (level-hysteresis) [encoder unit], and then wait until P1-15 remain in this state, return to the first gain.				
7	Position command		Valid	Invalid	Invalid
		Valid only in position mode (other modes are fixed as the first gain): In the last first gain, if the position command is not 0, switch to the second gain; At the last second gain, if the position command is in the state of 0, it returns to the first gain when the waiting time P1-15 remains in this state.				
8	Positioning completion		Valid	Invalid	Invalid
		Valid only in position mode (other modes are fixed as the first gain) In the last first gain, if the positioning is not completed, switch to the second gain; At the last second gain, if the state of positioning completion remains in this state for the waiting				

Gain switching condition setting			Related parameter		
P1-14.1	condition	Diagram	P1-15 Wait time	P1-16 Grade threshold	P1-17 threshold hysteresis loop
		time P1-15, the first gain is returned Note: it is necessary to set the mode of positioning completion detection according to P5-01.			
9	Actual speed		Valid	Valid (rpm)	Valid (rpm)
		Valid only in position mode (other modes are fixed as the first gain): When the absolute value of the actual speed exceeds (level + hysteresis) [RPM] at the last first gain, switch to the second gain. At the last second gain, the absolute value of the inter speed is less than (level-hysteresis) [RPM], and then wait until P1-15 remain in this state, return to the first gain.			
A	Position command+ actual speed		Valid	Valid (rpm)	Valid (rpm)
		Valid only in position mode (other modes are fixed as the first gain): In the last first gain, if the position command is not 0, switch to the second gain. At the last second gain, the state in which the position command is 0 maintains the second gain within the waiting time P1-15. When the position command is 0 and the waiting time P1-15 arrives, if the absolute value of the actual speed is less than (level) [RPM], the speed integral time constant is fixed at the second speed loop integral time constant (P1-07), and the others return to the first gain; If the absolute value of the actual speed is less than (level-hysteresis) [RPM], the speed integral also returns to the integral time constant of the first speed loop (P1-02).			

5-5. Vibration suppression

When the excitation frequency of the mechanical system is close to the natural frequency of a certain order of the system, the system amplitude increases significantly, which will cause vibration and noise.

Generally, the screw equipment with small load inertia can achieve better results by auto-tuning directly with the upper computer. When the inertia identified by other equipment in the process of inertia identification is small, it can also use the upper computer to auto-tune directly without manual adjustment. The current version needs to be re-energized after modifying the P2 parameters in the process of manual adjustment. In addition, after each parameter re-adjustment, it should first run at low speed to observe whether there is vibration. However, vibration or overshoot may occur during the adjustment process. Please perform manual adjustment when the enablement can be stopped or servo can be turned off at any time.

Band trap:

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 of notch filter is as follows:
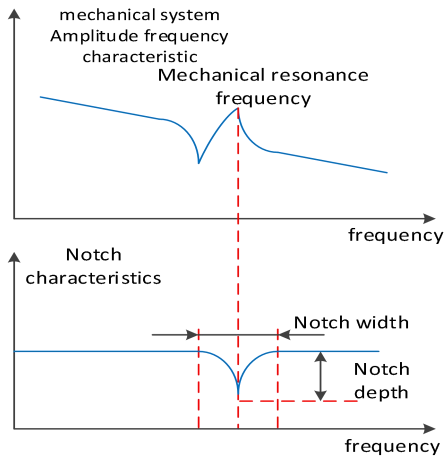
(1)   Open the Xinje servo software, click mechanical properies

(2)   Click measure, it will show below window

Measure ✕

Measurement conditions

Signal unit	Speed(rpm) ⌄
Original frequency(hz)	10
Terminal frequence(hz)	1000
Signal Amplitude(rpm)	500
Total Time(ms)	500

Measurement model

◉ Speed_instruction Current_feedback

○ Speed_command Speed_feedback

[Execute] [Cancel]
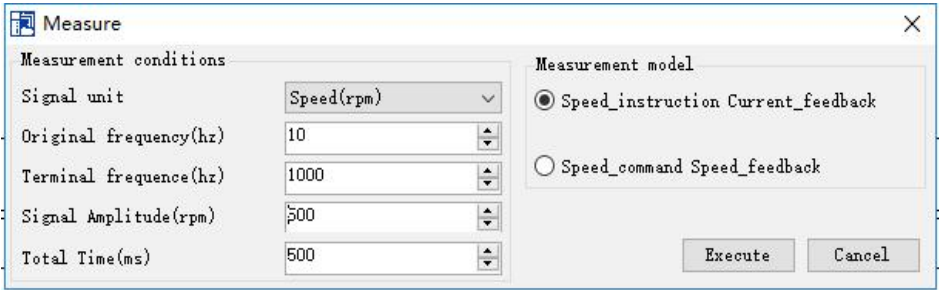
(3) click execute, wait for data reading to complete

(4) click amplitude and phase, set the filter width according to the waveform sharpness

(5) click display in the pointer window, set vibration frequency peak
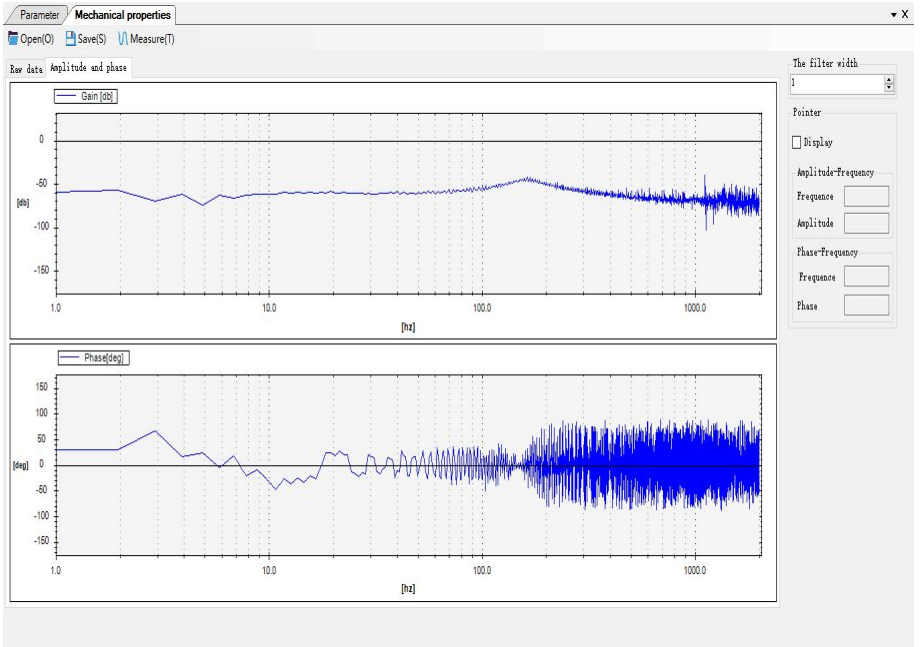
(6) open vibration suppression switch, set the vibration frequency

(7) if there is still vibration after setting notch frequency, please adjust P2-35.

Refer to below table for detailed parameters:

Parameter	Name	Explanation
P2-00.0	Disturbance observer switch	0: Close 1: Open
P2-41	Disturbance observer gain	Default 91, Generally changed to 85
P2-69.0	First notch switch	0: Close 1: Open
P2-69.1	Second notch switch	0: Close 1: Open
P2-69.3	Fourth notch switch	0: Close 1: Open
P2-71	First notch frequency	Setting according to the result of characteristic analysis
P2-74	Second notch frequency	Setting according to the result of characteristic analysis
P2-77	Fourth notch frequency	Setting according to the result of characteristic analysis

6. EtherCAT communication specification

Physical layer	100BASE-TX
Communication interface	RJ45 × 2 (CN1)
Network architecture	Tandem connection
transmission speed	2 x 100 Mbps (full duplex)
Data frame length	Maximum 1484 bytes
SyncManager	SM0：Mailbox output SM1：Mailbox input SM2：Periodic data output SM3：Periodic data input
FMMU (Bus Memory Management Unit)	FMMU0：Periodic Data Output Zone FMMU1：Periodic Data Output Zone FMMU2：Mailbox status zone
Application Layer Protocol	CoE：CANopen over EtherCAT
Synchronization mode	DC Synchronization mode（SYNC0）
Communication object	SDO：Aperiodic data objects PDO：Periodic Data Objects
LED light (the indicator lamp is located on the RJ45 port)	EtherCAT ERR(ER) × 1 EtherCAT Link / Activity (L / A) × 2 EtherCAT RUN(RN) × 1

Application Layer Specification	IEC61800-7 CiA402 Drive Profile
Support CIA402 operating mode	Homing Mode (HM) Cycle Synchronized Position Mode (CSP) Cycle Synchronized Velocity Mode (CSV) Cycle Synchronized Torque Mode (CST) Profile Position Mode (PP) Profile Velocity Mode (PV) Torque Profile Mode (TQ)

7. EtherCAT operation mode

7-1. Homing Mode

7-1-1. Overview

The user can let the driver search the origin position, and set the way to return to the origin, the speed and acceleration of return.

7-1-2. Operation steps

P5-22 corresponds to the positive limit terminal (the default value is 1, SI1 terminal), P5-23 corresponds to the negative limit terminal (the default value is 2, SI2 terminal), and P5-27 corresponds to the origin terminal (the default value is 3, SI3 terminal). If it is not allocated correctly, an error will be reported when homing.

1. 【Mode of operations:6060h】set to homing mode (0x06).

2. set 【Homing method:6098h】, the range is 1 to 35. (Support method 1, 2, 3, 4, 5, 6, 33, 34, 35, 37)

3. set【Homing speeds:6099h Sub-1】, define the speed when searching for origin switches (unit: command unit/s)

4. set【Homing speeds:6099h Sub-2】, define the speed of finding origin (unit: command unit/s)

5. set【Homing acceleration:609Ah】, define the regression acceleration speed (unit: command unit/s^2)

6. set【Controlword:6040h】to (0x06 > 0x07 > 0x0F), enable the driver and make the motor work.

7. set【Controlword:6040h】to (0x0F > 0x1F), find the (Home Switch) and regression.

8. read【Statusword:6041h】to get the driver status.

7-1-3. Related object table

Index	Name	Units	Access
6040h	Controlword	-	RW

6041h	Statusword	-	RO
6060h	Modes of operation	-	RW
6061h	Modes of operation display	-	RO
6098h	Homing method	-	RW
6099h	Homing speed	Command unit/s	RW
609A	Homing acceleration	Command unit /s^2	RW

7-2. Cyclic Synchronous Position Mode

7-2-1. Overview

The host computer plans the path in CSP mode and sends the PDO in a specified period. When transmitting each PDO, the data of target position and control word will be transmitted to the driver at the same time.

7-2-2. CSP mode
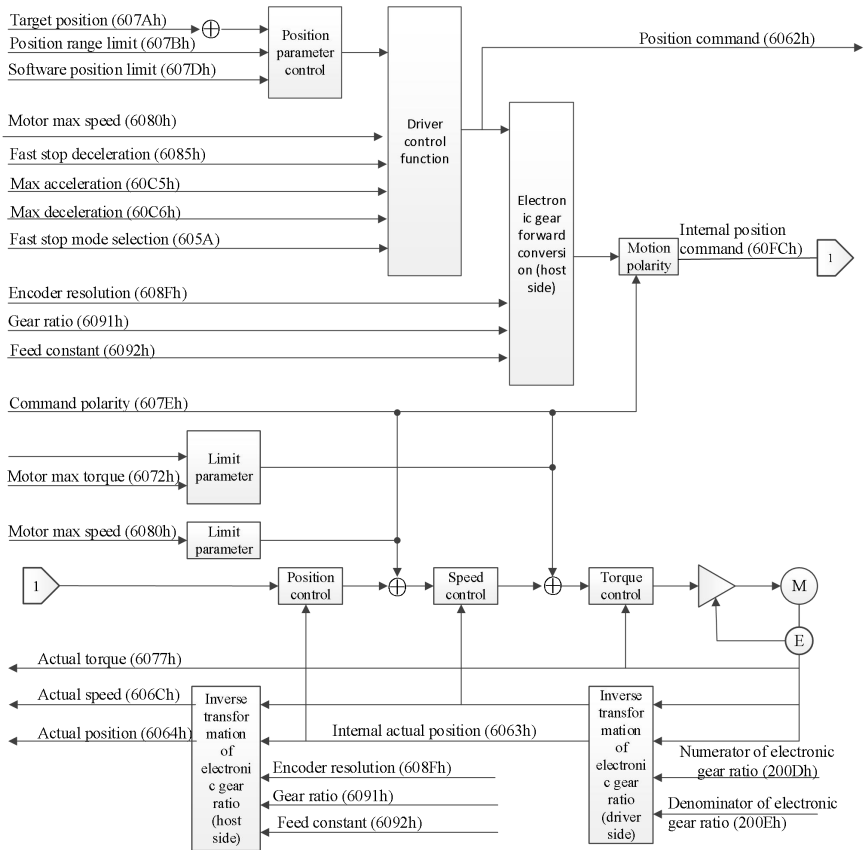
7-2-3. Operation steps

1. set【Mode of operations:6060h】to cyclic synchronous position mode) (0x08).

2. set【Interpolation time period: 60C2h】, settings must be the same as SYNC0 cycles.

◆ 60C2h Sub-1 can set the Interpolation time units, the range is 1ms~20 ms.

◆ 60C2h Sub-2 can set the Interpolation time index, the value fixed at -3 indicates that Interpolation time unit is 10^{-3} seconds.

3. Drive PDO Rx:

◆ Use 607Ah to set Target Pos Cmd (32-bit).

◆ Use 6040h Sub-0 to set control word.

7-2-4. Related object table

Index	Name	Units	Access
6040h	Control word	-	RW
6072h	Max torque	0.1%	RW
607Ah	Target Position	Command unit	RW
607Dh	Soft Position Limit	-	RW
	Number of entries	-	RW
607Bh	Position range limit	-	RW
	HighestSub-Index numbers	-	RW
60C5h	Max acceleration	Command unit $/s^2$	RW
60C6h	Max deceleration	Command unit $/s^2$	RW
60F2h	Positioning option code	-	RW

Detection type related to CSP control mode

Index	Name	Units	Test result
6041h	Statusword	-	RO
6062h	Position demand value (command position)	Command unit	RO
6063h	Position actual internal value	pulse	RO
6064h	Position actual value		RO
6065h	Following error window	Command unit	RW
6066h	Following error timeout	1ms	RW
606Ch	Velocity actual value	Command unit /s	RO
6076h	Motor rated torque	mN·m	RO
6077h	Torque actual value	0.1%	RO
60F4h	Following error actual value	Command unit	RO
60FAh	Control effort （Represents the output of internal instruction speed, position loop output）	Command unit	RO
60FCh	Position deamnd internal value （represents internal command position）	Command unit	RO

7-3. Cyclic Synchronous Velocity Mode

7-3-1. Overview

The host computer plans the speed in CSV mode and sends the PDO according to the specified period. When transmitting each PDO, the data of target velocity and control word will be transmitted to the driver at the same time.

7-3-2. The function of CSV mode
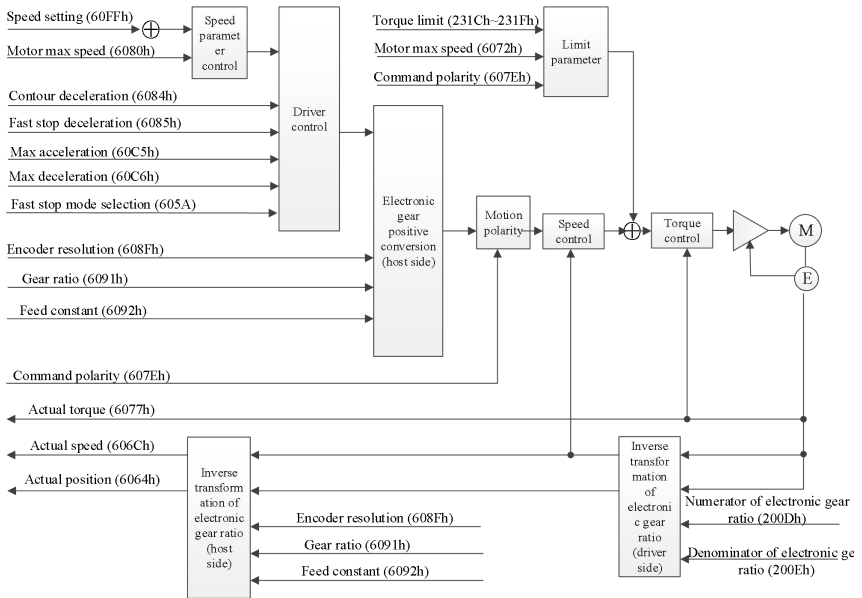
7-3-3. Operation steps

1. set【Mode of operations:6060h】 to Cyclic Synchronous Velocity Mode (0x09).

2. set【Interpolation time period:60C2h】, the settings should be same to the period of SYNC0.

   ◆ 60C2h Sub-1 can set Interpolation time units, the range is 1ms~20ms.

   ◆ 60C2h Sub-2 can set Interpolation time index, the value fixed at -3 indicates that Interpolation time unit is 10^{-3} seconds.

3. Drive PDO Rx:

   ◆ Use 60FFh to set Target Velocity Cmd (32-bit)

   ◆ Use 6040h Sub-0 to set the controlword

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7-3-4. Related object table

Index	Name	Units	Access
6040h	Control word	-	RW
60FFh	Target velocity	Command unit/s	RW
6072h	Max torque	0.1%	RW
6080h	Max motor speed	rpm	RW
60B1h	Velocity offset	Command unit/s	RW

Detection type related to csv control mode

Index	Name	Units	Access
6041h	Statusword	-	RO
6063h	Position actual internal value	Pulse	RO
6064h	Position actual value	Command unit	RO
606Bh	Velocity demand value	Command unit /s	RO
606Ch	Velocity actual value	Command unit /s	RO
6074h	Torque demand value	0.1%	RO
6076h	Motor rated torque	mN·m	RO
6077h	Torque actual value	0.1%	RO

7-4. Cyclic Synchronous Torque Mode

7-4-1. Overview

The upper computer plans the torque in the CST mode. In this mode, the host computer transmits the target torque and control word data to the driver at the same time when transmitting each PDO.

7-4-2. The function of CST mode

Torque limit (231Ch~231Fh)
Max torque (6072h)
Limit parameter

Target torque (6071h)
Max torque (6072h)
Command polarity (607Eh)
Target torque control

Motor max speed (6080h)
Torque slope (6087h)
Fast stop mode selection (605A)
Driver control

Torque control

Torque command (6074h)

M
E

Actual torque (6077h)
Actual torque (606Ch)
Actual position (6064h)
Inverse transformation of electronic gear ratio (host side)

Encoder resolution (608Fh)
Gear ratio (6091h)
Feed constant (6092h)

Inverse transformation of electronic gear ratio (driver side)

Numerator of electronic gear ratio (200Dh)
Denominator of electronic gear ratio (200Eh)

7-4-3. Operation steps

1. set【Mode of operations:6060h】to Cyclic Synchronous Velocity Mode (0x09)

2. set【Interpolation time period: 60C2h】, the settings should be same to the period of SYNC0

   ◆ 60C2h Sub-1 can set the Interpolation time units, the range is 1ms~20ms.

   ◆ 60C2h Sub-2 can set the Interpolation time index, the value fixed at -3 indicates that Interpolation time unit is 10^{-3} seconds.

3. Drive PDO Rx:

   ◆ Use 6071h to set the Target Torque Cmd (16-bit)

   ◆ Use 6040h Sub-0 to set the control word.

7-4-4. Related object table

Index	Name	Units	Access
6040h	Control word	-	RW
6071h	Target Torque	0.1%	RW
6072h	Max Torque	0.1%	RW
6080h	Max motor speed	rpm	RW
60B2h	Torque offset	0.1%	RW

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Detection type related to cst control mode

Index	Name	Units	Access
6041h	Status word	-	RO
6063h	Position actual internal value	Pulse	RO
6064h	Position actual value	Command unit	RO
606Ch	Velocity actual value	Command unit/s	RO
6074h	Torque demand	0.1%	RO
6075h	Motor rated current	mA	RO
6076h	Motor rated torque	mN·m	RO
6077h	Torque actual value	0.1%	RO
6078h	Current actual value	0.1%	RO
6079h	DC link circuit voltage	mV	RO

7-5. Profile Position Mode

7-5-1. Overview

After receiving the position command and speed command from the upper computer controller, the servo driver controls the servo motor to reach the target position.

7-5-2. Operation steps

1. set【control mode: 6060h】to profile position mode (0x01).
2. set【target position: 607Ah】to target position (unit: command unit).
3. set【profile speed: 6081h】to profile velocity (unit: command unit/s).
4. set【profile acceleration 6083h】to plan the acceleration slope (unit: command unit/s²).
5. set【profile deceleration 6084h】to plan the deceleration slope (unit: command unit/s²).
6. set【control word: 6040h】to (0x06 > 0x07 > 0x0F), at this time, the driver is only in the starting state, and the motor can run only after setting the relative or absolute motion mode. If the absolute motion is taken, 6040 can then be set to (0x1F). If it is relative motion, 6040 can then be set to (0x4fF> 0x5F).
7. read【position feedback: 6064h】to get the motor current feedback position.
8. read【status word: 6041h】to get the driver status, including following error, set-point acknowledge and target reached.

7-5-3. Related object list

Index	Name	Unit	Access
6040h	Controlword	UNSIGNED16	RW
6041h	Statusword	UNSIGNED16	RO
6060h	Mode of operation	INTEGER8	RW

Index	Name	Unit	Access
6061h	Modes of operation display	INTEGER8	RO
6062h	Position demand value [PUU]	INTEGER32	RO
6063h	Position actual value [increment]	INTEGER32	RO
6064h	Position actual value	INTEGER32	RO
6065h	Following error window	UNSIGNED32	RW
6067h	Position window	UNSIGNED32	RW
6068h	Position window time	UNSIGNED16	RW
607Ah	Target position	INTEGER32	RW
6080h	Max motor speed	rpm	RW
6081h	Profile velocity (internal speed)	UNSIGNED32	RW
6083h	Profile acceleration	UNSIGNED32	RW
6084h	Profile deceleration	UNSIGNED32	RW
6093h	Position factor	UNSIGNED32	RW
60F4h	Following error actual value	INTEGER32	RO
60FCh	Position demand value	INTEGER32	RO

7-6. Profile Velocity Mode

7-6-1. Overview

The driver can receive speed commands and plan acceleration and deceleration.

7-6-2. Operation steps

1. set 【control mode: 6060h】 to profile velocity mode (0x03).

2. set 【control word: 6040h】 to (0x06 > 0x07 > 0x0F), start the driver and run the motor.

3. set 【profile acceleration: 6083h】 to plan the acceleration slope (unit: command unit/s²).

4. set 【profile deceleration: 6084h】 to plan the deceleration slope (unit: command unit /s²).

5. set 【target speed: 60FFh】. The unit is command unit/s.

6. read 【status word: 6041h】 to get the driver status.

7-6-3. Related object list

Index	Name	Unit	Access
6040h	Controlword	UNSIGNED16	RW
6041h	Statusword	UNSIGNED16	RO
6060h	Modes of operation	INTEGER8	RW
6061h	Modes of operation display	INTEGER8	RO
606Bh	Velocity demand value	INTEGER32	RO
606Ch	Velocity actual value	INTEGER32	RO
606Dh	Velocity window	UNSIGNED16	RW
606Eh	Velocity window time	UNSIGNED16	RW

606Fh	Velocity threshold	UNSIGNED16	RW
60FFh	Target velocity	INTEGER32	RW
6080h	Max motor speed	rpm	RW

7-7. Torque Profile Mode

7-7-1. Overview

The servo driver can receive torque command and plan torque slope.

7-7-2. Operation steps

1. set【control mode: 6060h】to profile torque mode (0x04).

2. set【control word: 6040h】to (0x06 > 0x07 > 0x0F), start the driver and run the motor.

3. set【torque slope: 6087h】to plan the torque slope (unit: 0.1%/s).

4. set【target torque: 6071h】to target torque (unit: 0.1%).

7-7-3. Related object list

Index	Name	Unit	Access
6040h	Controlword	-	RW
6041h	Statusword	-	RO
6060h	Modes of operation	-	RW
6061h	Modes of operation display	-	RO
6071h	Target torque	0.1%	RW
6072h	Max torque	0.1%	RW
6074h	Torque demand value	0.1%	RO
6075h	Motor rated current	1mA	RO
6077h	Torque actual value	0.1%	RO
6078h	Current actual value	0.1%	RO
6087h	Torque slope	0.1%/s	RW

8. Mode common function

8-1. Touch Probe Function

8-1-1. Overview

The probe function can be triggered by the SI terminal of CN0 or encoder, and the feedback position can be fixed to the rising or falling edge by the P-(SI5)/D-(SI6) input terminal of CN0. The fixed position time can be less than 5 s. This function can be used for high-speed measurement or packaging applications.

8-1-2. Operation steps

P5-62 corresponds to probe 1, P5-63 corresponds to probe 2 (must be allocated on SI5/SI6).

【Touch probe function：60B8h】disable the probe in 60B8h, set the input terminal in P5-62/P5-63, then enable the object word 60B8h.

When reading the probe value, the corresponding probe value object (60BAh-60BDh) needs to be added to TxPDO.

8-1-3. Related object table

Index	Name	Units	Access
60B8h	Touch probe function	-	RW
60B9h	Touch probe status	-	RO
60BAh	Touch probe pos1 pos value	Command unit	RO
60BBh	Touch probe pos1 neg value	Command unit	RO
60BCh	Touch probe pos2 pos value	Command unit	RO
60BDh	Touch probe pos2 neg value	Command unit	RO

Users can get the current settings of probe function from object 60B8h. For the same probe, do not set the rising edge and the falling edge at the same time. Below is the bit description of 60B8h.

bit	value	note	
0	0	switch off Touch probe 1	stop/execute Touch probe1
	1	enable Touch probe 1	
1	0	Trigger first event	Touch probe1 mode selection
	1	Continuous	
2	0	Trigger with Touch probe1 input	Touch probe1 triggering selection
	1	Trigger with zero impulse signal of position encoder	

			(external input/Z phase)
3	0	Reserved	Not used
4	0	switch off sampling at positive edge of touch probe1	Touch probe1 rising edge selection
	1	enable sampling at positive edge of touch probe1	
5	0	switch off sampling at negative edge of touch probe1	Touch probe1 falling edge selection
	1	enable sampling at negative edge of touch probe1	
6-7	0	reserved	Retention parameters
8	0	switch off Touch probe 2	Stop/execute Touch probe2
	1	enable Touch probe 2	
9	0	Trigger first event	Touch probe2 mode selection (single/continuous)
	1	Continuous	
10	0	Trigger with Touch probe2 input	Touch probe2 triggering selection (external input/Z phase)
	1	Trigger with zero impulse signal of position encoder	
11	0	Reserved	Not used
12	0	switch off sampling at positive edge of touch probe2	Touch probe2 rising edge selection
	1	enable sampling at positive edge of touch probe2	
13	0	switch off sampling at negative edge of touch probe2	Touch probe2 falling edge selection
	1	enable sampling at negative edge of touch probe2	
14-15	0	reserved	Retention parameters

The user can get the current status of the probe from the object 60B9h. Below is description of the corresponding bits for 60B9h.

bit	value	note	
0	0	Touch probe1 is switch off	Probe 1 action stop
	1	Touch probe1 is enabled	Probe 1 action
1	0	Touch probe1 no positive edge value stored	Rising edge probe 1 incomplete state
	1	Touch probe1 positive edge value stored	Rising edge probe 1 completion state
2	0	Touch probe1 no negative edge value stored	Falling edge probe 1 incomplete

			state
	1	Touch probe1 negative edge value stored	Falling edge probe 1 completion state
3-5	-	reserved	Not used
6-7	-	Not supported	Not used
8	0	Touch probe2 is switch off	Probe 2 action stop
	1	Touch probe2 is enabled	Probe 2 action
9	0	Touch probe2 no positive edge value stored	Rising edge probe 2 incomplete state
	1	Touch probe2 positive edge value stored	Rising edge probe 2 completion state
10		Touch probe2 no negative edge value stored	Falling edge probe 2 incomplete state
		Touch probe2negative edge value stored	Falling edge probe 2 completion state
11-13	-	Reserved	Not used
14-15	-	Not supported	Not used

8-2. Position information

8-2-1. Electronic gear function

Index	Sub-Index	Name	Units	Access
608Fh	-	Position encoder resolution	-	RO
	00h	Highest Sub-Index supported	-	RO
	01h	Encoder increments	Pulse	RO
	02h	Motor revolutions	r（motor）	RO
6091h	-	Gear ratio	-	RW
	00h	Number of entries	-	RW
	01h	Motor revolutions	r（motor）	RW
	02h	Shaft revolutions	R（shaft）	RW
6092h	-	Feed constant	-	RW
	00h	Highest Sub-Index supported	-	RO
	01h	Feed	Command unit	RW

02h	Shaft revolutions	R（shaft）	RW

【Encoder resolution: 608Fh】

$$\text{Motor resolution} = \frac{\text{Encoder increments (608Fh-01h)}}{\text{Motor revolutions (608Fh-02h)}}$$

【Gear ratio: 6091h】

$$\text{Electronic gear ratio} = \frac{\text{Motor resolution (6091h-01h)}}{\text{Load shaft resolution (6091h-02h)}}$$

【Encoder frequency division ratio: 6092h】

$$\text{Encoder frequency division ratio} = \frac{\text{Feed constant (6092h-01h)}}{\text{Shaft revolutions (6092h-02h)}}$$

Note:

(1) 608Fh-01h (Encoder increments) is auto-set as the encoder resolution.

(2) 6092h-01h (Feed) default value is setas encoder resolution.

(3) 6091h-01h, 6091h-02h default value is all 1.

8-2-2. Initialization of absolute encoder

When absolute encoder is used in position control mode and multi-turn mode, it no needs homing operation.

8-2-3. Position range limit

If the value of [target position: 607A] exceeds [position range limit: 607B], perform wrap-around operation, do not change the factory value of 607B at - 01h and - 02h.

Index	Sub-Index	Name	Units	Access
607Ah	-	Position encoder resolution	-	RW
	00h	Highest Sub-Index supported	-	RW
607Bh	-	Position range limit	-	RW
	00h	Highest Sub-Index supported	-	RW
	01h	Min position range limit	Command unit	RW
	02h	Max position range limit	Command unit	RW

8-3. Interpolation time period

【Interpolation time period：60C2h】 is set automatically according to the communication cycle, please do not change.

Communication period	60C2h-01h	60C2h-02h

250us	25	-5
500us	5	-4
1ms	1	-3
2ms	2	-3
4ms	4	-3

Index	Sub-Index	Name	Units	Access
60C2h	-	Interpolation time period	-	-
	00h	Highest Sub-Index supported	-	RO
	01h	Interpolation time period value	-	RW
	02h	Interpolation time index	-	RW

9. Parameter list (refer to XML file for details)

9-1. CoE object word

9-1-1. Communication Profile zone

Index		Name	Data type	Access
1000h	VAR	device type	UNSIGNED32	RO
1001h	VAR	error register	UNSIGNED8	RO
1600h~03h	RECORD	Receive PDO mapping	UNSIGNED32	RW
1A00h~03h	RECORD	Transmit PDO mapping	UNSIGNED32	RW

9-1-2. Driver Profile zone

Index		Name	Data type	Access
603Fh	VAR	Error Code	UNSIGNED16	RO
6040h	VAR	Controlword	UNSIGNED16	RW
6041h	VAR	Statusword	UNSIGNED16	RO
605Bh	VAR	Shutdown option code	INTEGER16	RW
605Eh	VAR	Fault reaction option code	INTEGER16	RW
6060h	VAR	Modes of operation	INTEGER8	RW
6061h	VAR	Modes of operation display	INTEGER8	RO
6062h	VAR	Position demand value [PUU]	INTEGER32	RO
6063h	VAR	Position actual value [increment]	INTEGER32	RO
6064h	VAR	Position actual value	INTEGER32	RO
6065h	VAR	Following error window	UNSIGNED32	RW
6067h	VAR	Position windows	UNSIGNED32	RW
6068h	VAR	Position window time	UNSIGNED16	RW
606Bh	VAR	Velocity demand value	INTEGER32	RO
606Ch	VAR	Velocity actual value	INTEGER32	RO
606Dh	VAR	Velocity window	UNSIGNED16	RW
606Eh	VAR	Velocity window time	UNSIGNED16	RW
606Fh	VAR	Velocity threshold	UNSIGNED16	RW

6071h	VAR	Target torque	INTEGER16	RW
6072h	VAR	Max torque	UNSIGNED16	RW
6074h	VAR	Torque demand value	INTEGER16	RO
6075h	VAR	Motor rated current	UNSIGNED32	RO
6076h	VAR	Motor rated torque	UNSIGNED32	RO
6077h	VAR	Torque actual value	UNSIGNED16	RO
6078h	VAR	Current actual value	INTEGER16	RO
607Ah	VAR	Target position	INTEGER32	RW
607Ch	VAR	Home Offset	INTEGER32	RW
607Dh	ARRAY	Software position limit	INTEGER32	RW
607Eh	VAR	Polarity	UNSIGNED8	RW
607Fh	VAR	Max profile velocity	UNSIGNED32	RW
6080h	VAR	Max motor speed	UNSIGNED32	RW
6081h	VAR	Profile velocity	UNSIGNED32	RW
6083h	VAR	Profile acceleration	UNSIGNED32	RW
6084h	VAR	Profile deceleration	UNSIGNED32	RW
6085h	VAR	Quick stop deceleration	UNSIGNED32	RW
6086h	VAR	Motion profile type	INTEGER16	RW
6087h	VAR	Torque slope	UNSIGNED32	RW
6093h	ARRAY	Position factor	UNSIGNED32	RW
6098h	VAR	Homing method	INTEGER8	RW
6099h	ARRAY	Homing speeds	UNSIGNED32	RW
609Ah	VAR	Homing acceleration	UNSIGNED32	RW
60B0h	VAR	Position offset	INTEGER32	RW
60B1h	VAR	Velocity offset	INTEGER32	RW
60B2h	VAR	Torque offset	INTEGER16	RW
60B8h	VAR	Touch probe function	UNSIGNED16	RW
60B9h	VAR	Touch probe status	UNSIGNED16	RO
60BAh	VAR	Touch probe pos1 pos value	INTEGER32	RO
60BBh	VAR	Touch probe pos1 neg value	INTEGER32	RO
60BCh	VAR	Touch probe pos2 pos value	INTEGER32	RO
60BDh	VAR	Touch probe pos2 neg value	INTEGER32	RO

60C0h	VAR	Interpolation sub mode select	INTEGER16	RW
60C1h	ARRAY	Interpolation data record	UNSIGNED16/32	RW
60C2h	RECORD	Interpolation time period	SIGNED8	RW
60C5h	VAR	Max acceleration	UNSIGNED32	RW
60C6h	VAR	Max deceleration	UNSIGNED32	RW
60F2h	VAR	Positioning option code	UNSIGNED16	RW
60F4h	VAR	Following error actual value	INTEGER32	RO
60FCh	VAR	Position demand value	INTEGER32	RO
60FDh	VAR	Digital inputs	UNSIGNED32	RO
60FFh	VAR	Target velocity	INTEGER32	RW
6502h	VAR	Supported drive modes	UNSIGNED32	RO
Xinje custom area				
2000h~281Ah	VAR	Parameter Mapping	INTEGER16/32	RW

9-2. Driver parameters

9-2-1. Group P parameters

Modification and Effective Time:

○ represents servo OFF modification, effective immediately.

√ means that it may be changed at any time and shall take effect immediately.

● represents need to re-energize to take effect after the change.

△ represents can be changed at any time and take effect when motor is not rotating.

▲ represents can be modified at any time and takes effect when it needs to be powered on again.

Adding "n." before the parameter means the value is hex format.

Parameter:

PX-XX=n. x x x x

                → PX-XX.0
             → PX-XX.1
          → PX-XX.2
       → PX-XX.3
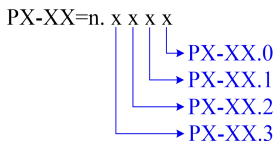
Function selection P0

P0-	Function	Unit	Default	Range	Effective	Suitable mode
P0-00	Driver type 0: Common type 1: EtherCat type	-	1	0～1	○	All
P0-01	P0-00=0: common type 1-internal torque mode 2-external analog torque mode 3-internal speed mode 4-external analog speed mode 5-internal position mode 6-external pulse position mode 7-external pulse speed mode P0-00=1: EtherCAT type 1-profile position control mode (PP) 3-profile speed control mode (PV) 4-profile torque control mode (TQ) 6-homing mode (HM) 8-cyclic synchronized position control mode (CSP) 9-cyclic synchronization speed	-	0	1～10	○	All

P0-	Function	Unit	Default	Range	Effective	Suitable mode
	control mode (CSV) 10-cyclic synchronized torque control mode (CST)					
P0-02	Control Mode 2 (Description same as above) When the /C-SEL signal is valid, the servo system will switch to the mode selected by P0-02	-	0	1～10	○	All
P0-03	Enabling mode: 0: Not enabled 1:IO/SON Input Signal 2: Software enabled (panel/Modbus) panel F1-05 writes 1; Modbus writes 1 to 0x2105 register. Write 0 to cancel enablement 3: Bus Enablation	-	3	0~3	○	All
P0-04	Rigidity level	-	20P1：0 20P2/20P4/ 20P7：15 >=21P5：10	0~63	△	All
P0-05	Selection of rotation direction	-	0	0~1	●	All
P0-07	First inertia ratio	1%	500	0~50000	√	All
P0-09	Forward direction of input pulse command	-	0	0~1	●	6, 7
P0-10 xxx□	0：CW/CCW 1：AB 2：P+D	-	2	0~2	○	6, 7
P0-10 x1x□	0: Falling edge is valid 1: Rising edge is valid	-	0	0~1	○	6, 7
P0-11	Set the low position of pulses per cycle ×1	-	0	0~9999	○	6
P0-12	Set the high position of pulses per cycle ×10000	-	0	0~65535	○	6
P0-13	Numerator of electronic gear	-	1	1~65535	○ (before 3770) √ (3770 and later and	6

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P0-	Function	Unit	Default	Range	Effective	Suitable mode
					only in mode 6)	
P0-14	Denominator of electronic gear	-	1	1~65535	○	6
P0-15	Pulse Frequency Corresponding to Rated Speed in Speed Mode	*100Hz	1000	0~10000	○	7
P0-16	Speed Instruction Pulse Filtering Time	0.01ms	100	0~10000	○	7
P0-23	Pulse Deviation Limit	*256 command unit	2000	0~65535	√	6
P0-24	version 3640 and before: Discharge resistance type 0: built in 1: external Version 3700 and later: This parameter is invalid	-	0	0~1	○	All

P0-	Function	Unit	Default	Range	Effective	Suitable mode
P0-25	Discharge Resistance power	W	Related to driver power	0~65535	√	All
P0-26	Discharge Resistance value	Ω		0~65535	√	All
P0-27	Servo OFF Stop Mode 0: Inertial operation stops and remains in inertial operation state after stopping. 2: The deceleration operation stops, and the inertia operation state is maintained after the stop.	-	0	0, 2	○	All
P0-28	Servo Overrun Stop Mode 0: deceleration stop, after stop, overrun direction moment is 0, receive instructions. 1: Inertia stops, after stopping, overrun direction moment is 0, receiving instructions. 2: The deceleration stops, after stopping, the overrun direction does not receive instructions. 3: Alarm (E-260)	-	2	0~3	○	All

P0-	Function	Unit	Default	Range	Effective	Suitable mode
P0-29	Servo Alarm Stop Mode 0: Inertial operation stops and remains in inertial operation state after stopping. 2: The deceleration operation stops, and the inertia operation state is maintained after the stop.	-	2	0, 2	○	All
P0-30	Stopping overtime time	1ms	20000	0~65535	○	All
P0-31	Decelerating stop time	1ms	25	0~5000	○	All
P0-33	Motor code	-	0	0~65535	●	All
P0-53	Read motor parameter alarm shielding bit 0 - do not shield the alarm 1 - shield does not read valid motor parameter alarm	-	0	0~1	●	1|3|5|6|7|8|9|10
P0-55	Open loop rotation speed	-	0	-6000~6000	●	1|2|3|4|5|6|7
P0-56	Number of encoder communication attempts	-	10	1~65535	●	1|2|3|4|5|6|7
P0-68.0~1	P0-68.xx□□ Number of continuous error alarms for the update sequence of coded data	-	0x05	0x01~0xFF	●	1|2|3|4|5|6|7
P0-68.2~3	P0-68.□□xx E-241 alarm filter times	-	0	0~0xFF	●	1|2|3|4|5|6|7
P0-69	Fan power on 0: Turn on the fan with temperature greater than 45 degrees and turn off the fan with temperature less than 42 degrees (hysteresis 3 degrees Celsius) 1: Turn on the fan after enabling, turn off the fan when enabling.	-	1	0/1	○	All
P0-74	Blocking alarm time	1ms	Related to driver power	0-65535	○	All
P0-75	Blocking alarm speed	1rpm	50	5~9999	○	All
P0-80	Motor thermal power protection mode 0 - current protection 1 - average thermal power protection 2 - analog thermal power protection	-	2	0~2	●	1|3|5|6|7

P0-	Function	Unit	Default	Range	Effective	Suitable mode
P0-92	Low position of electronic gear numerator	-	1	1~9999	√	6
P0-93	High position of electronic gear numerator*10000	-	0	1~65535	√	6
P0-94	Low position of electronic gear denominator	-	1	1~9999	√	6
P0-95	High position of electronic gear denominator*10000	-	0	1~65535	√	6

Parameter P1

P1-	Function	Unit	Default	Range	Effective	Suitable mode
P1-00	The gain of speed loop (fit for auto-tuning mode)	1Hz	200	10~20000	√	All
P1-01	speed loop integral time (fit for auto-tuning mode)	0.1ms	3300	15~51200	√	All
P1-02	The gain of position loop (fit for auto-tuning mode)	1/s	200	10~20000	√	All
P1-10	Speed feedforward gain	1%	0	0~300	√	5|6|7
P1-11	Speed feedforward filter time	0.01ms	50	0~10000	√	5|6|7
P1-14	Gain switching mode	-	0	0~0x00A2	√	1|2|3|4|5|6|7
P1-15	Gain switching waiting time	-	5	0~1000	√	1|2|3|4|5|6|7
P1-16	Gain switching level threshold	-	50	0~20000	√	1|2|3|4|5|6|7
P1-17	Hysteresis of gain switching level threshold	-	30	0~20000	√	1|2|3|4|5|6|7
P1-18	Position loop gain switching time	-	3	0~1000	√	1|2|3|4|5|6|7
P1-22	Speed command filter selection 0-first order low-pass filter 1-smooth average filter	-	0	0~1	○	3|7
P1-23	Speed command filter time	0.1ms	0	0~65535	○	3|7
P1-24	Position command--- first order low-pass filter time	0.1ms	0	0~65535	△	5|6
P1-25	Position command smoothing filtering time	0.1ms	0	0~65535	△	5|6
P1-74	Encoder zero offset detection cycle	-	1000	0~65535	√	1|2|3|4|5|6|7
P1-75	Encoder zero offset detection threshold	-	10	0~500	√	1|2|3|4|5|6|7

Parameter P2

P2-	Function	Unit	Default	Range	Effective	Suitable mode
P2-00.0	Disturbance observer switch 0 - off	-	0	0~1	○	1|2|3|4|5|6|7

P2-	Function	Unit	Default	Range	Effective	Suitable mode
	1 - on					
P2-01.0	Adaptive mode switch 0 - off 1 - on	-	20P1：0 Others：1	0~1	●	1|2|3|4|5|6|7
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
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
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
P2-03.3	Adaptive load type 0-Small Inertia Mode 1-Large Inertia Mode	-	0	0~1	●	1|2|3|4|5|6|7
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
P2-07	Adaptive mode inertia ratio (standard)	%	0	0~10000	○	1|2|3|4|5|6|7
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
P2-12	Maximum Inertia Ratio of Adaptive Mode (Standard)	-	30	1~10000	○	1|2|3|4|5|6|7
P2-15	Internal command self-tuning maximum stroke	0.01r	100	1~3000	√	1|2|3|4|5|6|7
P2-17	Maximum Speed of Inertia Identification and Internal Instruction Auto-tuning	-	0	0~65535	√	1|2|3|4|5|6|7
P2-18	Initial Inertia Ratio of Inertia	%	500	1~20000	√	1|2|3|4|5|6|7

P2-	Function	Unit	Default	Range	Effective	Suitable mode
	Identification					
P2-19	Adaptive mode bandwidth	%	20P1：100 20P2，20P4：70 >=20P7：50	1~100	○	1|2|3|4|5|6|7
P2-35	Torque Instruction Filtering Time Constant 1	0.01ms	100	0~65535	√	1|2|3|4|5|6|7
P2-36	Torque Instruction Filtering Time Constant 2	0.01ms	100	0~65535	√	1|2|3|4|5|6|7
P2-41	Disturbance Torque Compensation Coefficient (Non-adaptive Mode Effective)	%	99	0~100	√	1|2|3|4|5|6|7
P2-47.0	Model Loop Switch 0-OFF 1-ON	-	0	0~f	√	3|4|5|6|7
P2-49	Model loop gain	0.1Hz	500	10~20000	√	3|4|5|6|7
P2-60.0	Active Vibration Suppression Switch 0-OFF 1-ON	-	0	0~1	√	3|4|5|6|7
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
P2-61	Active Vibration Suppression frequency	0.1Hz	10000	10~20000	√	1|2|3|4|5|6|7
P2-69.3	Notch filter 3 switch	-	0	0~1	√	1|2|3|4|5|6|7
P2-70.0	Notch filter 4 switch	-	0	0~1	√	1|2|3|4|5|6|7
P2-70.1	Notch filter 5 switch	-	0	0~1	√	1|2|3|4|5|6|7
P2-71	First notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7
P2-72	First notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7
P2-73	First notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7
P2-74	Second notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7
P2-75	Second notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7
P2-76	Second notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7
P2-77	Third notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7

P2-	Function	Unit	Default	Range	Effective	Suitable mode
P2-78	Third notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7
P2-79	Third notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7
P2-80	Fourth notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7
P2-81	Fourth notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7
P2-82	Fourth notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7
P2-83	Fifth notch frequency	Hz	5000	50~5000	√	1|2|3|4|5|6|7
P2-84	Fifth notch attenuation	0.1dB	70	50~1000	√	1|2|3|4|5|6|7
P2-85	Fifth notch band width	Hz	0	0~1000	√	1|2|3|4|5|6|7

Speed control parameters P3

P3-	Function	Unit	Default value	Range	Effective	Suitable mode
P3-00	V-REF function distribution 0-V-REF input as speed command 1-V-REF input as external speed limit, actual speed limit is related to external analog speed limit 2-speed feedforward	-	0	0~2	○	1|2|4
P3-01	Rated speed corresponded analog voltage	0.001V	10000	1500~30000	○	1|2|4
P3-02	Analog voltage speed filter	0.01ms	0	0~10000	√	1|2|4
P3-03	Speed command input dead zone voltage	0.001v	0	0~500	√	1|2|4
P3-04	V-REF analog speed direction	-	0	0~1	√	1|2|4
P3-05	Preset speed 1	rpm	0	-9999~9999	√	3
P3-06	Preset speed 2	rpm	0	-9999~9999	√	3
P3-07	Preset speed 3	rpm	0	-9999~9999	√	3
P3-09	Acceleration time	ms	0	0~65535	○	3|4|7
P3-10	Deceleration time	ms	0	0~65535	○	3|4|7
P3-12	Zero-speed clamping mode	-	0	0~3	○	3|4|7
P3-13	Zero-speed clamping speed	rpm	10	0~300	○	3|4|7
P3-14	Forward Maximum Speed Instruction Limit	rpm	6500	0~10000	○	All
P3-15	Reverse Maximum Speed Instruction Limit	rpm	6500	0~10000	○	All

P3-	Function	Unit	Default value	Range	Effective	Suitable mode
P3-16	Internal Forward Speed Limitation in Torque Control	rpm	3000	5~10000	√	1|2
P3-17	Internal Reverse Speed Limitation in Torque Control	rpm	3000	5~10000	√	1|2
P3-18	Jogging speed	rpm	100	0~1000	○	All
P3-19	forward warning speed	rpm	3000	0~10000	○	1|2|3|4|5|6|7
P3-20	reverse warning speed	rpm	3000	0~10000	○	1|2|3|4|5|6|7
P3-21	forward alarming speed	rpm	7150	0~10000	○	1|2|3|4|5|6|7
P3-22	reverse alarming speed	rpm	7150	0~10000	○	1|2|3|4|5|6|7
P3-23	T-REF function distribution 0-input as torque command 1- As a necessary condition for external torque limit input, compared with P3-28 / P3-29, the minimum value is valid 2-torque feedforward	-	0	0~2	○	2|3|4|5|6|7
P3-24	Analog value corresponding to rated torque	0.001V	10000	1500~30000	○	2|3|4|5|6|7
P3-25	Analog voltage torque filtering time	0.01ms	0	0~10000	√	2|3|4|5|6|7
P3-26	Torque command input dead band voltage	0.001V	0	0~500	√	2|3|4|5|6|7
P3-27	Analog torque direction 0-forward 1-reverse	-	0	0~1	○	2|3|4|5|6|7
P3-28	Internal forward torque limit	%	300	0~1000	√	All
P3-29	Internal reverse torque limit	%	300	0~1000	√	All
P3-30	external forward torque limit	%	300	0~1000	√	1|2|3|4|5|6|7
P3-31	external reverse torque limit	%	300	0~1000	√	1|2|3|4|5|6|7
P3-32	Brake torque	1%	100	0~1000	√	1|2|3|4|5|6|7
P3-33	Preset torque	%	0	-1000~1000	√	1
P3-45	Torque mode switching delay	ms	40	0~9999	√	1|2

Internal position parameters P4

P4-	Function	Unit	Default value	Range	Effective	Suitable mode
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)	piece	2	0~f	○	5|6
P4-00.1	Homing function 0-off 1-on	-	0	0~1	○	5|6
P4-00.2	Homing overrun prohibition 0-not prohibit 1-prohibit	-	0	0~1	○	5|6
P4-01	Speed of hitting the proximity switch	rpm	600	0~65535	○	5|6
P4-02	Speed of leaving proximity switch	rpm	100	0~65535	○	5|6
P4-03.0	Internal Location Given Mode Sets Location Mode 0-relative positioning 1-Absolute positioning	-	0	0~1	○	5
P4-03.1	Internal Position-Given Mode Sets Step Change Mode 0-step-changing when signal is ON, recyclable 1-change step at signal rising edge, single step execution 2-starting at Signal rising edge, sequential execution of all, no cycle 3-set segment no. through communication 4-/CHSTP dual edge triggerring 5-terminal/PREFA(P5-57), /PREFB(P5-58), /PREFC(P5-59) select the segment no., range 1~3 6- terminal/PREFA (P5-57), /PREFB(P5-58), /PREFC(P5-59), /PREFD(P5-60) select	-	0	0~5	○	5

P4-	Function	Unit	Default value	Range	Effective	Suitable mode
	segment no., range 1~8 (version 3730 and before) terminal/ PREFA (P5-57), /PREFB(P5-58), /PREFC(P5-59), /PREFD(P5-60) select segment no., range 1~16 (version 3740 and later)					
P4-03.2	Internal position mode sets waiting mode 0-wait positioning completion 1-not wait positioning completion	-	0	0~1	○	5
P4-04	Valid segment number	-	0	0~35	○	5
P4-10~ P4-11	First segment pulse	1pul	0	-327689999~ 327679999	√	5
P4-12	First segment speed	0.1rpm	0	0~65535	√	5
P4-13	First segment acceleration time	1ms	0	0~65535	√	5
P4-14	First segment deceleration time	1ms	0	0~65535	√	5
P4-16	Adjusting time	1ms	0	0~65535	√	5
P4-10+ (n-1) *7 ~ P4-16+ (n-1) *7	segment 1 to 35 pulse parameters (n is segment number)	-	-	-	√	5

Note:

(1) set pulse number=pulse number (high bits) ×10000+pulse number (low bits)

(2) total 35 segments. Segment 1~12 can be set through the panel, segment 13~35 can be set through communication (RS232 or RS485).

Signal parameters P5

P5-	Function	Unit	Default value	Range	Effective	Suitable mode
P5-00	Positioning completion width/COIN	Command unit	11	1~65535	√	5|6
P5-01	Location Completion Detection Mode	-	0	0~3	√	5|6
P5-02	Location completion retention time	ms	0	0~65535	√	5|6

P5-	Function	Unit	Default value	Range	Effective	Suitable mode
P5-03	Rotation Detection Speed	rpm	50	0~10000	√	1|2|3|4|5|6|7
P5-04	Same speed detection speed	rpm	50	0~10000	√	1|2|3|4|5|6|7
P5-05	Reached detection speed	rpm	1000	0~10000	√	1|2|3|4|5|6|7
P5-06	Positioning near output width	Command unit	50	0~65535	√	5|6
P5-07	Servo OFF delay time	ms	500	0~65535	○	1|2|3|4|5|6|7
P5-08	Brake instruction output speed	rpm	30	20~10000	○	1|2|3|4|5|6|7
P5-09	Brake instruction waiting time	ms	500	0~65535	○	1|2|3|4|5|6|7
P5-10	user-defined output 1 trigger condition	-	0	0~ffff	√	1|2|3|4|5|6|7
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
P5-12	Select custom output 1 mode	-	0	0~3	√	1|2|3|4|5|6|7
P5-13	Setting custom output 1 hysteresis	Relating to trigger condition	0	0~65535	√	1|2|3|4|5|6|7
P5-14	Custom Output 2 Trigger Condition	-	0	0~ffff	√	1|2|3|4|5|6|7
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
P5-16	Select custom output 2 mode	-	0	0~3	√	1|2|3|4|5|6|7
P5-17	Setting custom output 2 hysteresis	Relating to trigger condition	0	0~65535	√	1|2|3|4|5|6|7
P5-18	SI filter time multiple	-	1	0~10000	√	1|2|3|4|5|6|7
P5-19	Z phase output maintain time	ms	2	1~65535	√	1|2|3|4|5|6|7
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	-	00	0~ff	√	1|2|3|4|5|6|7

P5-	Function	Unit	Default value	Range	Effective	Suitable mode
	SI2 terminal. 03: Input positive signal from SI3 terminal. 04: Input positive signal from SI4 terminal. 10: Set the signal to always be "valid". 11: 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
P5-21.0~1	/P-CON proportion action instruction	-	00	0~ff	√	1|2|3|4|5|6|7
P5-21.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-22.0~1	/P-OT: Forbidden forward driving	-	01	0~ff	√	1|2|3|4|5|6|7
P5-22.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-23.0~1	/N-OT: forbidden reverse driving	-	02	0~ff	√	1|2|3|4|5|6|7
P5-23.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-24.0~1	/ALM-RST: alarm clear	-	00	0~ff	√	1|2|3|4|5|6|7
P5-24.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-25.0~1	/P-CL：External Torque Limitation at Forward Rotation Side	-	00	0~ff	√	1|2|3|4|5|6|7
P5-25.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-26.0~1	/N-CL：External Torque Limitation at Reverse Rotation Side	-	00	0~ff	√	1|2|3|4|5|6|7

P5-	Function	Unit	Default value	Range	Effective	Suitable mode
P5-26.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-27.0~1	/SPD-D: Internal Speed Direction Selection	-	03	0~ff	√	1|2|3|4|7
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
P5-28.2	SI terminal filtering time	ms	0	0~f	√	3|5
P5-29.0~1	/SPD-B: Internal Setting Speed Selection	-	00	0~ff	√	3|5
P5-29.2	SI terminal filtering time	ms	0	0~f	√	3|5
P5-30.0~1	/C-SEL: control mode selection	-	00	0~ff	√	1|2|3|4|5|6|7
P5-30.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-31.0~1	/ZCLAMP: zero position clamping	-	00	0~ff	√	3|4|7
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
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
P5-33.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-34.0~1	/CLR: pulse offset clear	-	00	0~ff	√	5|6
P5-34.2	SI terminal filtering time	ms	0	0~f	√	5|6
P5-35.0~1	/CHGSTP: internal position mode change step signal	-	00	0~ff	√	5
P5-35.2	SI terminal filtering time	ms	0	0~f	√	5
P5-36.0~1	/I-SEL: inertia ratio switching	-	00	0~ff	√	1|2|3|4|5|6|7
P5-36.2	SI terminal filtering time	ms	0	0~f	√	1|2|3|4|5|6|7
P5-37	/COIN_HD: Location Completion Maintenance 00: No output to terminal 01: Output positive signal from SO1 terminal 02: Output positive signal from	-	0000	0~ffff	√	5|6

P5-	Function	Unit	Default value	Range	Effective	Suitable mode
	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					
P5-38	/COIN: positioning completion	-	0001	0~ffff	√	5|6
P5-39	/V-CMP: same speed detection	-	0000	0~ffff	√	3|4|7
P5-40	/TGON: rotation detection	-	0000	0~ffff	√	1|2|3|4|5|6|7
P5-41	/S-RDY: ready	-	0000	0~ffff	√	1|2|3|4|5|6|7
P5-42	/CLT: torque limit	-	0000	0~ffff	√	1|2|3|4|5|6|7
P5-43	/VLT: speed limit detection	-	0000	0~ffff	√	1|2
P5-44	/BK: brake locking	-	0000	0~ffff	○	1|2|3|4|5|6|7

P5-	Function	Unit	Default value	Range	Effective	Suitable mode
P5-45	/WARN: warning	-	0000	0~ffff	√	1|2|3|4|5|6|7
P5-46	/NEAR: near	-	0000	0~ffff	√	5|6
P5-47	/ALM: alarm	-	0002	0~ffff	√	1|2|3|4|5|6|7
P5-48	/Z: encoder Z phase signal output	-	0000	0~ffff	√	1|2|3|4|5|6|7
P5-49	/XNETERR: Xnet error signal	-	0	0~ffff	√	10
P5-50	/MRUN: internal position mode motion starting signal	-	0000	0~ffff	√	5
P5-51	/V-RDY: speed reached	-	0000	0~ffff	√	3|4|7
P5-52	/USER1: user-defined output 1	-	0000	0~ffff	√	1|2|3|4|5|6|7
P5-53	/USER2: user-defined output 2	-	0000	0~ffff	√	1|2|3|4|5|6|7
P5-57	PREFA segment 1 internal position	-	0	※1	√	5
P5-58	PREFB segment 2 internal position	-	0	※1	√	5
P5-59	PREFC segment 3 internal position	-	0	※1	√	5
P5-62	Probe function 1	-	0	0005	○	

| P5-63 | Probe function 2 | - | 0 | 0006 | ○ | |

Signal parameters P6 (some parameters are reserved)

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

Communication parameters P7 (not support RS485 communication)

P7-XX	Function	Unit	Default value	Range	Effective	Suitable mode
P7-10	RS232 station no.	-	1	0~100	○	1|2|3|4|5|6|7
P7-11.0~1	RS232 baud rate 00：300 01：600 02：1200 03：2400 04：4800 05：9600 06：19200 07：38400 08：57600 09：115200 0A：192000 0B：256000 0C：288000 0D：384000 0E：512000 0F：576000 10：768000 11：1M 12：2M 13：3M 14：4M	Baud rate	06	0~16	○	1|2|3|4|5|6|7

P7-XX	Function	Unit	Default value	Range	Effective	Suitable mode
	15：5M 16：6M					
P7-11.2	RS232 stop bit 0：2 bits 2：1 bit	Stop bit	2	0~2	○	1|2|3|4|5|6|7
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
P7-20	Homing mode Z phase numbers	-	1	0~99999	○	hm
	Note: this parameter indicates the number of Z phases found in homing mode.					
P7-21	Filter time after homing (bus)	ScanA Cycle	400	1~65535	○	10
	Note: after finding the zero position, return to the position mode, and the position has no deviation. After holding this parameter for a time, the homing action is completed and sent to the PLC homing completion flag					

Panel power on display P8

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode
P8-25	Panel power on display content	-	0	0~2	▲	1|2|3|4|5|6|7|8|9|10

Homing parameters P9

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode
P9-11.0	Homing find Z phase numbers	-	0	0~f	○	5|6
P9-11.1	New homing trigger mode 0-prohibit triggering 1-trigger through SI terminal 2-homing after enable	-	0	0~2	○	5|6
P9-11.2	0-New homing mode 0 1-homing mode 1 2-homing mode 2 3-homing mode 3 4-homing mode 4 5-homing mode 5 6-homing mode 6	-	0	0~7	○	5|6

Parameter	Function	Unit	Default value	Range	Effective	Suitable mode
	7-homing mode 7					
P9-11.3	Deceleration mode when meeting the overtravel signal	-	0	0~1	○	5|6
P9-12	Homing high speed	-	200	0~3000	○	5|6
P9-13	Homing low speed	-	20	0~1000	○	5|6
P9-14	Homing acceleration deceleration time	-	1000	0~5000	○	5|6
P9-15	Homing timeout time	-	0	0~12000	○	5|6
P9-16	Touch stop homing speed threshold	-	2	0~1000	○	5|6
P9-17	Touch stop homing torque threshold	-	100	0~300	○	5|6
P9-18	Touch stop homing time threshold	-	500	10~1500	○	5|6
P9-19	Quantitative pulses low bits	-	0	-9999~9999	○	5|6
P9-20	Quantitative pulses high bits	-	0	-9999~9999	○	5|6
P9-21	Homing selection	-	0	0~1	●	5|6
P9-22	Homing end filter time	-	500	50~10000	○	5|6

Table 1 input signal distribution

Input terminal parameter	Servo model	Range
P5-20~P5-36 P5-57~P5-59	DS5C series	n.0000~n.0003 n.0010~n.0013

Table 2 output signal distribution

Output terminal parameter	Servo model	Range
P5-37~P5-53	DS5C series	n.0000~n.0003 n.0010~n.0013

9-2-2. Group F parameters

Parameter	Content
F0-00	Clear the alarm
F0-01	Back to factory setting
F0-02	Clear the position offset
F1-00	Jog run

Parameter	Content
F1-01	Test run
F1-02	Current sampling zero calibration
F1-05	Panel enable
F1-06	Absolute encoder clear the turns

9-2-3. Group U 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		0.1℃
U0-07	Torque feedback		% rated
U0-08	pulse offset	（0000～9999）*1	Instruction
U0-09		（0000～9999）*10000	pulse
U0-10	Encoder feedback	（0000～9999）*1	Encoder pulse
U0-11		（0000～65535）*10000	
U0-12	input instruction pulse	（0000～9999）*1	Instruction
U0-13	numbers	（0000～9999）*10000	pulse
U0-14	position feedback	（0000～9999）*1	Instruction
U0-15		（0000～9999）*10000	pulse
U0-16	encoder accumulated	（0000～9999）*1	Encoder pulse
U0-17	position	（0000～9999）*10000	
U0-18	Torque current		0.01A
U0-19	Analog input V-REF value		0.001V
U0-20	Analog input T-REF value		0.001V
U0-21	Input signal status 1		
U0-22	Input signal status 2		
U0-23	output signal status 1		
U0-24	ouput signal status 2		
U0-25	Input pulse	（0000～9999）*1	Hz
U0-26	frequency	（0000～9999）*10000	
U0-41	Instantaneous output power		1W
U0-42	Average output power		1W

Code	Contents	Unit
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	Instantaneous regenerative braking discharge power	1W
U0-56	Average regenerative brake discharge power	1W
U0-57	Absolute encoder present position feedback low 32-bit	Encoder position
U0-58		
U0-59	Absolute encoder present position feedback high 32-bit	Encoder position
U0-60		
U0-89	Position command end flag	
U0-91	Multi-turn absolute motor turns	
U0-98	High power motor temperature	0.1℃

U1-XX：

Code	Contents	Unit
U1-00	present alarm code	
U1-01	present warning code	
U1-02	U phase current when alarming	0.01A
U1-03	V phase current when alarming	0.01A
U1-04	bus voltage when alarming	V
U1-05	IGBT temperature when alarming	0.1℃
U1-06	torque current when alarming	0.1A
U1-07	excitation current when alarming	A
U1-08	position offset when alarming	Command 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	

Code	Contents	Unit
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
U2-18	Cumulative turns of	（0000～9999）*1	Turn
U2-19	motor	（0000～9999）*10000	Turn
U2-20	Device serial no.: low 16-bit		
U2-21	Device serial no.: high 16-bit		
U2-22	Firmware generation date: year		
U2-23	Firmware generation date: month/day		

Code	Contents	Unit
U2-24	Firmware generation date: hour/minute	

U3-XX：

Code	Contents	Unit
U3-00	Motor code (including thermal power parameters) read automatically by driver	-
U3-01	Motor version	-
U3-02	Encoder version	-

U4-XX：

Code	Contents	Unit
U4-10	Resonance frequency detected by fast FFT	Hz
U4-16	Cumulative value of continuous overload operation of thermal power protection (supported by 3770 version and later)	-
U4-17	Cumulative value of instantaneous overload operation of thermal power protection (supported by 3770 version and later)	-

Appendix

Appendix 1. motor specification

Voltage level	220V			
Motor model MS	5S-40ST-	5S-60ST	5H-60ST	5S-60ST-
	CS00330	CS00630	CS00630	CS01330
	-20P1-S01/S02	-20P2-S01/S02	-20P2-S01/S02	20P4-S01/S02
Motor code	5022/5822	5003/5803	5803/58C3	5004/5804
Encoder bits	17	17	17	17
Pole-pair numbers	4	5	5	5
Rated speed [rpm]	3000	3000	3000	3000
Max speed [rpm]	6000	6500	6500	6500
Rated torque [Nm]	0.32	0.64	0.64	1.27
Max torque [Nm]	0.96	1.92	1.92	4.45
Overload multiples	3	3.5	3.5	3.5
Rated current [mA]	950	1900	1900	2800
Max current [mA]	2850	6650	6650	9800
Phase resistance [mΩ]	5780	2410	2410	1705
Phase inductance [mH10^{-3}]	5675	5150	5150	2910
Rotor inertia [$10\text{-}7\text{kg.m}^2$]	44	137	137	258
Back EMF [V/krpm]	34	35	35	42
Rated output power [W]	100	200	200	400
Protection level	IP65			
Insulation grade of motor	Class F (155℃)			
Ambient temperature	−15℃～＋40℃			
Ambient humidity	Relative humidity <90% (no condensation)			

Voltage level	220V		
Motor model MS	5H-60ST	5S-80ST	5H-80ST
	CS01330	CS02430	CS02430
	-20P4-S01/S02	-20P7-S01/S02	-20P7-S01/S02
Motor code	50C4/58C4	5011/5811	50D1/58D1
Encoder bits	17	17	17
Pole-pair numbers	5	5	5
Rated speed [rpm]	3000	3000	3000
Max speed [rpm]	6500	5200	5200
Rated torque [Nm]	1.27	2.39	2.39
Max torque [Nm]	4.45	7.17	7.17

Overload multiples	3.5	3	3
Rated current [mA]	2800	4000	4000
Max current [mA]	9800	12000	12000
Phase resistance [mΩ]	1665	990	990
Phase inductance [mH10^{-3}]	2810	3300	3300
Rotor inertia [10-7kg.m^2]	648	902	1650
Back EMF [V/krpm]	42	54	54
Rated output power [W]	400	750	750
Protection level	IP65		
Insulation grade of motor	Class F（155℃）		
Ambient temperature	－15℃～＋40℃		
Ambient humidity	Relative humidity <90% (no condensation)		

Appendix 2. Servo driver and motor matching list

Motor	Motor code	Suitable driver	Voltage level
MS-220STE-TL96015B□-415P0-XJ	916B	DS5C-415P0-PTA	Three phase 380V
MS-220STE-TL70015B□-411P0-XJ	916A	DS5C-411P0-PTA	Three phase 380V
MS5G-180STE-TL48015B□-47P5	9163	DS5C-47P5-PTA	Three phase 380V
MS5G-180STE-TL35015B□-45P5	9162	DS5C-45P5-PTA	Three phase 380V
MS5G-180STE-TL28015B□-44P4	9161	DS5C-45P5-PTA	Three phase 380V
MS-130ST-TL10030B(Z)-43P0	9148	DS5C-43P0-PTA	Three phase 380V
MS5G-180STE-TL19015B□-42P9	9166	DS5C-43P0-PTA	Three phase 380V
MS5G-130ST-TL14615B(Z)-42P3-S01	9175	DS5C-43P0-PTA	Three phase 380V
MS5G-130ST-CS/CM14615B(Z)-42P3-S01	5175	DS5C-43P0-PTA	Three phase 380V
MS-130ST-TL10025B□-22P6	9045	DS5C-22P6-PTA	Single phase /Three phase 220V
MS-130STE-T07730B□-22P4	404B	DS5C-22P3/22P6-PTA	Single phase /Three phase 220V
MS-130STE-TL15015GB-22P3(-F)	9046	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-TL14615BZ-22P3-S01	9875	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-TL14615B-22P3-S01	9075	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-CS/CM14615BZ-22P3-S01	5875	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-CS/CM14615B-22P3-S01	5075	DS5C-22P3-PTA	Single phase /Three phase 220V

Motor	Motor code	Suitable driver	Voltage level
MS5S-110STE-CS/CM06030B□-21P8	5037	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5S-110STE-TL06030B□-21P8	9037	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-TL11515BZ-21P8-S01	9874	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-TL11515B-21P8-S01	9074	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-CS/CM11515BZ-21P8-S01	5874	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-CS/CM11515B-21P8-S01	5074	DS5C-22P3-PTA	Single phase /Three phase 220V
MS5G-130STE-TL07220BZ-21P5-S01	9877	DS5C-21P5-PTA	Single phase /Three phase 220V
MS5G-130STE-TL07220B-21P5-S01	9077	DS5C-21P5-PTA	Single phase /Three phase 220V
MS5G-130STE-CS/CM07220BZ-21P5-S01	5877	DS5C-21P5-PTA	Single phase /Three phase 220V
MS5G-130STE-CS/CM07220B-21P5-S01	5077	DS5C-21P5-PTA	Single phase /Three phase 220V
MS-130ST-T10015B□-21P5	4044	DS5C-21P5-PTA	Single phase /Three phase 220V
MS-130ST-T06025B□-21P5	4042	DS5C-21P5-PTA	Single phase /Three phase 220V
MS5S-110STE-TL04830B□-21P5	9034	DS5C-21P5-PTA	Single phase /Three phase 220V
MS5S-110STE-CS/CM04830B□-21P5	5034	DS5C-21P5-PTA	Single phase /Three phase 220V
MS-110ST□-T05030B□-21P5	4032	DS5C-21P5-PTA	Single phase /Three phase 220V
MS-110ST□-T04030B□-21P2	4031	DS5C-21P5-PTA	Single phase /Three phase 220V
MS5S-110STE-TL03230B□-21P0	9033	DS5C-21P5-PTA	Single phase /Three phase 220V
MS5S-110STE-CS/CM03230B□-21P0-S01	5033	DS5C-21P5-PTA	Single phase /Three phase 220V
MS5H-80ST□-CS/CM03230B□-21P0-S01	50D2	DS5C-20P7-PTA	Single phase 220V
MS5S-80ST□-CS/CM03230B□-21P0-S01	5012	DS5C-20P7-PTA	Single phase 220V

Motor	Motor code	Suitable driver	Voltage level
MS5G-130STE-TL05415BZ-20P8-S01	9872	DS5C-20P7-PTA	Single phase 220V
MS5G-130STE-TL05415B-20P8-S01	9072	DS5C-20P7-PTA	Single phase 220V
MS5G-130STE-CS/CM05415BZ-20P8-S01	5872	DS5C-20P7-PTA	Single phase 220V
MS5G-130STE-CS/CM05415B-20P8-S01	5072	DS5C-20P7-PTA	Single phase 220V
MS5S-80ST-CS02430-20P7-S01/S02	5011	DS5C-20P7-PTA	Single phase 220V
MS5S-80ST-CS02430BZ-20P7-S01/S02	5811	DS5C-20P7-PTA	Single phase 220V
MS5H-80ST-CS02430B-20P7-S01/S02	50D1	DS5C-20P7-PTA	Single phase 220V
MS5H-80ST-CS02430B-20P7-S01/S02	58D1	DS5C-20P7-PTA	Single phase 220V
MS5S-60ST-CS01330B-20P4-S01/S02	5004	DS5C-20P4-PTA	Single phase 220V
MS5S-60ST-CS01330BZ-20P4-S01/S02	5804	DS5C-20P4-PTA	Single phase 220V
MS5H-60ST-CS01330B-20P4-S01/S02	50C4	DS5C-20P4-PTA	Single phase 220V
MS5H-60ST-CS01330BZ-20P4-S01/S02	58C4	DS5C-20P4-PTA	Single phase 220V
MS-60STE-TL01330B-20P4	9025	DS5C-20P4-PTA	Single phase 220V
MS5S-60ST-C00630B-20P2-S01/S02	5003	DS5C-20P2-PTA	Single phase 220V
MS5S-60ST-C00630BZ-20P2-S01/S02	5803	DS5C-20P2-PTA	Single phase 220V
MS5H-60ST-C00630B-20P2-S01/S02	50C3	DS5C-20P2-PTA	Single phase 220V
MS5H-60ST-C00630BZ-20P2-S01/S02	58C3	DS5C-20P2-PTA	Single phase 220V
MS5S-40ST-CS00330B-20P1-S01/S02	5022	DS5C-20P1-PTA	Single phase 220V
MS5S-40ST-CS00330BZ-20P1-S01/S02	5822	DS5C-20P1-PTA	Single phase 220V
MS6S-60CS/CM30B1/B2-20P4	5005	DS5C-20P4-PTA	Single phase 220V
MS6S-60CS/CM30BZ1/BZ2-20P4	5805	DS5C-20P4-PTA	Single phase 220V
MS6H-60CS/CM30B1/B2-20P4	50C5	DS5C-20P4-PTA	Single phase 220V
MS6H-60CS/CM30BZ1/BZ2-20P4	58C5	DS5C-20P4-PTA	Single phase 220V
MS6S-80CS/CM30B1/B2-20P7	5007	DS5C-20P7-PTA	Single phase 220V
MS6S-80CS/CM30BZ1/BZ2-20P7	5807	DS5C-20P7-PTA	Single phase 220V
MS6S-80CS/CM20B1/B2-20P7	5013	DS5C-20P7-PTA	Single phase 220V
MS6S-80CS/CM20BZ1/BZ2-20P7	5813	DS5C-20P7-PTA	Single phase 220V
MS6H-80CS/CM30B1/B2-20P7	50D7	DS5C-20P7-PTA	Single phase 220V
MS6H-80CS/CM30BZ1/BZ2-20P7	58D7	DS5C-20P7-PTA	Single phase 220V
MS6H-80CS/CM20B1/B2-20P7	50D3	DS5C-20P7-PTA	Single phase 220V
MS6H-80CS/CM20BZ1/BZ2-20P7	58D3	DS5C-20P7-PTA	Single phase 220V
MS6H-130CS/CM15B2-20P8	5082	DS5C-21P0-PTA	Single phase /Three phase 220V
MS6H-130CS/CM15B2-40P8	5182	DS5C-41P0-PTA	Three phase 380V
MS6H-130CS/CM15BZ2-40P8	5982	DS5C-41P0-PTA	Three phase 380V
MS6H-130TL15B2-40P8	9182	DS5C-41P0-PTA	Three phase 380V
MS6H-130TL15BZ2-40P8	9982	DS5C-41P0-PTA	Three phase 380V
MS6H-130CS/CM20B2-21P5	5087	DS5C-21P5-PTA	Single phase /Three

Motor	Motor code	Suitable driver	Voltage level
			phase 220V
MS6H-130CS/CM20BZ2-21P5	5887	DS5C-21P5-PTA	Single phase /Three phase 220V
MS6H-130TL20B2-21P5	9087	DS5C-21P5-PTA	Single phase /Three phase 220V
MS6H-130TL20BZ2-21P5	9887	DS5C-21P5-PTA	Single phase /Three phase 220V
MS6S-100CS/CM30B2-21P5	5083	DS5C-21P5-PTA	Single phase /Three phase 220V
MS6H-130CS/CM15B2-41P3	5181	DS5C-41P5-PTA	Three phase 380V
MS6H-130CS/CM15BZ2-41P3	5981	DS5C-41P5-PTA	Three phase 380V
MS6H-130TL15B2-41P3	9181	DS5C-41P5-PTA	Three phase 380V
MS6H-130TL15BZ2-41P3	9981	DS5C-41P5-PTA	Three phase 380V
MS6H-130CS/CM15B2-41P8	5186	DS5C-41P5-PTA	Three phase 380V
MS6H-130CS/CM15BZ2-41P8	5986	DS5C-41P5-PTA	Three phase 380V
MS6H-130TL15B2-41P8	9186	DS5C-41P5-PTA	Three phase 380V
MS6H-130TL15BZ2-41P8	9986	DS5C-41P5-PTA	Three phase 380V
MS6H-130CS/CM15B2-21P8	5084	DS5C-22P6-PTA	Single phase /Three phase 220V
MS6H-130CS/CM15BZ2-21P8	5884	DS5C-22P6-PTA	Single phase /Three phase 220V
MS6H-130TL15B2-21P8	9084	DS5C-22P6-PTA	Single phase /Three phase 220V
MS6H-130TL15BZ2-21P8	9884	DS5C-22P6-PTA	Single phase /Three phase 220V
MS6H-130CS/CM15B2-22P3	5085	DS5C-22P6-PTA	Single phase /Three phase 220V
MS6H-130CS/CM15BZ2-22P3	5885	DS5C-22P6-PTA	Single phase /Three phase 220V
MS6H-130TL15B2-22P3	9085	DS5C-22P6-PTA	Single phase /Three phase 220V
MS6H-130TL15BZ2-22P3	9885	DS5C-22P6-PTA	Single phase /Three phase 220V
MS6H-130CS/CM15B2-42P3	5185	DS5C-43P0-PTA	Three phase 380V
MS6H-130TL15B2-42P3	9185	DS5C-43P0-PTA	Three phase 380V
MS6H-130CS/CM15BZ2-42P3	5985	DS5C-43P0-PTA	Three phase 380V
MS6H-130TL15BZ2-42P3	9985	DS5C-43P0-PTA	Three phase 380V
MS6H-180CS/CM15B2-43P0	5196	DS5C-43P0-PTA-H	Three phase 380V

Motor	Motor code	Suitable driver	Voltage level
MS6H-180TL15B2-43P0	9196	DS5C-43P0-PTA-H	Three phase 380V
MS6H-180CS/CM15B2-44P4	5191	DS5C-45P5-PTA-H	Three phase 380V
MS6H-180TL15B2-44P4	9191	DS5C-45P5-PTA-H	Three phase 380V
MS6H-180CS/CM15B2-45P5	5192	DS5C-45P5-PTA-H	Three phase 380V
MS6H-180TL15B2-45P5	9192	DS5C-45P5-PTA-H	Three phase 380V
MS6H-180CS/CM15B2-47P5	5193	DS5C-47P5-PTA-H	Three phase 380V
MS6H-180TL15B2-47P5	9193	DS5C-47P5-PTA-H	Three phase 380V

Note:

Motors are divided into large inertia, small inertia and holding brake motors, and their motor codes are also different.

For example: 5003: 200W small inertia motor

50C3: 200W large inertia motor

5083: 200W brake motor

Appendix 3. Alarm list

Type		Code	Description	Reasons	Solutions
EEEE	1	EEEE1	Communication error between panel and CPU	①Voltage fluctuation of power supply is large, and low voltage leads to failure of panel refresh; ②Damage 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.
	3	E-013	FPGA loading error	①program damaged ②device damaged	Please contact the agent or the manufacturer.
	4	E-014	FPGA Access error	(1) Program damage (2) Device damage (3)Serious external interference	Please contact the agent or the manufacturer
	5	E-015	Program running error	Program damage	Please contact the agent or the manufacturer
	6	E-016	Processor operation error	Hardware damage	Please contact the agent or the manufacturer
	7	E-017	Processor operation timeout	Program damage	Please contact the agent or the manufacturer
	9	E-019	System password error	Program damage	Please contact the agent or the manufacturer
02	0	E-020	Parameter loading error	Failure of parameter self-checking	Re-energizing can restore default parameters, if there are repeated problems, please contact the agent or manufacturer.
	1	E-021	Parameter range beyond limit	Setting values are not within the prescribed setting	Check the parameters and
	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

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					R and T.
					(2) 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 instablity of FLASH chip	please contact the agent or the manufacturer
	8	E-028	Data reading failed during communication	(1) The cable is in poor contact or not connected (2) Abnormal data communication between driver and motor	① Check the communication wiring ② Power on and power off again

Type		Code	Explanation	Reason	Solution
03	0	E-030	Bus voltage U0-05 is higher than the actual preset threshold, 220V Power Supply Machine (U0-05≥402V) 380V Power Supply Machine (U0-05≥780V)	High voltage of power grid	Check the fluctuation of power grid, 220V driver normal voltage range 200V ~ 240V, 380V driver normal voltage range 360V ~ 420V. If the voltage fluctuation is large, it is recommended to use the correct voltage source and regulator.
				Excessive load moment of inertia (insufficient regeneration capacity)	(1) connect external regenerative resistor, (220V: bus voltage U0-05 = 392 discharge starts, U-05 = 377 discharge ends; 380V: U-05 = 750 discharge starts, U-05 = 720 discharge ends;) (2) 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

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 ≤ 300V)	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.
				Driver power off	Check the power supply
				① The supply voltage is too low ② Hardware damage	When the driver is powered on, please pay attention to whether there is relay closing sound

Type		Code	Explanation	Reason	Solution
04	1	E-041	Driver power down	Driver power off	Check the power supply
	3	E-043	Bus Voltage Charging Failure	low voltage of power grid when normal power on	low voltage of power grid when normal power on
				Hardware damage	When the driver is on, please pay attention to whether there is relay actuation sound
	4	E-044	Three phase voltage input phase loss	Three phase input power supply is lack of phase	Check the power supply
06	0	E-060	Module	① Long time	(1) Re-consider the capacity of the motor,

			temperature is too high (Module temperature U-06 $\geq$ 90℃ alarm, U-06 $\geq$ 70℃ Warning)	operation under heavy load ② The ambient temperature is too high ③ Cooling fan failure	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. (2) Enhance ventilation measures to reduce ambient temperature (3) Check whether the fan rotates when the servo is enabled; Module temperature U0-06 ≥ 45 ℃, fan on
	1	E-061	Motor overheat	Alarm when motor temperature is higher than 95℃	① Check whether the motor fan is abnormal ② Contact the manufacturer for technical support
	2	E-063	Thermocouple disconnection alarm	① The motor thermocouple of 11kw and above power is disconnected ② False opening detection and disconnection alarm of motor below 11kw	Check the external thermocouple connection Shield thermocouple disconnection alarm: P0-69.1 = 1
08	0	E-080	Overspeed (actual speed $\geq$ P3-21/P3-22) The maximum forward speed is P3-21 and the maximum reverse speed is P3-22.	Motor code not match	Check if the driver U3-70 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 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 P3-21 / P3-22, an alarm will be given

Type		Code	Explanation	Reason	Solution
09	2	E-092	Analog Tref Zero-Calibration Over limit	Analog Zero Calibration Operation Error	Please correct zero without analog voltage
	3	E-093	Analog Vref Zero-Calibration Over limit	Analog Zero Calibration Operation Error	Please correct zero without analog voltage
10	0	E-100	Position offset too large	In position control, the difference between the given position and the actual position exceeds the limit value.	(1) Observe whether the motor is blocked or not. (2) Increase the deviation pulse limit P0-23.
	1	E-101	Position command mutation	The position difference of every 6K cycle exceeds the command difference alarm value set by P0-70	(1) Check and modify procedures (2) Set the appropriate P0-70 value
11	0	E-110	External UVW Short Circuit Discovered in Self-Inspection	Not match the motor code	Check if the driver U3-70 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).
15	0	E-150	Power cable disconnection	Any phase in UVW of driver, cable or motor broken	Disconnect the power supply of the driver and check the connection of the power cable. It is suggested that the multimeter be used to test the condition. After eliminating the errors, the driver should be re-energized.

Type		Code	Explanation	Reason	Solution
16	1	E-161	Driver thermal power overload	Not match the motor code	Check if the driver U3-70 is identical with the motor code of the motor label (the number after MOTOR CODE), if not, please change to the same one, then power on again.
				Overload, the actual operating torque exceeds the rated torque, and continuous operation for a long time. (Monitor U0-02 to check the actual operating torque. If the motor is in normal operation, it will not jam or jitter. If the U0-02 is longer than 100, it will be considered improper selection of the motor.)	Increase the capacity of drivers and motors. Extend the acceleration and deceleration time and reduce the load. Monitor the U-00, whether it is running over speed.
				Mechanisms are impacted, suddenly weighted and distorted.	Eliminate mechanical distortion. Reduce load
				Motor action when motor brake is not opened	Measure the voltage of the brake terminal and decide to open the brake. It is suggested to use servo BK signal to control the brake lock. If it is not servo control, attention must be paid to the timing of brake opening and motor action.
				Wrong wiring of encoder cable, power cable or broken wire or loose pin of connector plug	Check the UVW connection of power cable to see if there is any phase sequence error. The multimeter is used to measure whether all the encoder cable are on. Check whether the plug is loose, for machine vibration, whether the plug has shrinkage pin, virtual

				welding, damage.
		In multiple mechanical wirings, incorrect connection of motor cable to other shafts leads to incorrect wiring.	Detection of servo wiring, the motor cable, encoder cable is 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.

Type			Code	Explanation	Reason	Solution
16	5		E-165	Anti-blocking alarm Judging that the current motor output torque is greater than P3-28/P3-29 (P3-38 /P3-39 for version 3760 and later), and the time reaches P0-74 (unit ms), and the speed is lower than P0-75 (unit 1 rpm).	(1) Machinery is impacted, suddenly becomes heavier and distorted (2) When the brake of the motor is not opened, the motor moves (3) The parameter setting is unreasonable.	(1) Eliminate the factors of mechanical distortion. Reduce load (2) Measure the voltage of the brake terminal and determine the opening of the brake It is suggested to use servo BK brake signal to control the brake lock. If it is not servo control, attention must be paid to the timing of brake opening and motor action. (3) Monitor the actual output torque range of U0-02 and check whether the setting of P3-28/29 torque limit is reasonable. (After version 3760, the output torque limit setting parameters of anti locked rotor alarm are P3-38 and P3-39）

20	0	E-200	Regenerative resistance overload	The discharge power of regeneration resistance exceeds the rated value	① Replace the regenerative discharge resistor with higher power ② Check whether the regeneration resistance is properly connected
22	0	E-220	Communication error of absolute servo encoder	Motor matching error	Check if the motor matches correctly
				Unconnected encoder cable or poor contact	Check whether the value of U0-54 increases rapidly. If yes, the encoder circuit is disconnected. Disconnect the power supply of the driver, check the connection of the encoder cable, if there is cable loosening, it is recommended to use the multimeter to test the conduction condition; after eliminating errors, power on again Hot plugging is strictly prohibited, and special cables are required for tank chains.
				Received encoder data errors, and the number of errors exceeds the number of errors retries of encoder registers P0-56	Check whether the value of U0-79 and U0-54 increase. If yes, the encoder is interfered. Encoder wire and strong power 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
	1	E-221	Too many CRC errors in encoder communication	The received encoder data is wrong and the number of errors exceeds the value in encoder error retry number register P0-56	Encoder interfered, isolate interference source

Type		code	Explanation	Reason	Solution
22	2	E-222	Absolute value servo encoder battery low voltage alarm (can shield this alarm)	① The battery voltage in the encoder cable battery box is lower than 3.2V ② New machine power on alarm	① Please replace the battery while keeping the servo driver power on to avoid error of encoder position information; Battery Specification: No. 5 battery, 3.6V. ② If the encoder cable is disconnected from the motor, the current position of the motor will be lost, an alarm will be given, and F0-00 = 1 will clear the alarm
	3	E-223	alarm of absolute value servo encoder	Encoder cable with battery box is not used for multi-turn absolute motor	① Please use encoder cable with battery box ② Power off and power on again (the driver panel shall be completely off). If the alarm cannot be removed, please contact the agent or manufacturer
				Generally, it is the problem of the encoder itself, or the power supply of the encoder is unstable	
				Abnormal power on of main control chip of multi-turn absolute value servo encoder	
	7	E-227	Power on encoder multi turn signal data error	Generally, it is the problem of the encoder itself, or the power supply of the encoder is unstable	In the case of no battery, unplugging the encoder cable may cause this alarm.
	8	E-228	Absolute value servo encoder value overflow	The motor runs in one direction continuously, the encoder data value is too large, overflow	① Set F1-06 = 1, clear the absolute encoder's multiple turns ② Set P0-79 = 1, the alarm can be shielded.
24	0	E-240	Timing error in fetching encoder position data	①The number of consecutive errors in encoder data update sequence is greater than the value in P0-68 ② CPU timer fluctuates	① Restart driver ②Check the arrangement of transmission cables to ensure that the strong and weak current are wired separately. ③High current equipment is

Type		code	Explanation	Reason	Solution
					supplied separately. ④The grounding is good.
	1	E-241	Encoder responds to data scrambling	The received encoder data is wrong and the number of errors exceeds the value in encoder error retry number register P0-56	① Check the arrangement of transmission cables to ensure that the strong and weak current are wired separately. ② High current equipment is supplied separately. ③ The grounding is good.
	3	E-243	Delta encoder abnormal	The status frame fed back by the encoder is wrong, which is the alarm of delta encoder itself	①Check whether the encoder cable is normal ②Confirm whether the encoder is normal
25	0	E-250	Zero return error alarm	①P9-15 is not 0 and the total time to return to the origin exceeds the time set by P9-15 ②The parameter setting of the original function is wrong.	① Increase P9-15 ② Ensure that the direction of mechanical offset (P9-19, P9-20) is opposite to the direction of returning to the origin ③Check whether there is a problem with the origin signal ④Check the parameter setting of the new return to the original function
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	(1) Reduce inertia or use brake motor (2) Increase the stop timeout time

Type		code	Explanation	Reason	Solution
				(3) The setting of braking torque is too small.	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
	5	E-265	Excessive motor vibration	Mechanical vibration	(1)Set P2-03.0 to 0; (2)Check the motor installation
28	0	E-280	Failed to read motor parameters	Request to read EEPROM failed	On the premise that the professional determines that the driver and motor are matched and can be used together, it can (read the motor parameter alarm shielding bit) through P0-53 and correctly set P0-33 motor code.
	1	E-281	Error writing data to encoder EEPROM	Request to write EEPROM failed	On the premise that the driver and motor are matched and can be used together, read the alarm shielding position of motor

Type		code	Explanation	Reason	Solution
					parameters through P0-53, and set the motor code of P0-33 correctly.
31	0	E-310	Motor code is error	Power mismatch between driver and motor.	Check whether the power of motor and driver is consistent, and replace the driver corresponding to the motor
	1	E-311	Motor code missing	The driver is equipped with optical encoder motor, P0-33 is n.0000, and the motor parameters are not written in the motor	On the premise that the driver and motor are matched and can be used together, read the alarm shielding position of motor parameters through P0-53, and set the motor code of P0-33 correctly
	2	E-312	The motor code does not match the software version	① Update motor parameters ② Update software version	Contact the manufacturer for technical support
	3	E-313	Encoder software version mismatch	Encoder software version mismatch	①Update driver firmware to maximize current motor parameter performance ②Read the alarm shielding position of motor parameters through P0-53, and set the motor code of P0-33 correctly. At this time, the motor parameters are in the driver, which can work normally, but may affect some performance
	4	E-314	The motor code does not match the software version	The encoder version does not match . The encoder version currently used by the motor is higher than the encoder version supported by the drive firmware	①Update motor parameters ②Update the software version ③Contact the manufacturer for technical support
	5	E-315	Invalid read parameter	There are motor parameters in the motor encoder, but the parameter is 0 (this is the	On the premise that the driver and motor are matched and can be used together, read the alarm shielding position of motor

Type		code	Explanation	Reason	Solution
				property of the motor encoder), and P0-33 is not n.0000	parameters through P0-53, and set the motor code of P0-33 correctly.
	6	E-316	Auto-read code error	The auto read motor code is inconsistent with the motor code set in P0-33	Check U3-70 and motor code on motor body nameplate. If the two values are different, contact the manufacturer's technical support
80	4	E-804	PDO watchdog abnormal protection	EtherCAT communication disconnected	Confirm whether the sending time of PDO from the upper device is fixed (interrupted). Confirm that the PDO watchdog detection delay value is too large. Confirm whether there is any problem with the wiring of EtherCAT communication cable and whether there is excessive noise on the cable. The servo alarm can be cleared by setting SM2013 + 20*(n-1) or by servo panel F0-00 = 1

Type		Code	Explanation	Reason	Solution
85	0	E-850	TxPDO assign fault protection	TxPDO mapped data size exceeds 24 bytes	Confirm that the data size of TxPDO mapping is set within 24 bytes. The servo alarm can be cleared by setting SM2013 + 20*(n-1) or by servo panel F0-00 = 1
	1	E-851	RxPDO assign fault protection	RxPDO mapped data size exceeds 24 bytes	Confirm that the data size of RxPDO mapping is set within 24 bytes. The servo alarm can be cleared by setting SM2013 + 20*(n-1) or by servo panel F0-00 = 1
88	1	E-881	Control mode setting abnormal protection	When the set value of 6060h is 0 and the set value of 6061h is 0, change the PDS state to "operation enabled" and the control mode corresponding to	Confirm the set value of 6060h. The servo alarm can be cleared by setting SM2013 + 20*(n-1) or by servo panel F0-00 = 1

				6060h is not set. In full closed-loop control, 6060h is the case when the mode other than position control is set	

Appendix 4. Modbus address list

■ Parameter address

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

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

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

Parameter	Modbus address		Parameter	Modbus address	
	Hexadecimal	Decimal		Hexadecimal	Decimal
P5-00	0x0500	1280	P5-27	0x051B	1307
P5-01	0x0501	1281	P5-28	0x051C	1308
P5-02	0x0502	1282	P5-29	0x051D	1309
P5-03	0x0503	1283	P5-30	0x051E	1310
P5-04	0x0504	1284	P5-31	0x051F	1311
P5-05	0x0505	1285	P5-32	0x0520	1312
P5-06	0x0506	1286	P5-33	0x0521	1313
P5-07	0x0507	1287	P5-34	0x0522	1314
P5-08	0x0508	1288	P5-35	0x0523	1315
P5-09	0x0509	1289	P5-36	0x0524	1316
P5-10	0x050A	1290	P5-37	0x0525	1317
P5-11	0x050B	1291	P5-38	0x0526	1318
P5-12	0x050C	1292	P5-39	0x0527	1319
P5-13	0x050D	1293	P5-40	0x0528	1320
P5-14	0x050E	1294	P5-41	0x0529	1321
P5-15	0x050F	1295	P5-42	0x052A	1322
P5-16	0x0510	1296	P5-43	0x052B	1323
P5-17	0x0511	1297	P5-44	0x052C	1324
P5-18	0x0512	1298	P5-45	0x052D	1325
P5-19	0x0513	1299	P5-46	0x052E	1326
P5-20	0x0514	1300	P5-47	0x052F	1327
P5-21	0x0515	1301	P5-48	0x0530	1328
P5-22	0x0516	1302	P5-49	0x0531	1329
P5-23	0x0517	1303	P5-50	0x0532	1330
P5-24	0x0518	1304	P5-51	0x0533	1331
P5-25	0x0519	1305	P5-52	0x0534	1332
P5-26	0x051A	1306	P5-53	0x0535	1333

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

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

■ Monitor parameters group U

Parameter	Modbus address		Parameter	Modbus address	
	Hexadecimal	Decimal		Hexadecimal	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
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

Parameter	Modbus address		Parameter	Modbus address	
	Hexadecimal	Decimal		Hexadecimal	Decimal
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	U2-18	0x1212	4626
U1-19	0x1113	4371	U2-19	0x1213	4627
U1-20	0x1114	4372	U2-20	0x1214	4628
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	
	Hexadecimal	Decimal		Hexadecimal	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. New functions of version 3770

◆ The numerator of electronic gear ratio can be modified in real time in pulse position mode, and it is not allowed to be modified in enable mode in other modes.

◆ Improve the homing function and add 8 modes.

◆ Add the second group of gain parameters, and the two groups of gain parameters can be switched.

◆ The internal speed command S-shaped curve filtering function is added, and the parameter P3-11 is added.

◆ Add Z-phase output function of multi-turn motor.

◆ Add parameter P8-25. When powered on, the panel directly displays speed or torque feedback according to group P parameter settings.

◆ P8-2 = 0: normal display, as before, power on to display 'bb' or 'run', the default setting.

◆ P8-2 = 1: power on the panel to display the value of U0-00, speed feedback, unit: rpm.

◆ P8-2 = 2: the value of U0-07 displayed on the panel when powered on, torque feedback, unit %.