



DS3 series PQA servo drive

User manual

WUXI XINJE ELECTRIC CO., LTD.

Serial No. SC3 02 201401007 1.0

All copyrights reserved by WUXI XINJE ELECTRIC CO., LTD.

Any copying, transferring or any other usage is prohibited. Otherwise Xinje will have the right to pursue legal responsibilities. All rights including patent and permission of modules and designs are reserved.

January, 2010

Safety Precautions

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

The following defines the symbols used in this manual to indicate varying degrees of safety precautions and to identify the corresponding level of hazard inherent to each. Failure to follow precautions provided in this manual can result in serious, possibly even fatal, injury, and/or damage to the persons, products, or related equipment and systems.



CAUTION

Indicates a potentially hazardous situation, which, if not heeded, could result in death or serious injury



WARNING

Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury.

● Checking Products upon Delivery



CAUTION

1. DO NOT install any drive which is damaged, lack of accessories or not the same with the model ordered.
Doing so may result in electric shock.

● Installation



WARNING

1. Cut off external power supply before installation.
Not doing so may result in electric shock.



CAUTION

1. Always use the servomotor and servo amplifier in one of the specified combinations.
Never use the products in an environment subject to water, corrosive gases, inflammable gases, or combustibles.
Doing so may result in electric shock, fire or malfunction.
2. DO NOT touch any metallic part.
Doing so may result in malfunction.

● Wiring



WARNING

1. Cut off external power supply before wiring.
Not doing so may result in electric shock.
2. Connect AC power supply to the corresponding terminals.
Faulty wiring may result in fire.



CAUTION

1. Do not connect a three-phase power supply to the U, V, or W output terminals.
Doing so may result in injury or fire.
2. Use 2mm² wire to grounding the ground terminals.
Not doing so may result in electric shock.
3. Securely fasten the power supply terminal screws and motor output terminal screws.
Not doing so may result in fire.

● Operation



WARNING

1. Never touch any rotating motor parts while the motor is running.
Doing so may result in injury.
2. DO NOT touch the inside the drive.
Doing so may result in electric shock.
3. Do not remove the panel cover while the power is ON.
Doing so may result in electric shock.
4. Do not touch terminals for five minutes after the power has been turned OFF.
Residual voltage may cause electric shock.



CAUTION

1. Conduct trial operation on the servomotor alone with the motor shaft disconnected from machine to avoid any unexpected accidents.
Not doing so may result in injury.
2. Before starting operation with a machine connected, change the settings to match the parameters of the machine.
Starting operation without matching the proper settings may cause the machine to run out of control or malfunction.
3. Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.
Not doing so may result in injury.
4. Do not touch the heat sinks during operation.
Not doing so may result in burns due to high temperatures.
5. Do not attempt to change wiring while the power is ON.
Doing so may result in electric shock or injury

Catalog

Preface	IV
1 Checking Product and Part Names	5
1-1. Checking Products on Delivery	5
1-2. Product appearance and name rule	5
1-3. Adaptation table of servo drive and motor	8
2 Installations	9
2-1. Servo motor	9
2-1-1. Storage Temperature	9
2-1-2. Installation Site	9
2-1-3. Concentricity	9
2-1-4. Orientation	10
2-1-5. Handling Oil and Water	10
2-1-6. Cable Stress	10
2-2. Servo Drive	10
2-2-1. Storage Conditions	10
2-2-2. Installation Site	10
2-2-3. Orientation	11
2-2-4. Installation	11
3 Wiring	13
3-1. Main Circuit Wiring	13
3-1-1. The terminal arrangement	13
3-1-2. Main circuit terminals	14
3-1-3. Winding Terminals on Servo motor	15
3-1-4. CN0, CN1, CN2 terminals	15
3-1-5. Communication port	17
3-2. Signal terminals	19
3-2-1. Pulse signal	19
3-2-2. SI input signal	20
3-2-3. Analog input circuit	20
3-2-4. Output signal	20
3-2-5. Encoder feedback signal	21
3-3. Standard wiring example	21
3-3-1. Position Control Mode	21
3-4. Regenerative Resistor	23
4 Use the operate panel	24
4-1. Basic Operation	24
4-1-1. Functions of operate panel	24
4-1-2. Basic Mode Switching	24
4-2. Running status mode	25
4-3. Monitoring Mode	26
4-4. Auxiliary Function	31
4-4-1. F0-XX	31
4-4-2. F1-XX	32
4-5. Alarm (E-XXX)	33
4-6. Example	33

4-7. Change the motor code.....	34
5 Run the servo system.....	35
5-1. Control mode selection	35
5-2. Basic function setting	35
5-2-1. Servo ON setting.....	36
5-2-2. Switch the motor rotate direction	36
5-2-3. Stop mode	36
5-2-4. Overtravel Limit (P-OT & N-OT)	37
5-2-5. Power-off Brake (BK)	38
5-2-6. Alarm output	40
5-3. Position mode (external pulse command)	40
5-3-1. External position mode	41
5-3-2. Pulse command and pulse form	41
5-3-3. Electronic gear ratio.....	42
5-3-4. Position command filter.....	45
5-3-5. Pulse deviation clear (/CLR)	46
5-3-6. Positioning complete (/COIN, /COIN_HD)	46
5-3-7. Positioning near (/NEAR).....	48
5-3-8. Command pulse prohibition (/INHIBIT).....	49
5-3-9. Positoin pulse difference.....	49
5-5. Speed control (analog voltage command).....	50
5-5-1. Control mode selection	50
5-5-2. Analog value of rated speed	51
5-5-3. Speed command difference auto-adjustment (F1-03).....	51
5-5-4. Proportion action command (/P-CON).....	52
5-5-5. Zero clamp (/ZCLAMP).....	52
5-5-6. Speed coincidence checking (/V-CMP).....	52
5-5-7. Torque limit	53
5-5-8. Soft start.....	54
5-5-9. Filter.....	55
5-5-10. Speed reach signal (/V-RDY).....	55
5-5-11. Alarm speed	56
5-6. Speed control (internal speed).....	56
5-6-1. Control mode selection	57
5-6-2. Internal speed setting	57
5-6-3. Input signal setting.....	57
5-7. Speed control (pulse frequency command).....	58
5-7-1. Control mode selection	59
5-7-2. Pulse frequency command.....	59
5-7-3. Command pulse frequency at rated speed	59
5-7-4. Speed command pulse filter time.....	59
5-8. Torque control (analog voltage command)	59
5-8-1. Control mode selection	60
5-8-2. The analog value of rated torque	60
5-8-3. Torque command offset autoadjustment (F1-04)	61
5-8-4. Torque command filter time	61
5-8-5. Torque limit	61
5-8-5-1. Internal speed limit.....	61
5-8-5-2. External speed limit.....	61
5-8-5-3. Speed up to limit value output.....	62
5-9. Torque control (internal setting)	62

5-9-1. Control mode selection	62
5-9-2. Internal torque command	62
5-10. Switch the control mode	62
5-11. Other output signals	63
5-11-1. /ALM and /ALM-RST	63
5-11-2. /WARN	63
5-11-3. Rotation checking (/TGON)	63
5-11-4. Hysteresis loop.....	64
5-11-5. Servo ready (/S-RDY)	64
5-11-6. ABZ phase feedback signal of encoder	64
5-11-7. User-defined output signal.....	66
5-11-8. IO filter time	67
5-12. I/O signal distribution	68
5-12-1. Input signal distribution	68
5-12-2. Default setting of input terminal	68
5-12-3. Output terminal distribution	69
5-12-4. Default setting of output terminal	69
6 Servo gain adjustment	70
6-1. Gain parameter adjustment	70
6-1-1. Gain parameters	70
6-1-2. Other parameters.....	71
6-2. Parameter switching	72
6-2-1. G-SEL signal input	73
6-2-2. Gain filter time constant	73
6-3. Inertia ratio switching (I-SEL)	74
6-4. Rigidity level adjustment	74
6-5. The experience of gain adjustment	74
7 Servo vibration suppression	76
7-1. Servo vibration suppression	76
8 Specification and dimension	78
8-1. Servo motor.....	78
8-1-1. Servo motor specification	78
8-1-2. Torque-Speed Feature.....	81
8-1-3. Servo motor dimensions	83
8-2. Servo drives.....	86
8-2-1. General specification	86
8-2-2. Performance specification	86
8-2-3. Servo drive dimensions.....	87
9 Alarm Information.....	89
Appendix 1 Parameter list	93
Appendix 2 Application	103

Preface

This chapter describes the constitution of this manual, the intended user, and how to acquire this manual.

1. Checking Product and Part Names

This chapter describes the procedure for checking products upon delivery as well as names for product parts.

2. Installation

This chapter describes precautions for servomotor and servo drive installation.

3. Wiring

This chapter describes the procedure used to connect DS3 Series products to peripheral devices and gives typical examples of main circuit wiring as well as I/O signal connections.

4. Parameter Settings and Functions

This chapter describes the procedure for setting and applying parameters.

5. Use Digital Panel

This chapter describes the basic operation of the digital panel and the features it offers.

6. Ratings and Characteristics

This chapter provides the ratings, torque-speed characteristics diagrams, and dimensional drawings of the DS3 series servo drives and MS series servomotors.

7. Alarm Information

This chapter describes the alarm information of DS3 series servo drives.

Intended User

This manual is intended for the following users.

- Those designing DS3 Series servodrive systems.
- Those installing or wiring DS3 Series servodrives.
- Those performing trial operation or adjustments of DS3 Series servo drives.
- Those maintaining or inspecting DS3 Series servodrives.

How to Acquire This Manual

1. Electrical Manual

- (1) Log on Xinje official website www.xinje.com to download.
- (2) Acquire this manual on a CD from an authorized distributor.

1 Checking Product and Part Names

1-1. Checking Products on Delivery

Use the following checklist when products are delivered.

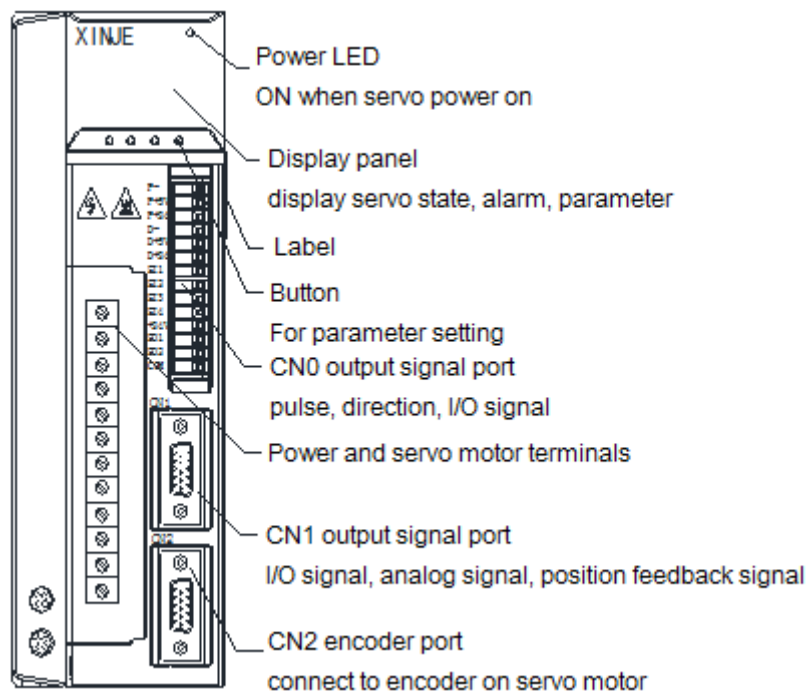
Items	Comments
Are the delivered products the ones that were ordered?	Check the model numbers marked on the nameplates of the servomotor and servo drive.
Does the servomotor shaft rotate smoothly?	The servomotor shaft is normal if it can be turned smoothly by hand. Servomotors with brakes, however, cannot 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 screwdriver.
Is the motor code the same with the code in drive?	Check the motor code marked on the nameplates of the servomotor and the parameter P0-33 on the servo drive.

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

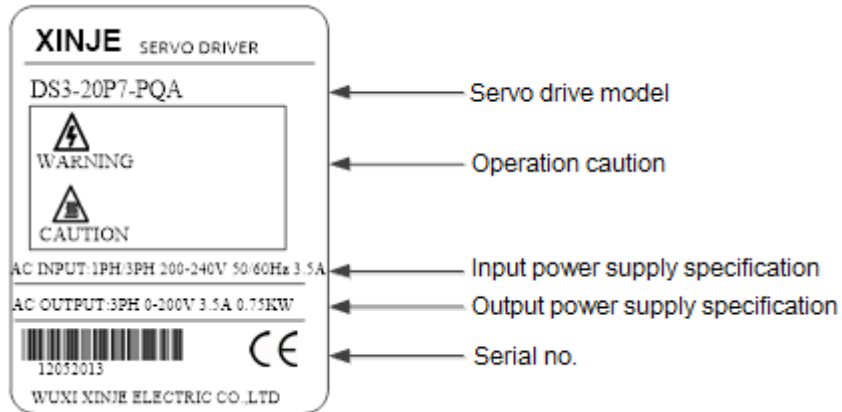
1-2. Product appearance and name rule

DS3-2□P□-PQA DS3-4□P□-PQA

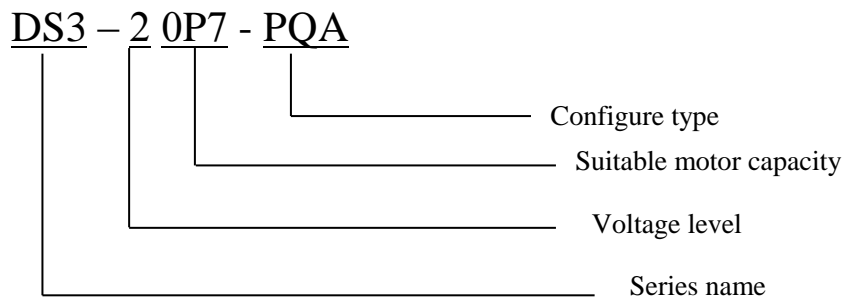
Appearance and nameplate



Servo drive nameplate



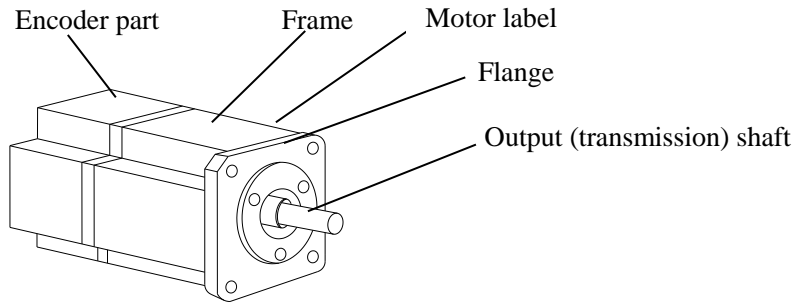
(1) Naming rule



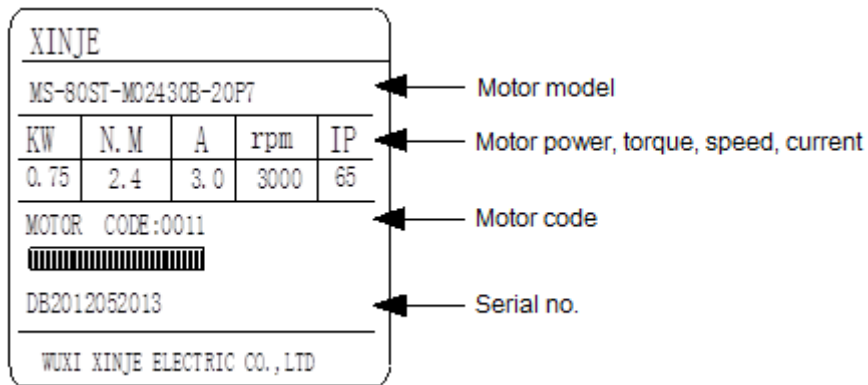
Series	DS3	DS3 series servo drive
Voltage level	2	220V
	4	380V
Suitable motor capacity	0P2	0.2 KW
	0P4	0.4KW
	0P7	0.75KW
	1P5	1.5KW
	2P3	2.3KW
	3P0	3.0KW
	5P5	5.5KW
Configuration type	7P5	7.5KW
	P	Input command type: pulse
	Q	Encoder type: Q-quadrature encoder
	A	Design order: A

■ **Servo motor**

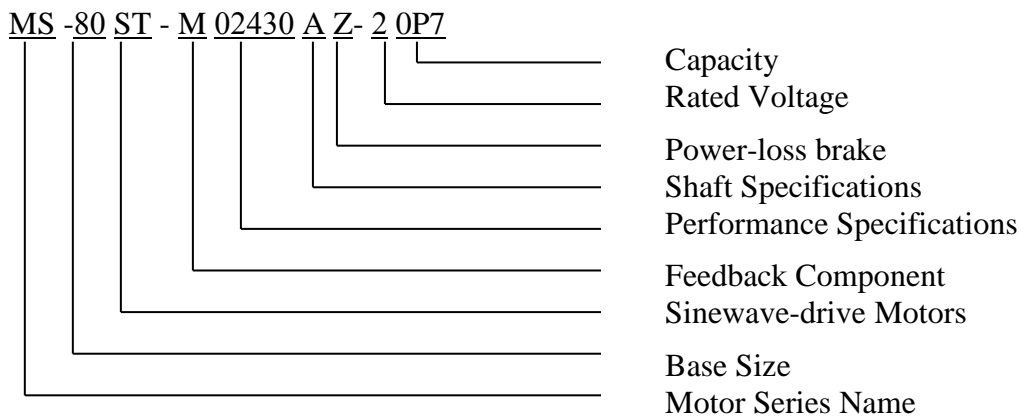
(1) Appearance and nameplate



Motor label



(2) Naming rule



Base number	60, 80, 90, 110, 130, 180	
Feedback component no.	M	Optical pulse encoder
Performance parameter no.	First 3 bits mean rated torque, last 2 bits mean rated speed Such as: 00630: rated torque 0.6N.m, rated speed 3000rpm 06025: rated torque 6.0N.m, rated speed 2500rpm 19015: rated torque 19.0N.m, rated speed 1500rpm	
Shaft spec	A	No bond
	B	With bond

Power-loss brake	Vacant	No
	Z	With power-off brake
Voltage level	2	220V
	4	380V
Power	Such as: 0P4: 0.4kW 0P7: 0.75kW 1P5: 1.5KW	

1-3. Adaptation table of servo drive and motor

Suitable drive	Motor type	Motor code	Voltage level	
DS3-20P2-PQA	MS-60ST-M00630-20P2	1003	1 or 3 phase 220V	
DS3-20P4-PQA	MS-60ST-M01330-20P4	1004 (0004)		
DS3-20P7-PQA	MS-80ST-M02430-20P7	1011 (0011)		
	MS-80ST-M03520-20P7	0012		
	MS-90ST-M02430-20P7	0021		
DS3-21P5-PQA	MS-110ST-M04030-21P2	0031		3 phase 220V
	MS-110ST-M05030-21P5	0032		
	MS-130ST-M06025-21P5	1042 (0042)		
	MS-130ST-M10015-21P5	1044 (0044)		
DS3-22P3-PQA	MS-130ST-M07725-22P0	0043		
	MS-130ST-M15015-22P3	0046		
DS3-41P5-PQA	MS-110ST-M04030-41P2	0131	3 phase 380V	
	MS-110ST-M05030-41P5	0132		
	MS-130ST-M06025-41P5	0142		
	MS-130ST-M10015-41P5	0144		
DS3-43P0-PQA	MS-130ST-M10030-43P0	1148		
	MS-180ST-M19015-43P0	0156		
	MS-180ST-M20015-43P0	1052		
DS3-45P5-PQA	MS-180ST-M21520-44P5	0150		
	MS-180ST-M27015-44P3	0151		
	MS-180ST-M35015-45P5	0152		
DS3-47P5-PQA	MS-180ST-M48015-47P5	0153		

2 Installations

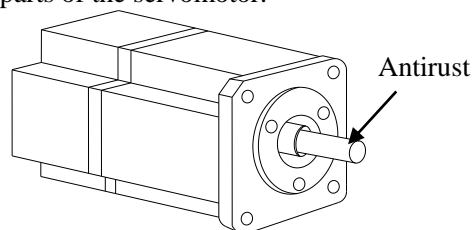
2-1. Servo motor

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



CAUTION

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



2-1-1. Storage Temperature

Store the servomotor within $-20\sim+60\text{ }^{\circ}\text{C}$ as long as it is stored with the power cable disconnected.

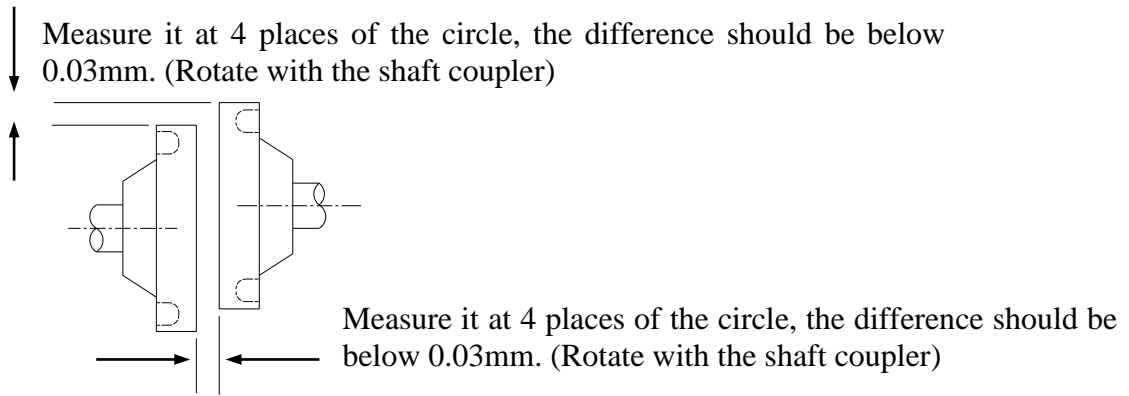
2-1-2. Installation Site

MS series servomotors are designed for indoor use. Install the servomotor in environments that satisfy the following conditions.

- Free of corrosive or explosive gases.
- Well-ventilated and free of dust and moisture.
- Ambient temperature of 0 ° to $50\text{ }^{\circ}\text{C}$.
- Relative humidity (r.h.) of 20 to 80% with no condensation.
- Accessible for inspection and cleaning.

2-1-3. Concentricity

Please use coupling when connecting to machine; keep the shaft center of servo motor and machine at the same line. It should be accord to the following diagram when installing the servo motor.



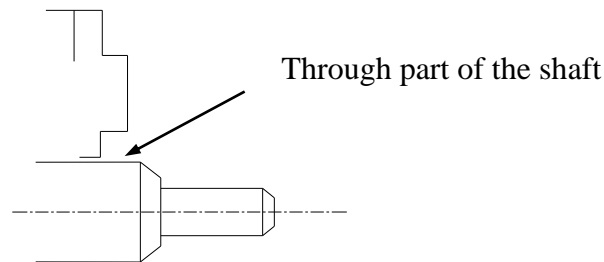
- Note:** (1) If the concentricity is not enough, it will cause the vibration and bearing damage.
 (2) When installing the coupler, prevent direct impact to the shaft. This can damage the encoder mounted on the shaft end at the opposite side of the load.

2-1-4. Orientation

MS series servomotors can be installed either horizontally or vertically.

2-1-5. Handling Oil and Water

Install a protective cover over the servomotor if it is used in a location that is subject to water or oil mist. Also use a servomotor with an oil seal when needed to seal the through-shaft section.



2-1-6. Cable Stress

Make sure that the power lines are free from bends and tension. Be especially careful to wire signal line cables so that they are not subject to stress because the core wires are very thin, measuring only 0.2 to 0.3mm².

2-2. Servo Drive

The DS3 series PQA servo drives are base-type servo drive. Incorrect installation will cause problems. Follow the installation instructions below

2-2-1. Storage Conditions

Store the servo drive within -20~+60°C, as long as it is stored with the power cable disconnected.

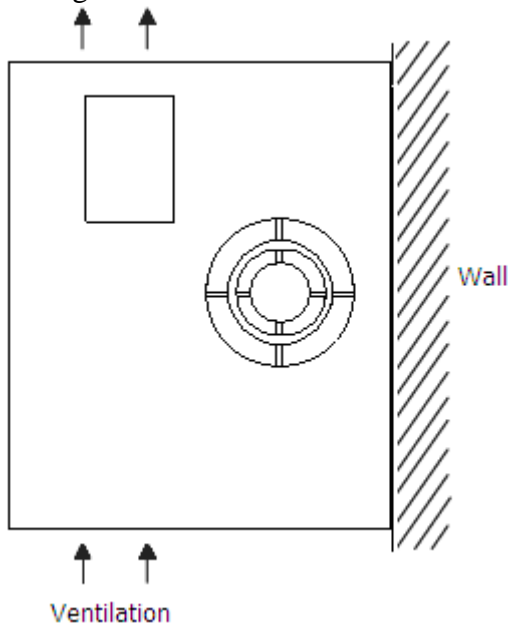
2-2-2. Installation Site

The following precautions apply to the installation site.

Situation	Installation Precaution
Installation in a Control Panel	Design the control panel size, unit layout, and cooling method so the temperature around the servo drives does not exceed 50 °C.
Installation Near a Heating Unit	Minimize heat radiated from the heating unit as well as any temperature rise caused by natural convection so the temperature around the servo drives does not exceed 50 °C.
Installation Near a Source of Vibration	Install a vibration isolator beneath the servo drive to avoid subjecting it to vibration.
Installation at a Site Exposed to Corrosive Gas	Corrosive gas does not have an immediate effect on the servo drives, but will eventually cause electronic components and terminals to malfunction. Take appropriate action to avoid corrosive gas.
Other Situations	Do not install the servo drive in hot and humid locations or locations subject to excessive dust or iron powder in the air.

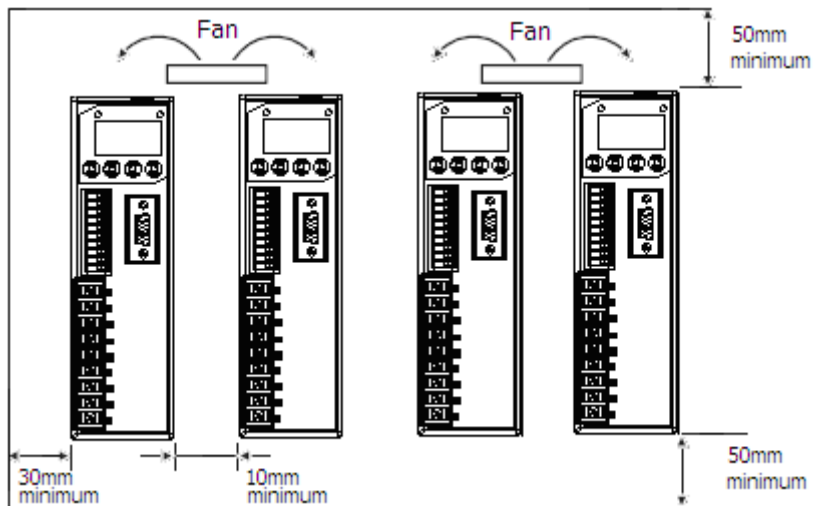
2-2-3. Orientation

Install the servo drive perpendicular to the wall as shown in the figure. The servo drive must be oriented this way because it is designed to be cooled by natural convection or by a cooling fan.



2-2-4. Installation

Follow the procedure below to install multiple servo drives side by side in a control panel.



■ 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

- Ambient Temperature: 0~50 °C
- Humidity: 90%RH or less
- Vibration: 4.9m/s²
- Condensation and Freezing: None
- Ambient Temperature for Long-term Reliability: 50 °C maximum

3 Wiring

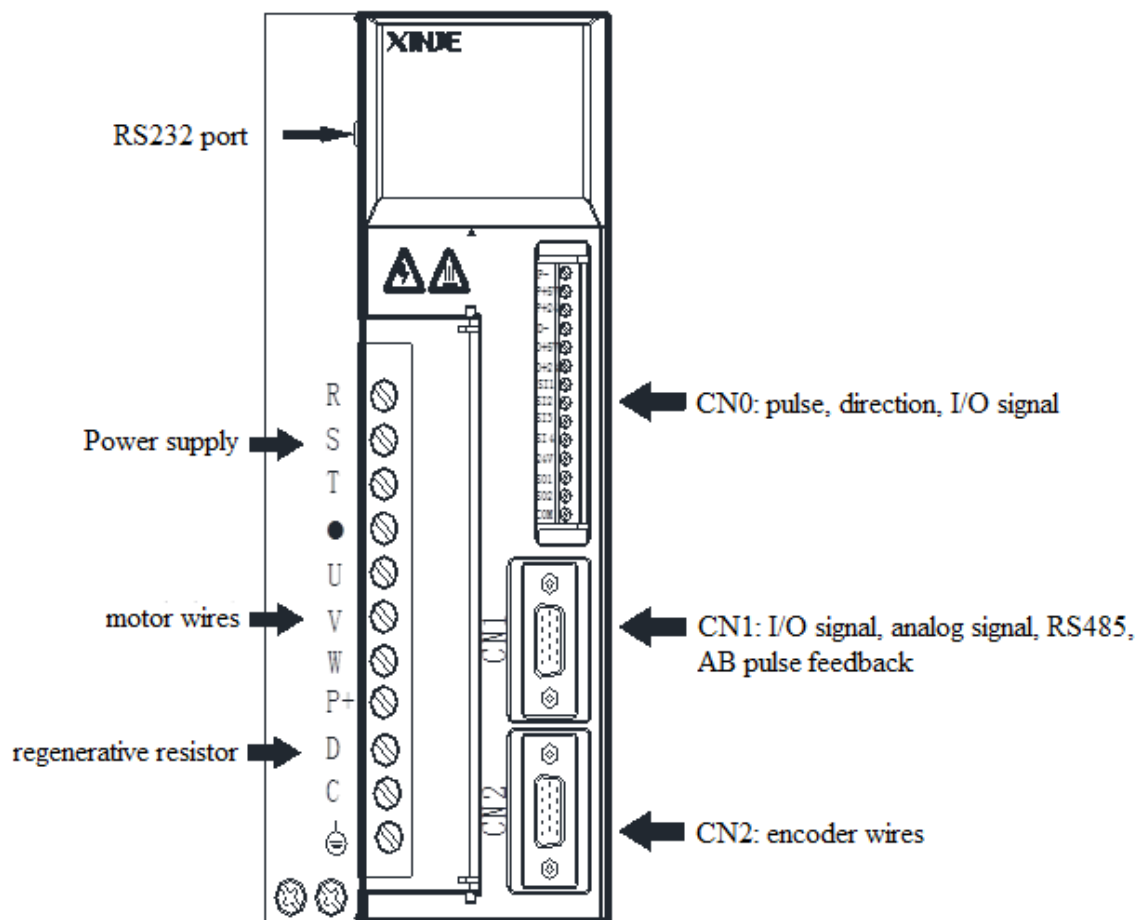
3-1. Main Circuit Wiring



Caution

1. Do not bundle or run power and signal lines together in the same duct. Keep power and signal lines separated by at least 11.81inch(30cm)
2. Use twisted pair wires or multi-core shielded-pair wires for signal and encoder (PG) feedback lines.
The maximum length is 118.11 inch (3m) for reference input lines and is 787.40 inch (20m) for encoder (PG) feedback lines.
3. Do not touch the power terminals for 5 minutes after turning power OFF because high voltage may still remain in the servo amplifier.
Please make sure to check the wiring after the CHARGE light is going off.
4. Avoid frequently turning power ON and OFF. Do not turn power ON or OFF more than once per minute.
Since the servo amplifier has a capacitor in the power supply, a high charging current flows for 0.2s when power is turned ON. Frequently turning power ON and OFF causes main power devices like capacitors and fuses to deteriorate, resulting in unexpected problems.

3-1-1. The terminal arrangement



3-1-2. Main circuit terminals

		■ DS3-20P2-PQA、DS3-20P4-PQA、DS3-20P7-PQA											
Terminal	Function	Explanation											
L1/L2/L3	Power supply input of main circuit	Single or 3 phase AC 200~240V, 50/60Hz											
●	Vacant terminal	-											
U、V、W	Motor terminals	Connect the motor <table border="1"> <thead> <tr> <th>Terminal</th> <th>Color</th> </tr> </thead> <tbody> <tr> <td>U</td> <td>brown</td> </tr> <tr> <td>V</td> <td>black</td> </tr> <tr> <td>W</td> <td>blue</td> </tr> <tr> <td>PE</td> <td>Yellow green</td> </tr> </tbody> </table>		Terminal	Color	U	brown	V	black	W	blue	PE	Yellow green
Terminal	Color												
U	brown												
V	black												
W	blue												
PE	Yellow green												
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, set P0-24=1, P0-25= power value, P0-26= resistor value (see chapter 3-4)											
P+/P-	Bus terminal	Real-time check the bus voltage, please take attention of this terminal											

		■ DS3-21P5-PQA、DS3-22P3-PQA、DS3-41P5-PQA											
Terminal	Function	Explanation											
R/S/T	Power supply input of main circuit	DS3-21P5/22P3-PQA 3 phase AC 200~240V, 50/60Hz DS3-41P5-PQA 3 phase AC 360~400V, 50/60Hz											
●	Vacant	-											
U、V、W	Motor terminals	Connect the motor <table border="1"> <thead> <tr> <th>Terminal</th> <th>Color</th> </tr> </thead> <tbody> <tr> <td>U</td> <td>brown</td> </tr> <tr> <td>V</td> <td>black</td> </tr> <tr> <td>W</td> <td>blue</td> </tr> <tr> <td>PE</td> <td>Yellow green</td> </tr> </tbody> </table>		Terminal	Color	U	brown	V	black	W	blue	PE	Yellow green
Terminal	Color												
U	brown												
V	black												
W	blue												
PE	Yellow green												
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, set P0-24=1, P0-25=power value, P0-26=resistor value (see chapter 3-4)											
⊕	Ground	Connect to ground terminal of motor, then connect to the ground											

		■ DS3-43P0-PQA													
		Terminal	Function	Explanation											
	R	R/S/T	Power supply input of main circuit	3 phase AC 360~400V, 50/60Hz											
	S	•	Vacant												
	T	•	Vacant												
	U	U、V、W	Motor terminals	Connect the motor											
	V			<table border="1"> <thead> <tr> <th>Terminal</th> <th>Color</th> </tr> </thead> <tbody> <tr> <td>U</td> <td>brown</td> </tr> <tr> <td>V</td> <td>black</td> </tr> <tr> <td>W</td> <td>blue</td> </tr> <tr> <td>PE</td> <td>Yellow green</td> </tr> </tbody> </table>		Terminal	Color	U	brown	V	black	W	blue	PE	Yellow green
	Terminal			Color											
	U			brown											
	V	black													
	W	blue													
	PE	Yellow green													
W															
P+	P+, D, C	Internal regenerative resistor	Short P+ and D, disconnect P+ and C, set P0-24=0												
D		External regenerative resistor	Connect regenerative resistor between P+ and C, disconnect P+ and D, set P0-24=1, P0-25=power value, P0-26=resistor value (see chapter 3-4)												
C															
P-	P+/P-	Bus terminal	Real-time check the bus voltage, please take attention of this terminal												

3-1-3. Winding Terminals on Servo motor

Symbol	60, 80, 90 Series	110, 130, 180 Series
PE	4-yellow green (yellow green)	1-yellow green
U	1-brown (red)	2-brown
V	3-black (blue)	3-black
W	2-blue (yellow)	4-blue
Terminal for brake	1: +24V 2: GND	

3-1-4. CN0, CN1, CN2 terminals

CN0	CN1(DB15)	CN2
P-		
P+5V		
P+24V		
D-		
D+5V		
D+24V		
SI1		
SI2		
SI3		
SI4		
+24V		
S01		
S02		
COM		

■ CN0 terminals

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

■ CN1 (DB15) terminals

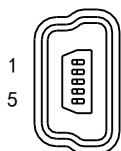
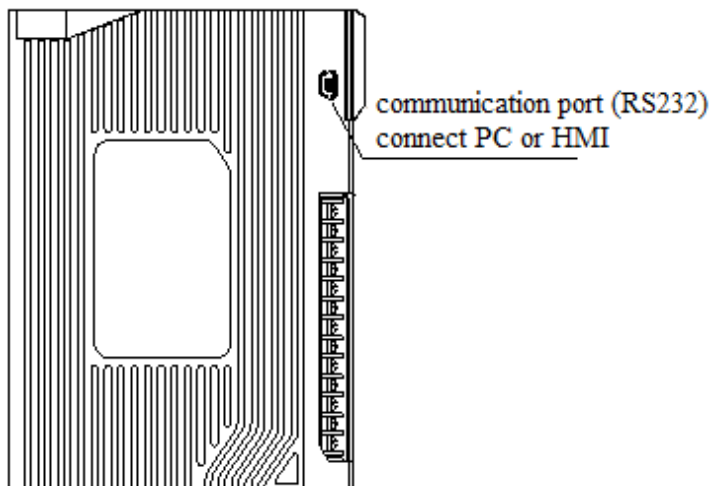
No.	Name	Explanation	No.	Name	Explanation
1	NC	Reserved	9	Z-	Encoder output Z-
2	NC	Reserved	10	B+	Encoder output B+
3	SI5	Input 5	11	T-REF	Torque analog input
4	SO3	Output 3	12	V-REF	Speed analog input
5	B-	Encoder output B-	13	GND	GND for analog input
6	A+	Encoder output A+	14	A	RS485+
7	A-	Encoder output A-	15	B	RS485-
8	Z+	Encoder output Z+			

■ CN2 terminals

Drive port	Motor encoder port		Name	Drive port	Motor encoder port		Name
	60、80、90 series	110、130、180 series			60、80、90 series	110、130、180 series	
1	9	4	A+	2	4	5	B+
3	7	6	Z+	4	6	10	U+
5	11	12	W+	6	13	7	A-
7	14	8	B-	8	5	9	Z-
9	8	13	U-	10	15	15	W-
11	1	1	Connect to shield layer	12	3	3	GND
13	2	2	5V	14	10	11	V+
15	12	14	V-				

3-1-5. Communication port

■ RS-232 communication



(5-pin port)

Pin no.	Name	Explanation
1	TXD	RS232 send
2	RXD	RS232 receive
3	GND	RS232 ground

Note: please use the cable supplied by XINJE Company

Communication parameters:

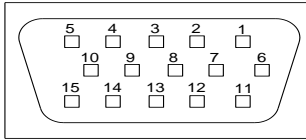
RS232 default communication parameters: baud rate 19200bps, data bit 8, stop bit 1, even parity, Modbus station no.1 (the station no. cannot be changed).

Please set the following parameters through P7-11:

Parameter no.	Function	Default value	Range	Effective time
n.xx□□	Baud rate	06	00~10 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	At once
n.x□XX	Stop bit	2	0: 2 bits, 2: 1 bit	At once
n.□XXX	Parity bit	2	0~2 0:no parity, 1: odd parity, 2: even parity	At once

Note: data bit cannot be changed, it is 8 bits.

■ RS-485 port



Pin no.	Name
CN1-14	A
CN1-15	B

Communication parameters:

RS485 default communication parameters: baud rate 19200bps, data bit 8, stop bit 1, even parity, Modbus station no.1.

The Modbus station no. can be set through P7-00:

Parameter	Function	Default value	Range	Effective time
P7-00	Modbus station no.	1	0~255	At once

The communication parameters can be set through P7-01:

Parameter	Function	Default value	Range	Effective time
n.XX□□	Baud rate	06	00~10 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	At once
n.X□XX	Stop bit	2	0: 2 bits, 2: 1 bit	At once
n.□XXX	Parity bit	2	0~2 0:no parity, 1: odd parity, 2: even parity	At once

Note: data bit cannot be changed, it is 8 bits.



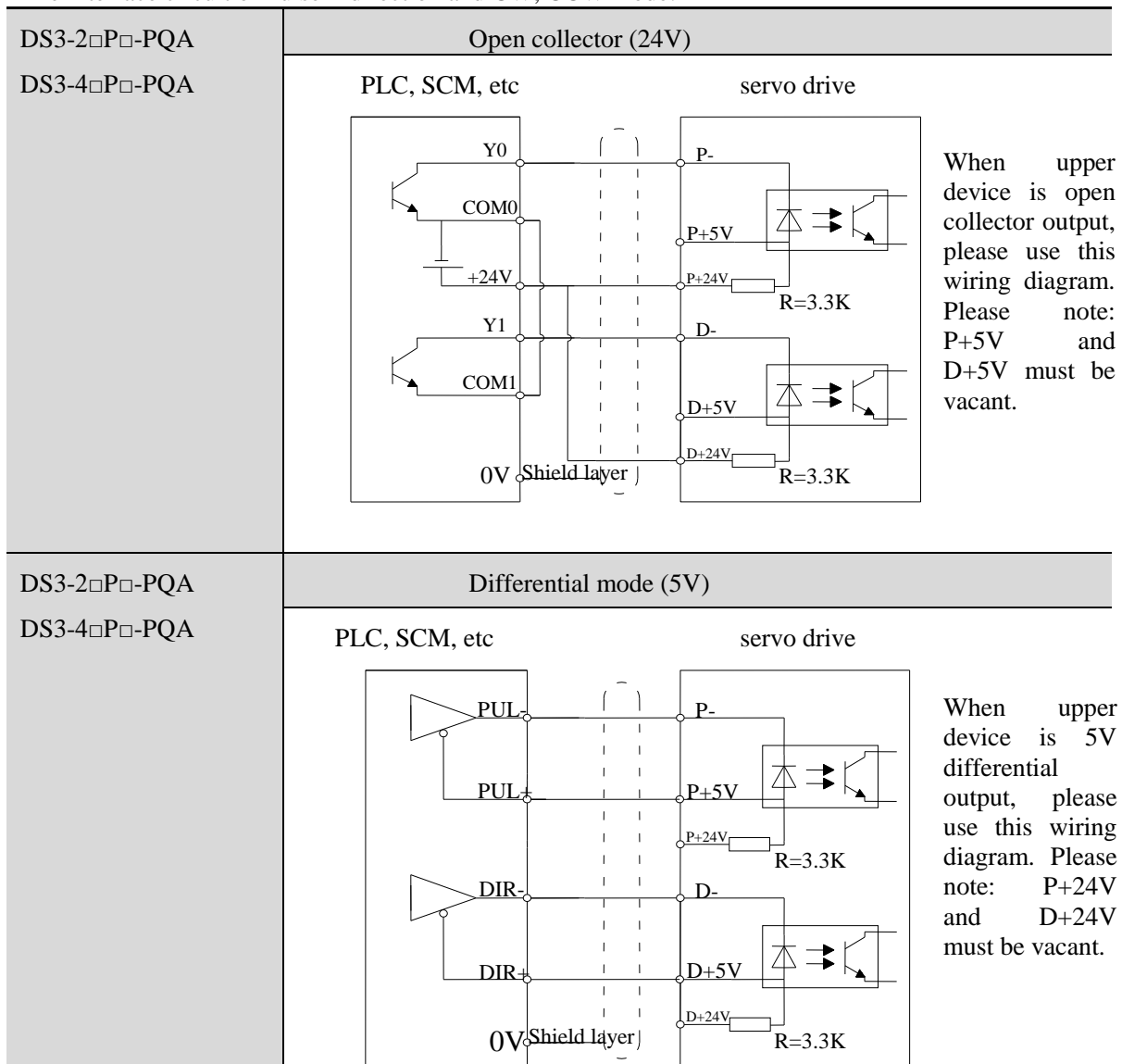
1. Support standard Modbus RTU protocol, it is used as Modbus slave device.
2. RS232 port and RS485 port cannot be used at the same time.

3-2. Signal terminals

3-2-1. Pulse signal

Command	Choice	Meaning	P-input signal	D-input signal	Chapter
P0-10 xxx□	0	CW, CCW double pulse mode	CW	CCW	5-3-2
	1	AB phase mode	A phase	B phase	
	2	Pulse + direction mode	Pulse	Direction	
Collector open circuit (24V) input positive signal: P+24V/D+24V Differential mode (5V) input positive signal: P+5V/D+5V					

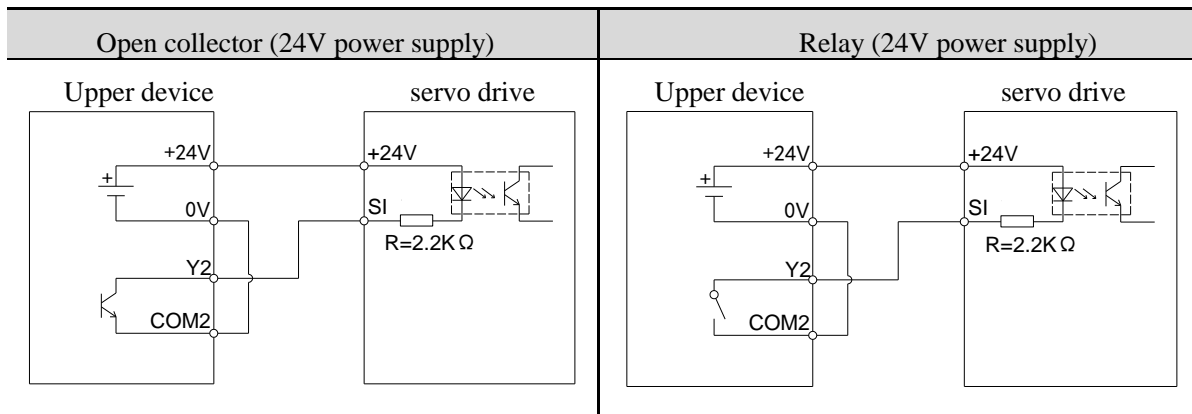
The interface circuit of Pulse + direction and CW, CCW mode:



3-2-2. SI input signal

Please use relay or open collector transistor to connect. When using relay, please choose micro-current relay. Otherwise, the contact will be not good.

Type	Input terminal	Function	Reference chapter
Digital input	SI1~SI5	Multi-functional input	5-12-1

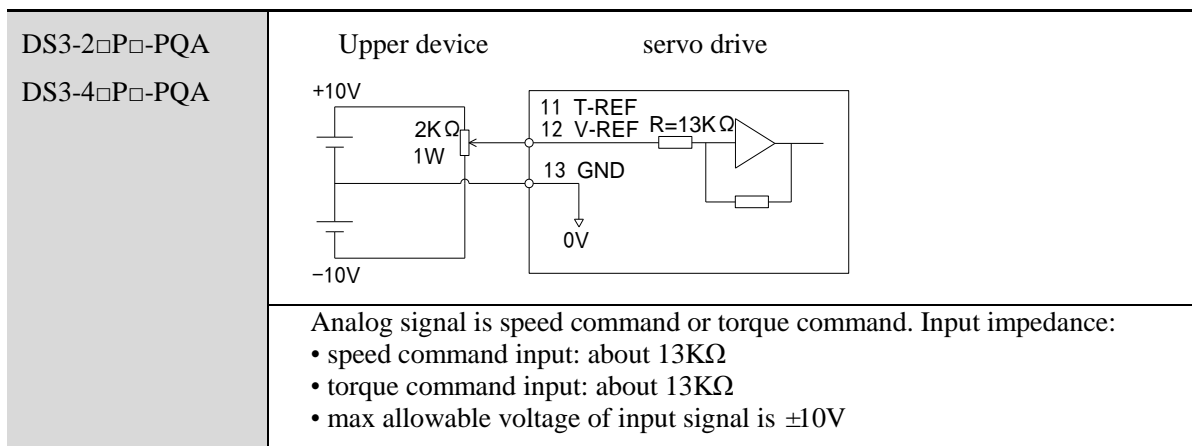


Note: the max allowable voltage and current of open collector output circuit:

Voltage: max DC30V

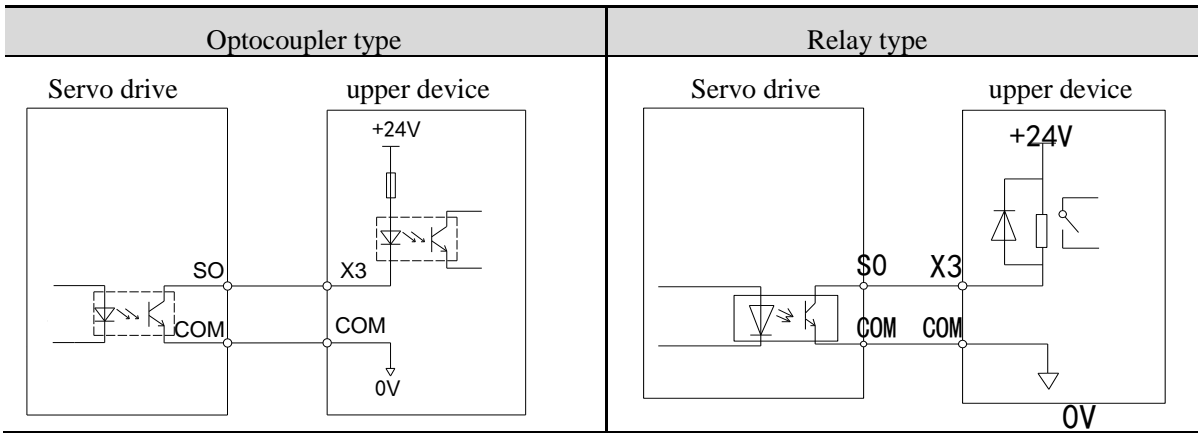
Current: max DC50mA

3-2-3. Analog input circuit



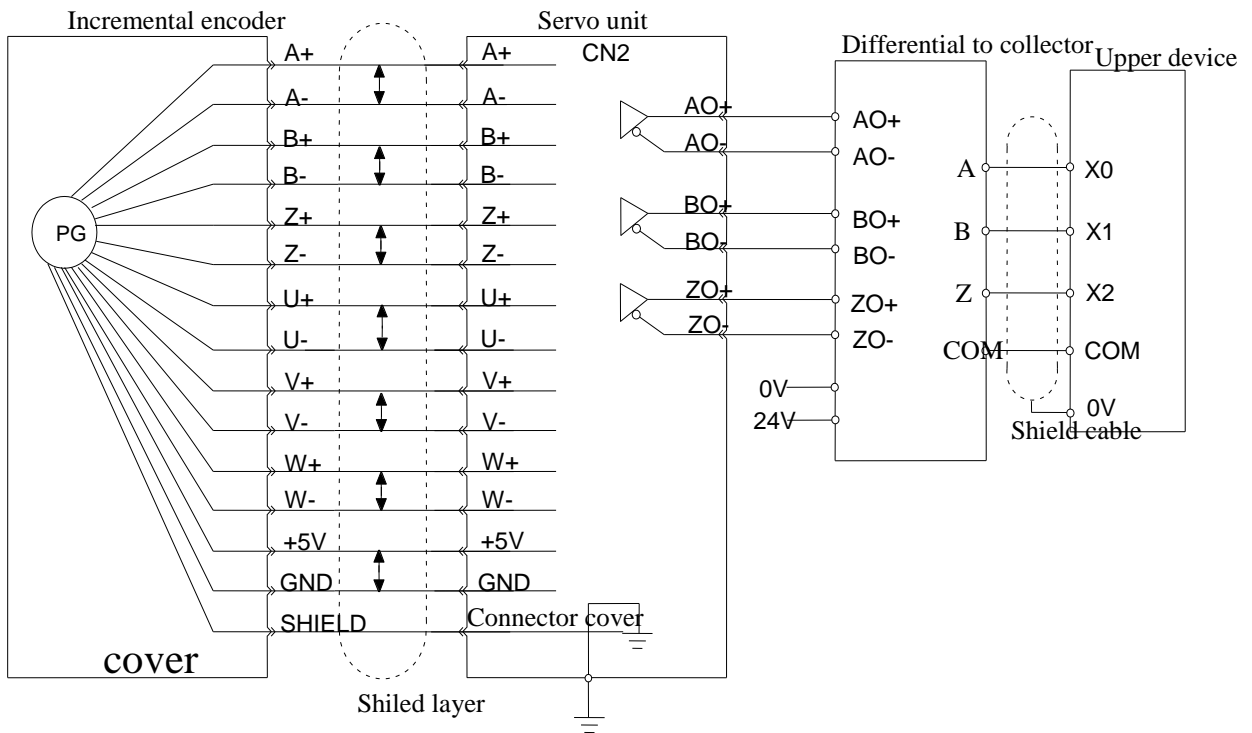
3-2-4. Output signal

Type	Output terminal	Function	Reference chapter
Optocoupler output	SO1~SO3	Multi-functional output terminal	5-12-3



Note: SO output max allowable load current is 400mA.

3-2-5. Encoder feedback signal

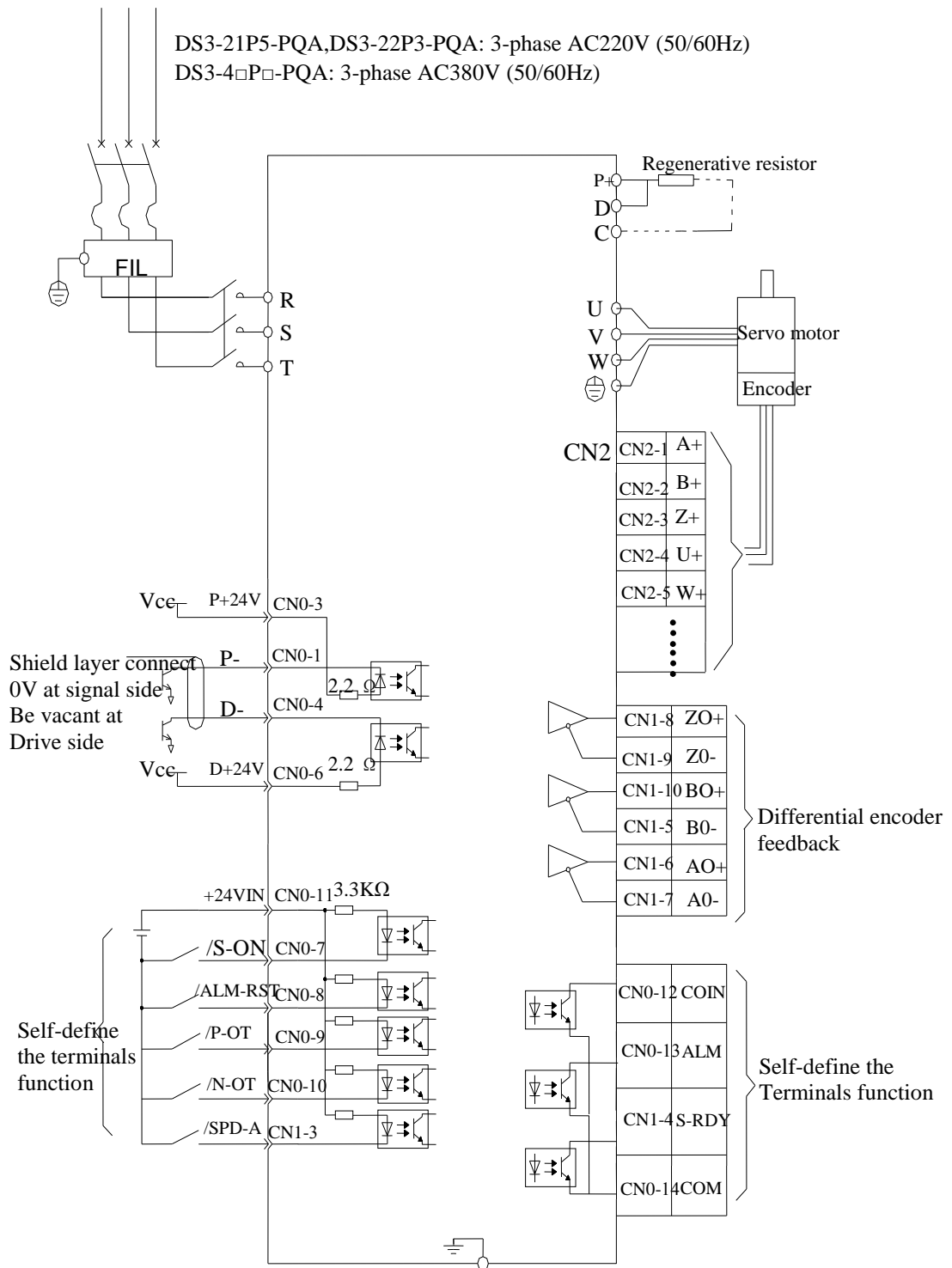


3-3. Standard wiring example

For the following wiring diagram, the input and output terminal function is out of factory settings. The setting can be changed, please see chapter 5-12.

3-3-1. Position Control Mode

- DS3-21P5-PQA



3-4. Regenerative Resistor

When the servo motor operates in generator mode, power is returned to the servo drive side. This is called regenerative power. The regenerative power is absorbed by charging the smoothing capacitor, but when the capacitor's charging limit is exceeded, the regenerative power needs to be reduced by the regenerative resistor.

The servomotor is driven in regeneration (generator) mode in the following conditions:

- From decelerating to stop for acceleration/deceleration operation.
- Move down on the vertical axis.
- The external load drives the motor running

Servo drive	Regenerative resistor connection terminals
DS3-2□P□-PQA DS3-4□P□-PQA	for internal regenerative resistor: short P+ and D, disconnect P+ and C, P0-24=0. for external regenerative resistor: connect resistor between P+ and C, disconnect P+ and D, P0-24=1, P0-25=power value, P0-26=resistor value.

Parameter	Signal name	Setting	Meaning	Effective	Modify
P0-24	Choose regenerative resistor	0	Use internal regenerative resistor	At once	Servo OFF
		1	Use external regenerative resistor (resistor type please refer to the following table)		

Parameter	Signal name	Setting	Unit	Effective
P0-25	Discharge resistor power	1. self-cooling mode (natural convection cooling): below 20% of regenerative resistor capacity (W) 2. forced air cooling: below 50% of regenerative resistor capacity (W)	W	At once
P0-26	Discharge resistor value	Resistor value	Ω	At once

The type of regenerative resistor:

Servo drive type	External regenerative resistor (recommend value)	External regenerative resistor (recommend value)
DS3-20P2-PQA	15Ω—50Ω	200W and above
DS3-20P4-PQA	15Ω—50Ω	500W and above
DS3-20P7-PQA	15Ω—50Ω	500W and above
DS3-21P5-PQA	15Ω—40Ω	1000W and above
DS3-22P3-PQA	15Ω—40Ω	1000W and above
DS3-41P5-PQA	25Ω—40Ω	1000W and above
DS3-43P0-PQA	25Ω—40Ω	1000W and above
DS3-45P5-PQA	20Ω	1000W and above
DS3-47P5-PQA	20Ω	1000W and above



1. The temperature will be very high when the regenerative resistor is discharging, please using heat-resistant non-flammable wire. Don't touch the regenerative resistor when wiring.

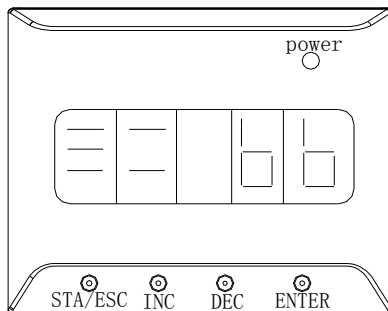
2. When you choose the regenerative resistor, please make the resistor value close to the min value of recommend value. The resistor power is decided by the actual condition specially the heat.

4 Use the operate panel

4-1. Basic Operation

4-1-1. Functions of operate panel

- 5-bit LED: Displaying parameter settings, status or alarm.
- Power LED POWER: The LED is on when the servo drive is powered on.



Key Name	Function
STATUS/ESC	Press: Status switch, status return
INC	Press: Increase the value; Press and hold: Increase the value continuously
DEC	Press: Decrease the value; Press and hold: Decrease the value continuously
ENTER	Press: Shift the editing digit; Press and hold: Enter a status, Enter

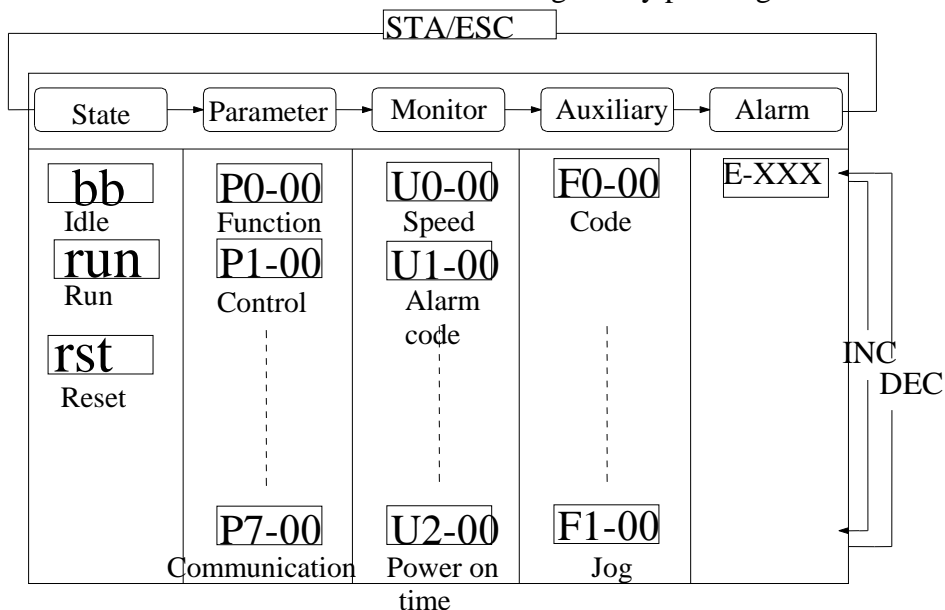


the operate panel will self-check after power, all the LED will light for 1s.

4-1-2. Basic Mode Switching

The operate panel can display the status, set parameter and run the command by switching the basic mode.

The running status, auxiliary function, parameter setting, and monitoring are the basic modes. The modes switch as the below diagram by pressing STATUS/ESC.

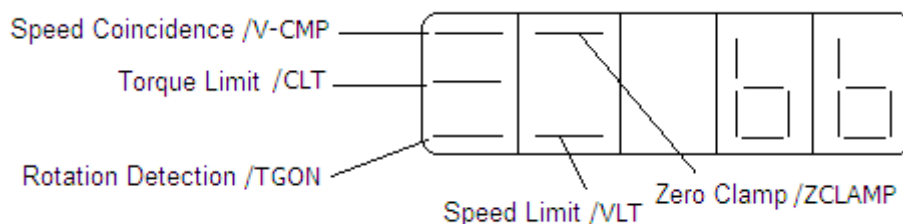


Display mode:

- Monitor Function UX—XX: The first X means group No., the last two X means the member No. in the group.
- Auxiliary Function FX—XX: The first X means group No., the last two X means the member No. in the group.
- Parameter Setting PX—XX: The first X means group No., the last two X means the member No. in the group.
- Alarm E—XXX: XXX means the alarm code.
- State: bb means the servo is in idle state; run means the servo is in running state.

4-2. Running status mode

➤ Speed and Torque Control Mode



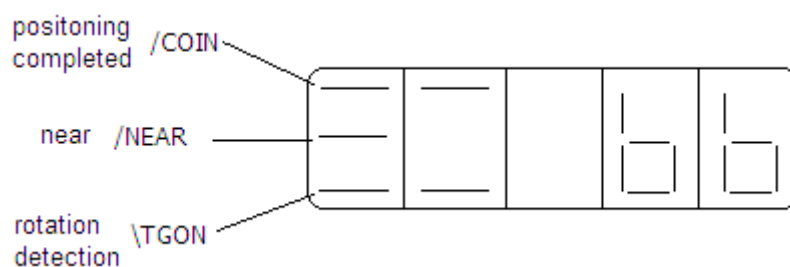
A. Bit contents:

Bit Data	Description
P5-39 Speed Coincidence (/V-CMP)	Light when the motor actual speed and command speed is the same. Speed coincidence signal checking width: P5-04 (unit: rpm)
P5-42 Torque Limit (/CLT)	Light when actual torque exceeds preset value. Forward Torque Limit: P3-28 Reverse Torque Limit: P3-29
P5-40 Rotation Detection (/TGON)	Light when the motor speed exceeds the rotation detection speed. Rotation Detection Speed Level: P5-03 (Unit: rpm)
P5-31 Zero Clamp (/ZCLAMP)	Light when zero clamp signal is ON.
P5-43 Speed Limit (/VLT)	Light when actual speed exceeds preset value. Forward speed limit during Torque Control: P3-16, reverse speed limit: P3-17

B. The code contents:

Code	Description
	Standby Servo OFF (motor power OFF)
	Run Servo ON (motor power ON)
	Reset Servo re-power
	Forward Run Prohibited P-OT ON. Please refer to 5-2-4 “Overtravel Limit”
	Reverse Run Prohibited N-OT ON. Please refer to 5-2-4 “Overtravel Limit”

➤ Position Control Mode



A. The bit contents:

Bit Data	Description
P5-38 Positioning Completed (/COIN)	Light when set position and actual position is the same. Positioning accomplishment width: P5-00 (unit: command pulse)
P5-36 Near (/NEAR)	Light when set position and actual position is the same. Near signal width: P5-06
P5-40 Rotation Detection (/TGON)	Light when the motor speed exceeds the rotation detection speed. Rotation detection speed: P5-03 (unit: rpm)

B. The code contents:

Code	Description
	Standby Servo OFF (motor power OFF)
	Run Servo ON (motor power ON)
	Reset Servo re-power
	Forward Run Prohibited P-OT ON. Please refer to 5-2-4 “Overtravel Limit”
	Reverse Run Prohibited N-OT ON. Please refer to 5-2-4 “Overtravel Limit”

4-3. Monitoring Mode

U0-XX

Number	Monitor Display	Unit
U0-00	Actual speed of motor	Rpm
U0-01	Input speed command	Rpm
U0-02	Torque command	% of rated
U0-03	Rotate angle (mechanism angle)	0.1 °
U0-04	Rotate angle (electrical angle)	0.1 °
U0-05	Bus voltage	V
U0-06	IPM temperature	0.1°C
U0-07	Torque feedback	% of rated
U0-08	Pulse offset value	(0000~9999)*1
U0-09		(0000~65535)*10000
U0-10	Encoder feedback value	(0000~9999)*1
U0-11		(0000~65535)*10000
U0-12	Pulse value of input command	(0000~9999)*1
U0-13		(0000~65535)*10000
U0-14	Position feedback	(0000~9999)*1
U0-15		(0000~65535)*10000

U0-16	Encoder position	(0000~9999)*1	encoder pulse
U0-17	(Accumulated)	(0000~65535)*10000	
U0-18	Current, 2-bit decimal/torque current		0.1A
U0-19	Analog input V-REF		0.01V
U0-20	Analog input T-REF		0.01V
U0-21	Input signal status 1		
U0-22	Input signal status 2		
U0-23	Output signal status 1		
U0-24	Output signal status 2		
U0-25	Input pulse frequency	(0000~9999)*1	Hz
U0-26		(0000~9999)*10000	
U0-27	U-phase current sampling zero value related to current value		0.01A
U0-28	V-phase current sampling zero value related to current value		0.01A
U0-29	W-phase current sampling zero value related to current value		0.01A
U0-30	VREF input analog zero value related to digital value		0~4095
U0-31	TREF input analog zero value related to digital value		0~4095
U0-32	Electric zero	(0000~9999)*1	
U0-33		(0000~9999)*10000	
U0-34	Output excitation voltage		% of bus voltage
U0-35	Output torque voltage		% of bus voltage
U0-36	Excitation current (change around 0)		0.01A
U0-37	VREF sampling value		0~4095
U0-38	TREF sampling value		0~4095
U0-39	Reserved		
U0-40	Reserved		
U0-41	Instantaneous output power		1W
U0-42	Average output power		1W
U0-43	Instantaneous thermal power		1W
U0-44	Average thermal power		1W
U0-45	Reserved		
U0-46	Reserved		
U0-47	Reserved		
U0-48	Reserved		
U0-49	Position feedforward		1 command unit
U0-50	Speed feedforward		rpm
U0-51	Torque feedforward		% of rated
U0-52	Instantaneous bus capacitor power		1W
U0-53	Average bus capacitor power		1W
U0-54	Reserved		
U0-55	Instantaneous regenerative braking discharge power		
U0-56	Average regenerative braking discharge power		

U1-XX:

Number	Contents	Unit
U1-00	Current alarm code	
U1-01	Current 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

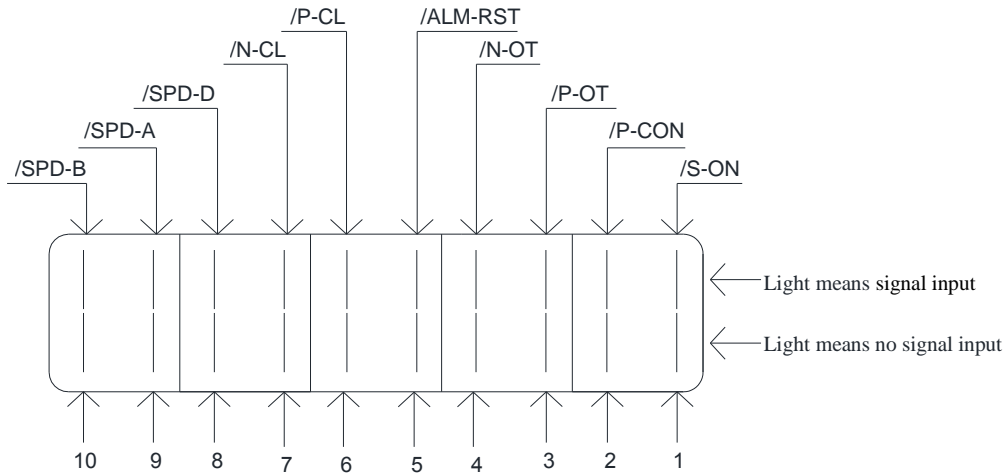
U1-05	IGBT temperature when alarming	0.1°C
U1-06	Q axis current (torque current) when alarming	0.1A
U1-07	Excitation current when alarming	A
U1-08	Position offset when alarming	Command pulse
U1-09	Speed value when alarming	rpm
U1-10	The alarm occurred time second (low 16 bits), count from power on	s
U1-11	The alarm occurred time second (high 16 bits), count from power on	s
U1-12	Run error times, count from power on	
U1-13	Warning times, count from power on	
U1-14	History alarm times	
U1-15	History warning times	
U1-16	The second time alarm code recently	
U1-17	The third time alarm code recently	
U1-18	The fourth time alarm code recently	
U1-19	The fifth time alarm code recently	
U1-20	The sixth time alarm code recently	
U1-21	The second time warning code recently	
U1-22	The third time warning code recently	
U1-23	The fourth time warning code recently	
U1-24	The fifth time warning code recently	
U1-25	The sixth time warning code recently	

U2-XX:

Number	Contents		Unit
U2-00	Power on times		
U2-01	Series (low 16 bits)		
U2-02	Series (high 16 bits)		
U2-03	Type		
U2-04	Out of factory date: year		
U2-05	Out of factory date: month		
U2-06	Out of factory date: day		
U2-07	Hardware version		
U2-08	Hardware version		
U2-09	Total run time (from the first time power on)		Hour
U2-10	Total run time (from the first time power on)		Minute
U2-11	Total run time (from the first time power on)		Second
U2-12	This time run time (from this time power on)		Hour
U2-13	This time run time (from this time power on)		Minute
U2-14	This time run time (from this time power on)		Second
U2-15	Average output power (count from the first time enable)		1W
U2-16	Average heating power (count from the first time enable)		1W
U2-17	Average bus capacitor filter power		1W
U2-18	Motor	accumulative (0000~9999)*1	circle
U2-19	circles	(0000~9999)*10000	circle
U2-20	Device serial number: low 16 bits		

U2-21	Device serial number: high 16 bits	
-------	------------------------------------	--

■ U0-21 input signal status

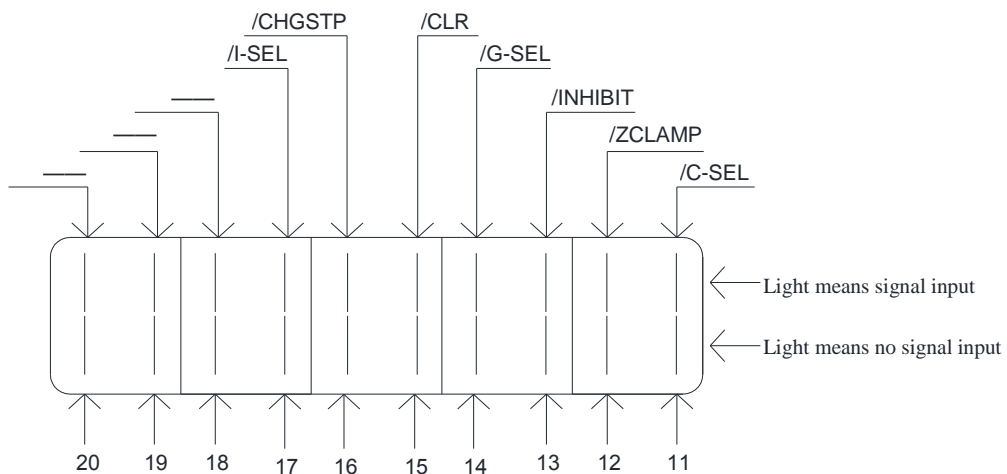


■ U0-21 input signal 1 assignment

Segment code	Explanation	Segment code	Explanation
1	/S-ON servo enable signal	2	/P-CON proportion action command
3	/P-OT forward run prohibited	4	/N-OT reverse run prohibited
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 set speed selection
9	/SPD-A internal set speed selection	10	/SPD-B internal set speed selection

Note: read the status through communication, the binary value from right to left are related to /S-ON, /P-CON. 0 means no input, 1 means has input. For 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

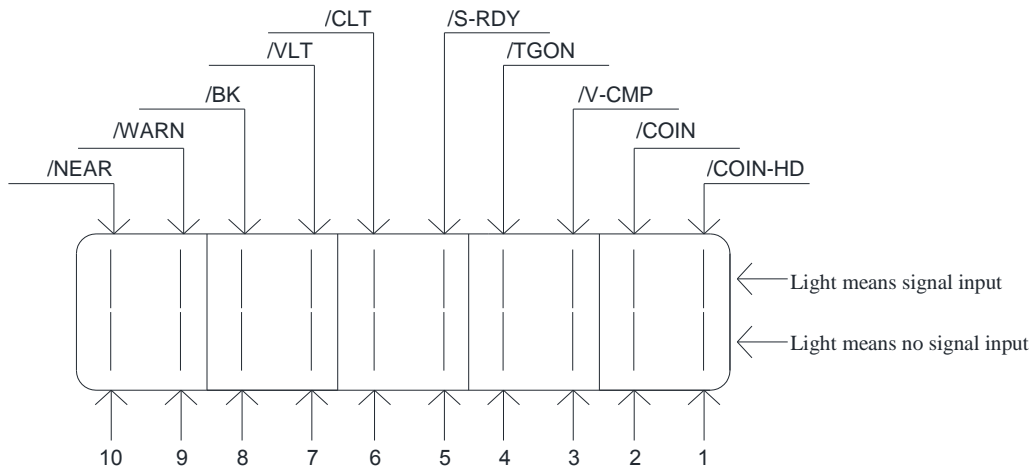
Segment code	Explanation	Segment code	Explanation
11	/C-SEL control mode	12	/ZCLAMP zero clamp
13	/INHIBIT command pulse prohibited	14	/G-SEL gain switch
15	/CLR pulse clear	16	/CHGSTP change step
17	/I-SEL inertia switch	18	—
19	—	20	—

Note: read the status through communication, the binary value from right to left are related to /C-SEL, /ZCLAMP. 0 means no input, 1 means has input. For example: 0x0001 means /C-SEL has input, 0x0041 means /C-SEL and /I-SEL has input.



“—“ is reserved bit, it is always 0.

■ U0-23 output signal status

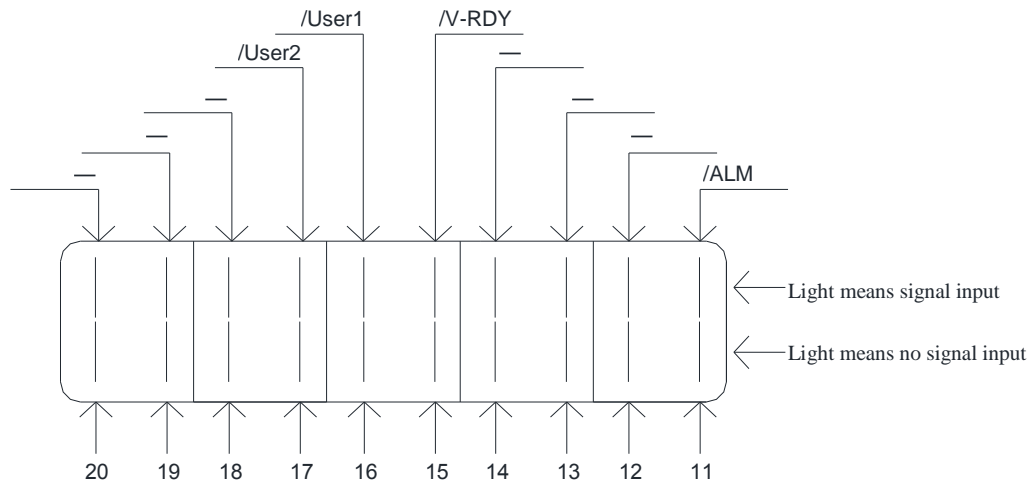


■ U0-23 output signal 1 assignment

Segment code	Explanation	Segment code	Explanation
1	Positioning complete maintain (/COIN_HD)	2	Positioning end (/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	Brake lock (/BK)
9	Warn (/WARN)	10	Output near (/NEAR)

Note: read the status through communication, the binary value from right to left are related to /COIN_HD, /COIN. 0 means no output, 1 means has output. For example: 0x0001 means /COIN_HD has output, 0x0201 means /COIN_HD and /NEAR has output.

■ U0-24 output signal status



■ U0-24 output signal 2 assignment

Segment code	Explanation	Segment code	Explanation
11	Alarm (/ALM)	12	—
13	—	14	—
15	Speed reach (/V-RDY)	16	Self-defined output 1
17	Self-defined output 2	18	—
19	—	20	—

Note: read the status through communication, the binary value from right to left are related to /ALM, “-“. 0 means no output, 1 means has output. For example: 0x0001 means /ALM has output, 0x0041 means /ALM and self-defined output 2 has output.



“—“ is reserved bit, it is always 0.

4-4. Auxiliary Function

Group No.	Content
F0-**	Clean the alarm, back to out of factory settings, clean the offset
F1-**	Jog run, test run, zero, enable

4-4-1. F0-XX

Function No.	Description
F0-00	Clean the alarm
F0-01	Back to out of factory settings
F0-02	Clean the offset

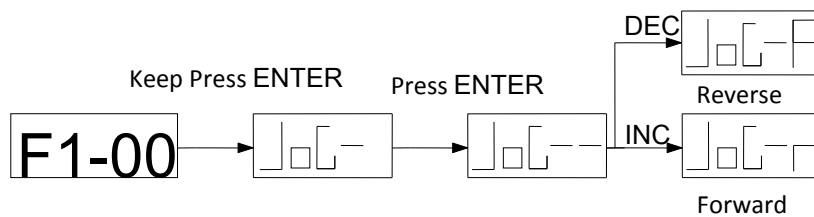
1. Clean the alarm
Set F0-00=1 to reset the alarm. When the alarm occurred, please find out the alarm reasons then clean the alarm.
2. Back to out of factory settings
Set F0-01=1, then press ENTER. No need to re-power the servo drive.
3. Clean the offset
Set F0-02=1 to clean the offset.

4-4-2. F1-XX

Function code	Explanation
F1-00	Jog run
F1-01	Test run
F1-02	Current sampling zero
F1-03	Vref zero
F1-04	Tref zero
F1-05	Software enable

1. Jog (F1-00)

Make sure that the motor shaft is not connected to the machine before jogging!



When the servo is in jog run mode, gain and other parameters will join the process. Please adjust the parameters according to the jog run status.

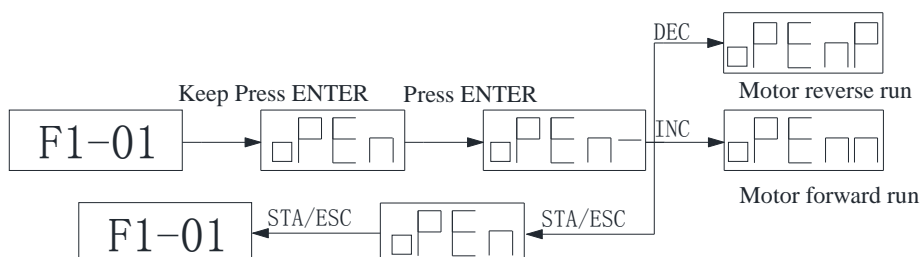
P3-18	JOG speed					
	Unit	Default	Setting range	Suitable mode	Change	Effective
	1Rpm	100	0~1000	JOG	Servo OFF	Immediately

2. Test run (F1-01)

Make sure that the motor shaft is not connected to the machine before test run!

When servo drive is connected with non-original encoder line or power line, test run must be run first to ensure that the encoder line or power line is connected correctly.

Test run can detect the connection of power line and encoder feedback. Please operate the servo as the following steps. If the motor shaft jitter or servo alarm, please cut off the power at once then check the wiring.



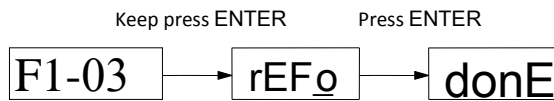
3. Current sampling zero (F1-02)

After the servo drive updated to latest software version, or the motor does not revolve smoothly for long time, the current offset auto-adjustment is recommended.



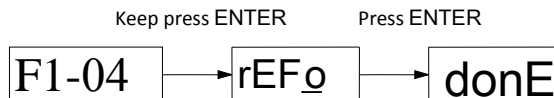
Press STATUS/ESC to exit.

4. Vref zero (F1-03)



Press STATUS/ESC key to exit.

5. Tref zero (F1-04)



Press STATUS/ESC key to exit.

6. Forced Servo enables (F1-05)

Parameter	Signal name	Set	Meaning	Modify	Effective
P0-03	Enable mode	0	Not enable	Servo OFF	At once
		1 (default)	I/O enable /S-ON		
		2	Software enable (F1-05 or communication)		
		3	Bus enable (the model support movement bus)		
P0-03=2 F1-05 = 0: cancel the enable, return to bb status. F1-05 = 1: forced enable, servo is in RUN status.					

4-5. Alarm (E-XXX)

The alarm code will show when there is error in the drive. Set F0-00=1 to reset the alarm.

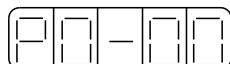
If the servo is OFF caused by alarm, it is no need to reset the alarm.

Note: please find out the alarm reason before reset the alarm.

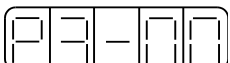
4-6. Example

The example below shows how to change parameter P3-09 from 2000 to 3000.

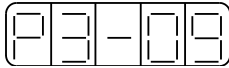
1. Press the STATUS/ESC key to select the parameter setting mode.



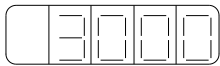
2. At this time the second LED is blinking, and press INC or DEC key to set the group No. to 3. Press ENTER key to confirm.



3. At this time the last LED is blinking, and press INC or DEC key to set the member No. to 9. Press and hold ENTER key to confirm.



4. At this time the panel displays the value in P3-09, and the last decimal “0” is blinking. Press ENTER to left shift the blinking decimal. Press INC, DEC or ENTER key to modify the value to 3000, and press and hold ENTER to confirm.



The parameter in P3-09 in changed from 2000 to 3000.

Repeat steps 2 to 4 to change the parameter again.

5. Press STATUS/ESC key to return.



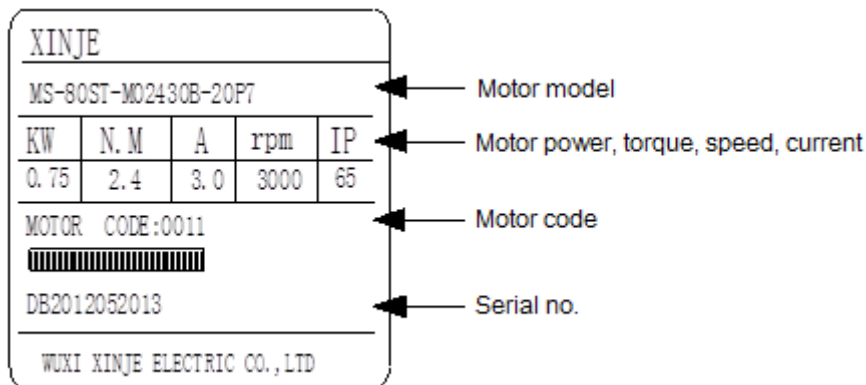
when the parameters are over the setting range, the drive will show E-021 alarm.

4-7. Change the motor code

One servo drive can match several servo motors with same power level. Before using the servo system, please make sure the motor code on the servo motor label is the same to P0-33.



Motor label



If the servo motor code set error, the servo will show E-310 alarm. Please clean the alarm through F0-00 then set the motor code again.

5 Run the servo system

5-1. Control mode selection

PQA servo mode 1 and 2 can be switched to each other via /C-SEL signal.

Parameter		Control mode	Reference
P0-01	1	Torque control (internal setting) Control the output torque of servo motor via operating panel or communication.	5-9
	2	Torque control (analog voltage command) Control the output torque of servo motor via analog voltage command. It is mostly used to close-loop torque control with upper device, such as tension control. (If servo drive doesn't have analog input port, it cannot use this mode.)	5-8
	3	Speed control (internal speed setting) Use /SPD-D, /SPD-A, /SPD-B to select the speed which is set in the servo drive. The servo drive can set 3 speeds.	5-6
	4	Speed control (analog voltage command) Control the speed of servo motor via analog voltage command. It is mostly used to close-loop speed control with upper device. (If servo drive doesn't have analog input port, it cannot use this mode.)	5-5
	5	Position control (internal position command) Control the position via internal position command; it can set pulse quantity and torque. Note: hardware version need v3.2.1 and higher	5-4
	6 (default setting)	Position control (external pulse command) Control the position of servo motor via pulse command. Control the position via pulse quantity; control the speed via pulse frequency.	5-3
	7	Speed control (pulse frequency command) Control the speed of servo motor via pulse frequency, but not control the position.	5-7
P0-02 mode2	Same to mode 1	The servo will enter mode 2 when /C-SEL signal is effective.	5-10

5-2. Basic function setting

Parameter	Name	Reference
P0-03	Enable mode	5-2-1
P5-20	Servo ON setting /S-ON	
P0-05	Switch the motor rotate direction	5-2-2
P0-27	Servo OFF stop mode	5-2-3
P0-28	Motor overtravel stop mode	
P0-29	Alarm stop mode	
P0-30	Stop time out time	
P3-32	Brake torque	
P5-22	Forward run ban /P-OT	5-2-4
P5-23	Reverse run ban /N-OT	
P5-44	Power loss brake /BK	5-2-5
P5-47	Alarm output /ALM	5-2-6

5-2-1. Servo ON setting

When servo ON signal is ineffective, the servo motor cannot run.

Parameter	Signal name	Setting	Meaning	Modify	Effective
P0-03	Enable mode	0	Not enable	Servo OFF	At once
		1 (default)	I/O enable /S-ON		
		2	Software enable (F1-05 or communication)		
		3	Bus enable (the model support bus movement)		

Parameter	Signal	Setting	Explanation	Range
P5-20	/S-ON	n.0001 (default value)	When S11 is ON, servo motor powers on and enables to run.	0001~0015
		n.0010	Always effective, no need to wiring.	

/S-ON signal can be set to other input via parameter P5-20.

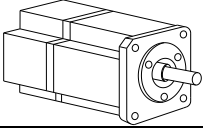
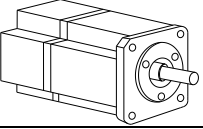
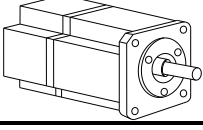
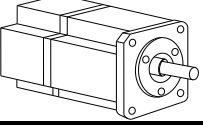


the input terminal assigned by function parameters cannot be duplicated. Please refer to chapter 5-12-1.

5-2-2. Switch the motor rotate direction

Change the motor rotate direction without changing the motor wiring. The standard forward rotate direction is “CCW rotate” look at the load side.

“Reverse mode” will change the motor rotate direction.

Mode	Forward rotate	Reverse rotate
Standard setting: CCW is forward rotate	 CCW	 CW
Reverse mode: CW is forward rotate	 CW	 CCW

■ Set the rotate direction

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

P0-05 is functional in mode 2, 4, 6, 7.

5-2-3. Stop mode

Set the stop mode when servo is OFF or alarm.

Parameter	Function	Setting value	Default value
P0-27	Servo OFF stop mode	0 or 2	0

P0-29	Alarm	0 or 2	0	
0: Inertia run stop, keep inertia movement after stop 2: deceleration stop, keep inertia movement after stop				
P0-30	Stop time out time			
	Unit	Default value	Range	Suitable mode
	1ms	2000	0~65535	All the modes
P3-32	Brake torque			
	Unit	Default value	Range	Suitable mode
	1% of rated torque	100	0~300	All the modes



- the stop mode is 0. the motor will inertia stop until the speed is less than P5-03 (rotate detection speed) then change to free stop when servo OFF or alarm. At the same time, the servo will count the inertia stop time. If the time is larger than P0-30 but the motor speed is not smaller than P5-03, servo will free stop and show stop time out alarm.
- the stop mode is 2. The motor will produce a brake torque P3-32 and deceleration stop until the speed is less than P5-03 then change to free stop when servo OFF or alarm. At the same time, servo will count the inertia stop time. If the time is larger than P0-30, but P5-03 is not smaller than P5-03, servo will free stop and show stop time out alarm.

Stop mode when overtravel

Parameter	Function	Range	Default value
P0-28	Motor stop mode when overtravel	0~3	2

P0-28	Meaning
0	Deceleration stop, the torque is 0 in overtravel direction after stop, receive command.
1	Inertia stop, the torque is 0 in overtravel direction after stop, receive command.
2	Deceleration stop, not receive command in overtravel direction after stop.
3	Alarm (E-260)

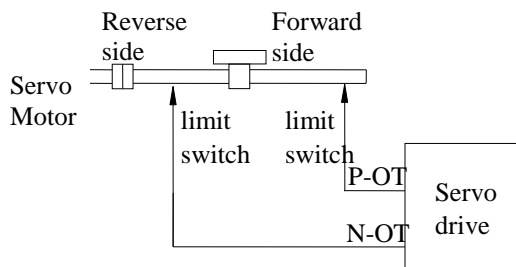


- The brake torque is P3-32 when deceleration stop and stop time out time is effective for overtravel process.
- there is position offset pulse when the motor stop by overtravel signal in position control mode. The position offset can be cleaned by inputting the signal /CLR. If the servo still can receive the pulse, the pulse will accumulate until the servo alarm.

5-2-4. Overtravel Limit (P-OT & N-OT)

(1) Use the overtravel signal

Please connect P-OT and N-OT to the limit switch. Make sure to wiring as the following diagram when linear driving to avoid machine damage.



(2) Set the overtravel signal

Parameter	Signal	Setting	Meaning	Modify
P5-22	/P-OT	n.0003 (default)	SI3=ON, prohibit the forward running	Range: 0000-0015

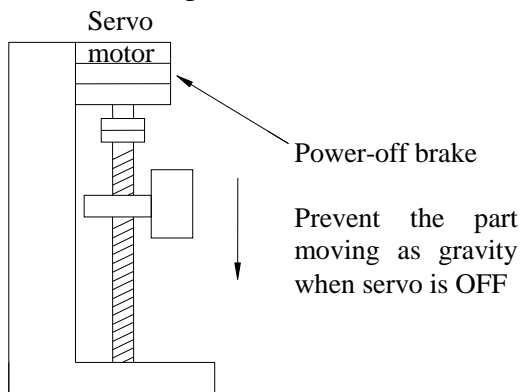
		n.0013	SI3=ON, allow the forward running	
P5-23	/N-OT	n.0004 (default)	SI4=ON, prohibit the reverse running	Range: 0000-0015
		n.0014	SI4=ON, allow the reverse running	

Note:

1. /P-OT, /N-OT can be changed to other terminal input via parameter P5-22 and P5-23.
2. The input terminals function cannot be the same. Please refer to chapter 5-12-1.

5-2-5. Power-off Brake (BK)

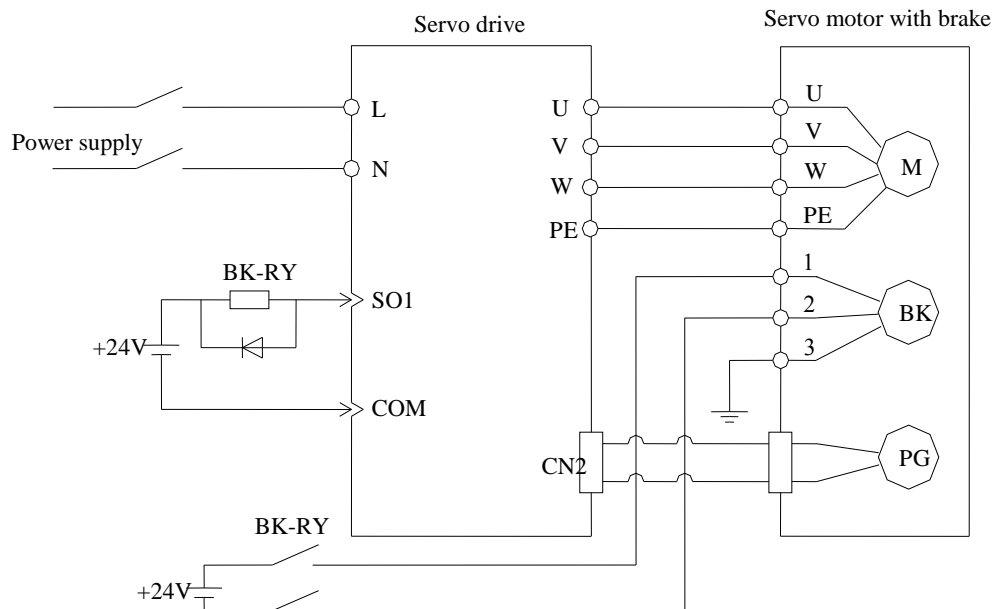
It is used when servo drive controls the vertical shaft. The function of power-off brake is the moveable part will not shift when servo is OFF.



The brake built into the MS series servo motor with brakes is a de-energization brake, which is used only to hold and cannot be used for braking.

1. Wiring Example

The ON/OFF circuit of brake includes sequence output signal /BK and brake power. The following diagram shows a standard wiring example.



Note: (1) the working voltage of brake is DC 24V.

(2) In the above diagram, BK signal output from SO1, please set P5-44 to n.0011.

2. Brake signal

Parameter	Signal	Type	Default	Explanation	Modify
P5-44	/BK	Output	n.0000	Need to distribute	Range 0000-0013
/BK signal can output from output terminal via setting parameter P5-44.					

When set P5-44=0011, it means output from SO1 terminal.

3. The switch time between BK signal and SON signal

If the machine moves slightly due to gravity because of the brake has action delay time. Please adjust the time as below parameter.

P5-07	Servo OFF delay time (brake command)					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1ms	0	0~65535	All the modes	Servo OFF	Immediately

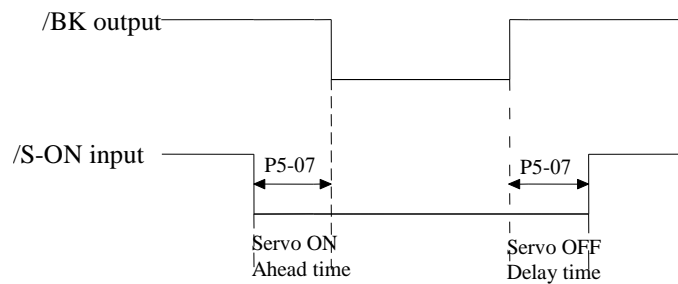
P5-07 Meaning: delay the time P5-07 to release the brake when the enable is ON. When the enable is OFF and the signal is true, lock the brake and delay the time P5-07 then close the enable.



this setting is rotation detection TGON invalid time when motor stop.

The following diagram is the brake control output signal /BK and servo SON signal act time when using the servo motor with brake.

Before outputting /BK to release the brake, servo already power on; after not output /BK and brake is ON, servo is OFF.



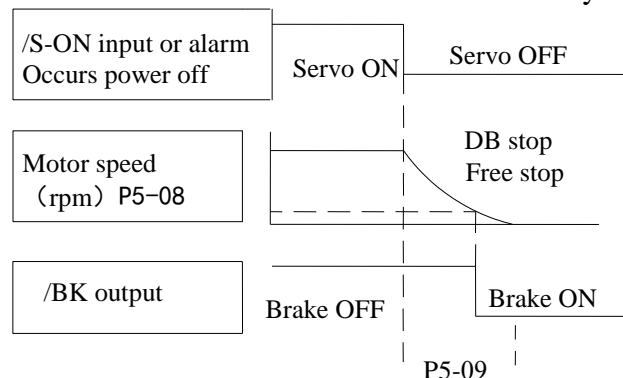
4. Brake ON parameter (When servo motor is rotating)

The motor will power OFF when alarm occurs. The machine will move as gravity until the brake action.

Set below parameters in order to use brake when motor speed decreases to setting value or waiting time ends.

P5-08	Brake command output speed					
	Unit	Default	Range	Suitable mode	Modify	Effective
	rpm	30	0~10000	All the modes	Any	Immediately
P5-09	Brake command waiting time					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1ms	500	0~1000	All the modes	Servo OFF	Immediately

Set the brake time when servo OFF caused by /S-ON signal or alarm.



The brake is used to protect the position. The brake must be effective at suitable time

when servo motor stop. Users can adjust the parameters according to the machine action.

The /BK signal from ON to OFF under either of the following conditions:

1. Motor speed drops below the value of P5-08 after servo OFF.
2. over the time of P5-09 after servo OFF.

5-2-6. Alarm output

Parameter	Signal	Default	Meaning	Modify
P5-47	Alarm output	n.0002 (default)	SO2 and COM pass through when servo alarm, output the alarm signal	Range: 0000-0013 Distribute the signal to output terminal through P5-47. P5-47=0001, it outputs from SO1.
		n.0012	SO2 and COM cut off when servo alarm	



- (1) Servo unit is forced OFF when alarm. The motor will move with external force. If the motor needs to hold the position, please choose motor with power loss brake and use /BK signal. Please refer to chapter 5-2-5.
- (2) The output terminals distributed by function parameters cannot be same. Please refer to chapter 5-12-3.

5-3. Position mode (external pulse command)

Parameter		
Parameter	Name	Reference chapter
P0-01	Control mode selection	5-3-1
P0-09	Pulse command positive direction	5-3-2
P0-10	Pulse command form	
P0-11	Motor pulse per rotation*1	5-3-3
P0-12	Motor pulse per rotation*10000	
P0-13	Electronic gear ratio (numerator)	
P0-14	Electronic gear ratio (denominator)	
P5-20	Servo ON signal /S-ON	5-2-1

Other available parameters			
Key word	Parameter	Name	Reference
Command filter	P1-24	Position command filter type	5-3-4
	P1-25	Position command filter time constant	
Clean offset pulse	P5-34	Clean the offset pulse /CLR	5-3-5
Positioning finish	P5-00	Positioning finish width	5-3-6
	P5-01	Positioning finish detection mode	
	P5-02	Positioning finish hold time	
	P5-37	Positioning finish hold /COIN-HD	
	P5-38	Positioning finish signal output /COIN	
Positioning near	P5-46	Positioning near signal output /NEAR	5-3-7
	P5-06	Positioning near signal output width	
Prohibit Pulse	P5-32	Command pulse prohibit /INHIBIT	5-3-8
Offset pulse	P0-23	Pulse offset limit value	5-3-9

limit value			
-------------	--	--	--

5-3-1. External position mode

Parameter	Setting value	Meaning	Modify	Effective
P0-01	6	Position control (external pulse)	Servo OFF	Immediately
Function: control the position by the external pulse command				

5-3-2. Pulse command and pulse form

1. Pulse command direction

P0-09	Pulse command positive direction					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	—	0	0~1	6, 7	Servo OFF	At once
P0-09 will change the count direction of servo which control the motor rotation direction. If motor rotation direction is not same to expected direction in position mode, please set this parameter.						

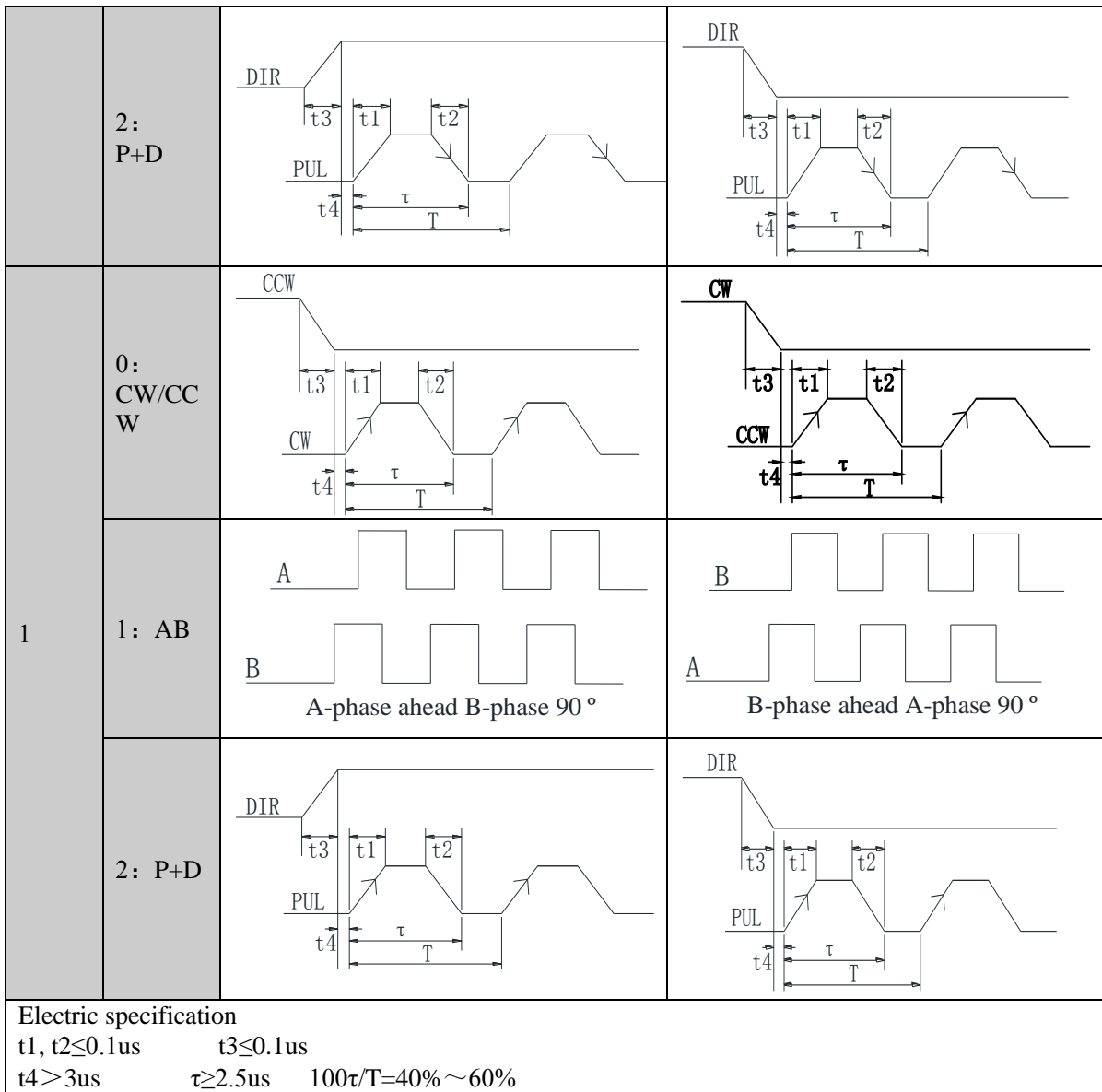
2. Pulse command form selectoin

Parameter	Set value	Command form	Suitable mode	Change	Effective
P0-10 xxx□	0	CW, CCW mode	6, 7	Servo OFF	At once
	1	AB phase			
	2	Pulse + direction (default)			

Parameter	Set value	Command form	Suitable mode	Change	Effective
P0-10 xx□x	0	Pulse signal falling edge effective (default)	6, 7	Servo OFF	At once
	1	Pulse signal rising edge effective			

3. Command pulse explanation

P0-10 xx□x	P0-10 xxx□	Forward run	Reverse run
0	0: CW/CCW		
	1: AB	<p>A-phase ahead B-phase 90°</p>	<p>B-phase ahead A-phase 90°</p>



5-3-3. Electronic gear ratio

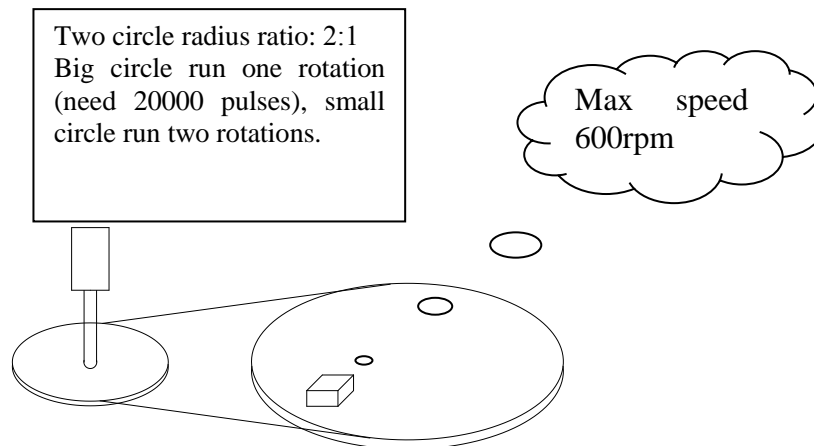
P0-11	Pulse per rotation $\times 1$					
	Unit	Default value	Range	Suitable mode	Change	Effective
	p	0	0~9999	6	Any	At once
P0-12	Pulse per rotation $\times 10000$					
	Unit	Default value	Range	Suitable mode	Change	Effective
	P	1	0~65535	6	Any	At once
P0-13	Electronic gear ratio (numerator)					
	Unit	Default value	Range	Suitable mode	Change	Effective
	—	1	0~65535	6	Any	At once
P0-14	Electronic gear ratio (denominator)					
	Unit	Default value	Range	Suitable mode	Change	Effective
	—	1	1~65535	6	Any	At once
<p>Note: P0-11~P0-14 are parameters about electronic gear ratio. P0-11 and P0-12 are a group, P0-13 and P0-14 are a group. The priority of P0-11 and P0-12 is higher than P0-13 and P0-14. P0-13 and P0-14</p>						

are effective when P0-11 and P0-12 are zero.

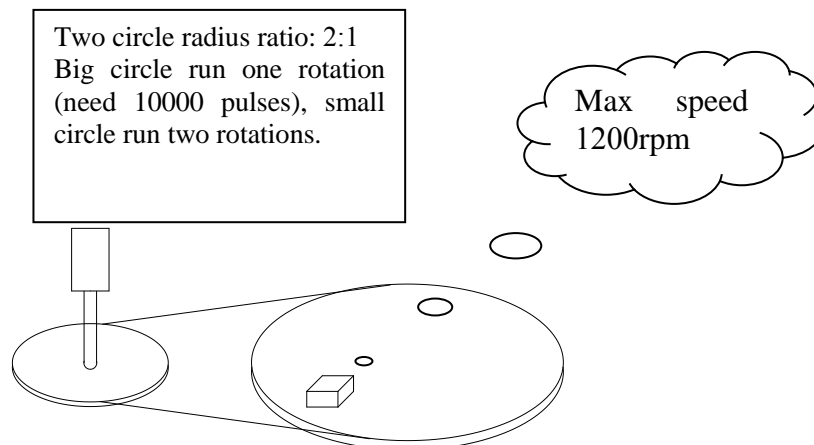
The electronic gear ratio functions:

1. Set the command pulse per rotation to ensure the motor speed meet the requirements. For example, the PLC max output pulse frequency is 200KHz. If the electronic gear ratio is not changed, motor needs 10000 pulses per rotation, the motor max speed is 1200rpm. If the electronic gear ratio is 2:1 or the pulses per rotation is 5000, the motor speed can up to 2400rpm.

Example: electronic gear ratio is 1:1 or pulses per rotation is 10000, PLC max output pulse frequency is 200KHz.

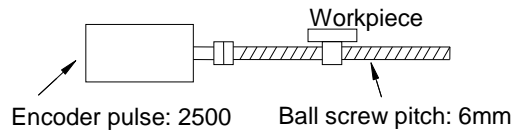


Electronic gear ratio is 2:1 or pulses per rotation is 5000, PLC max output pulse frequency is 200KHz.



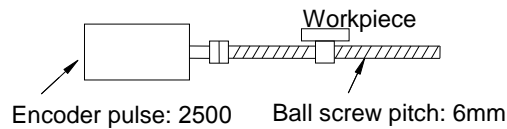
2. Set the actual length per command pulse for precise positioning. For example: the object moves 1um per command pulse. The command pulses of load rotating one circle = 6mm / 1um = 6000. In the case of deceleration ratio is 1:1, set pulse per rotation P0-11=6000, P0-12=0. Then if the PLC outputs 6000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

Not use electronic gear ratio



1 rotation is 10000 pulses
 Workpiece moves 6mm per rotation, so the length per pulse is $6\text{mm}/10000 = 0.6\mu\text{m}$.
 The workpiece moves 10mm, so it needs $10\text{mm}/0.6\mu\text{m} = 16666.6666$ pulses. The decimal will be discarded for actual pulse sending.

Use electronic gear



After setting electronic gear ratio, 1 rotation is 6000 pulses
 Workpiece moves 6mm per rotation, so the length per pulse is $6\text{mm}/6000 = 1\mu\text{m}$.
 The workpiece moves 10mm, it needs $10\text{mm}/1\mu\text{m} = 10000$ pulses. It will not produce decimal and error.

Calculate the electronic gear ratio (B/A) using the following steps:

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

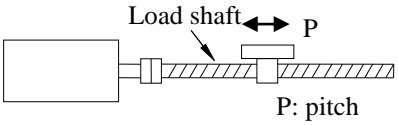
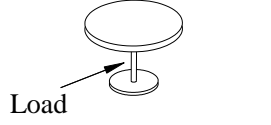
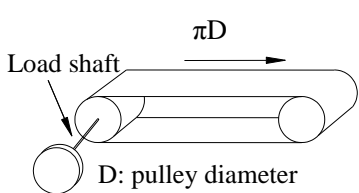
Note:

1. Pulses per rotation and electronic gear ratio can limit the command pulses of motor rotate 1 circle. The priority of pulses per rotation is higher than electronic gear ratio. Only when pulses per rotation is 0, the electronic gear ratio will be effective. If the pulses per rotation is fractional, it is better to use electronic gear ratio.
2. When P0-13 and P0-14 is over the range, please use the integer in the range from the reduction of the decimal number.
3. The motor encoder accuracy is 2500P/R.
4. The command unit is not machine accuracy. Refine the command unit based on machine accuracy can improve the servo positioning precision. For example: in the application of screw, the machine precision can up to 0.01mm, so the command unit 0.01mm is more

accurate than 0.1mm.

2. Example of setting the electronic gear

The example for different loads:

Step	Ball screw	Round table	Belt + pulley
	 <p>P: pitch</p> $l_{\text{rotate}} = \frac{P}{\text{command unit}}$	 <p>Load shaft</p> $l_{\text{rotate}} = \frac{360^\circ}{\text{command unit}}$	 <p>πD</p> <p>D: pulley diameter</p> $l_{\text{rotate}} = \frac{\pi D}{\text{command unit}}$
1	Ball screw pitch: 6mm Machine deceleration ratio: 1/1	1-circle rotate angle: 360° Deceleration ratio: 3/1	Pulley diameter: 100mm Deceleration ratio: 2/1
2	2500P/R	2500P/R	2500P/R
3	1 command unit: 0.001mm	1 command unit: 0.1°	1 command unit: 0.02mm
4	$6\text{mm}/0.001\text{mm} = 6000$	$360/0.1 = 3600$	$314\text{mm}/0.02\text{mm} = 15700$
5	$\frac{B}{A} = \frac{2500 \times 4}{6000} \times \frac{1}{1}$	$\frac{B}{A} = \frac{2500 \times 4}{3600} \times \frac{3}{1}$	$\frac{B}{A} = \frac{2500 \times 4}{15700} \times \frac{2}{1}$
6	P0-13=10000 P0-14=6000 Reduction of the fraction P0-13=5 P0-14=3	P0-13=30000 P0-14=3600 Reduction of the fraction P0-13=25 P0-14=3	P0-13=20000 P0-14=15700 Reduction of the fraction P0-13=25 P0-14=3

5-3-4. Position command filter

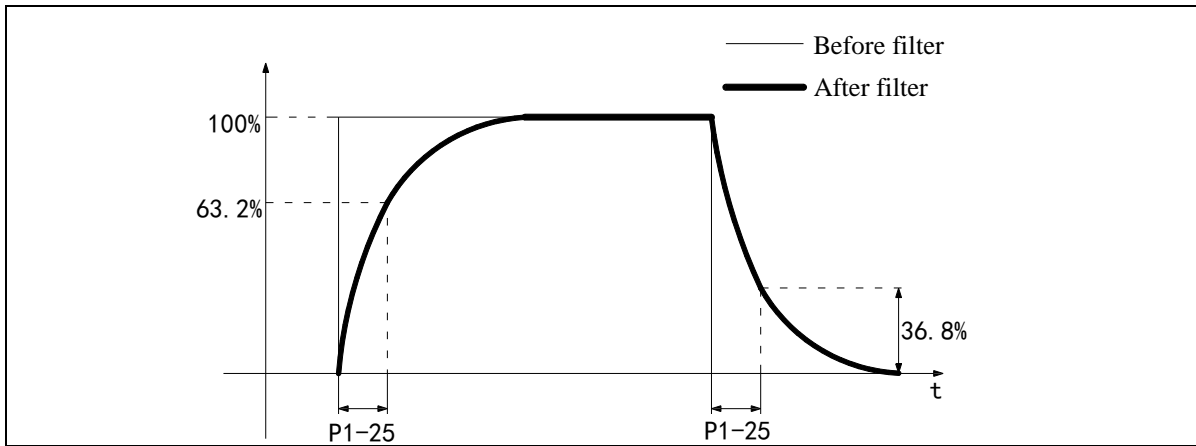
P1-24	Position command filter					
	Default value	Range	Suitable mode	Meaning	Change	Effective
	0	0	6	Filter certain frequency command pulse	Servo OFF	At once

P1-24 setting	Contents
0	First-order inertia filter

Filter time: filter time constant or set as the following parameter

P1-25	Position command filter time					
	Unit	Default	Range	Suitable mode	Change	Effective
	0.1ms	0	0~65535	6	Any	At once

First-order inertia filter diagram:



5-3-5. Pulse deviation clear (/CLR)

Pulse deviation: the difference between command pulse of controller (such as PLC) and feedback pulse of servo in position mode. Its unit is 1 reference unit; it is related to the command unit of electronic gear ratio.

Parameter	Signal	Default	Meaning	Modify
P5-34	/CLR	n.0000	Need distribution	Range: 0000-0015. Distribute to output terminal through P5-34. When it set to 0001, output the signal from S11.



The input terminal distributed by function parameter cannot be same. Please refer to chapter 5-12-1.

5-3-6. Positioning complete (/COIN, /COIN_HD)

Use the signal when the controller needs to confirm the completion of positioning.

Parameter	Signal	Type	Default setting	Meaning	Change
P5-37	/COIN-HD	Output	n.0000	After COIN signal keeps the time of P5-02, output COIN-HD	Range 0000-0013, distribute to output terminal through P5-37. When set P5-37=0001, it means output signal from SO1.

Parameter	Signal	Default	Meaning	Modify
P5-28	/COIN	n.0001	Output positioning complete signal from SO1	Range: 0000-0013, distribute to output terminal through P5-28. When it set to 0002, it means output from SO2.
		n.0011	SO1 and COM cut off when positioning complete	



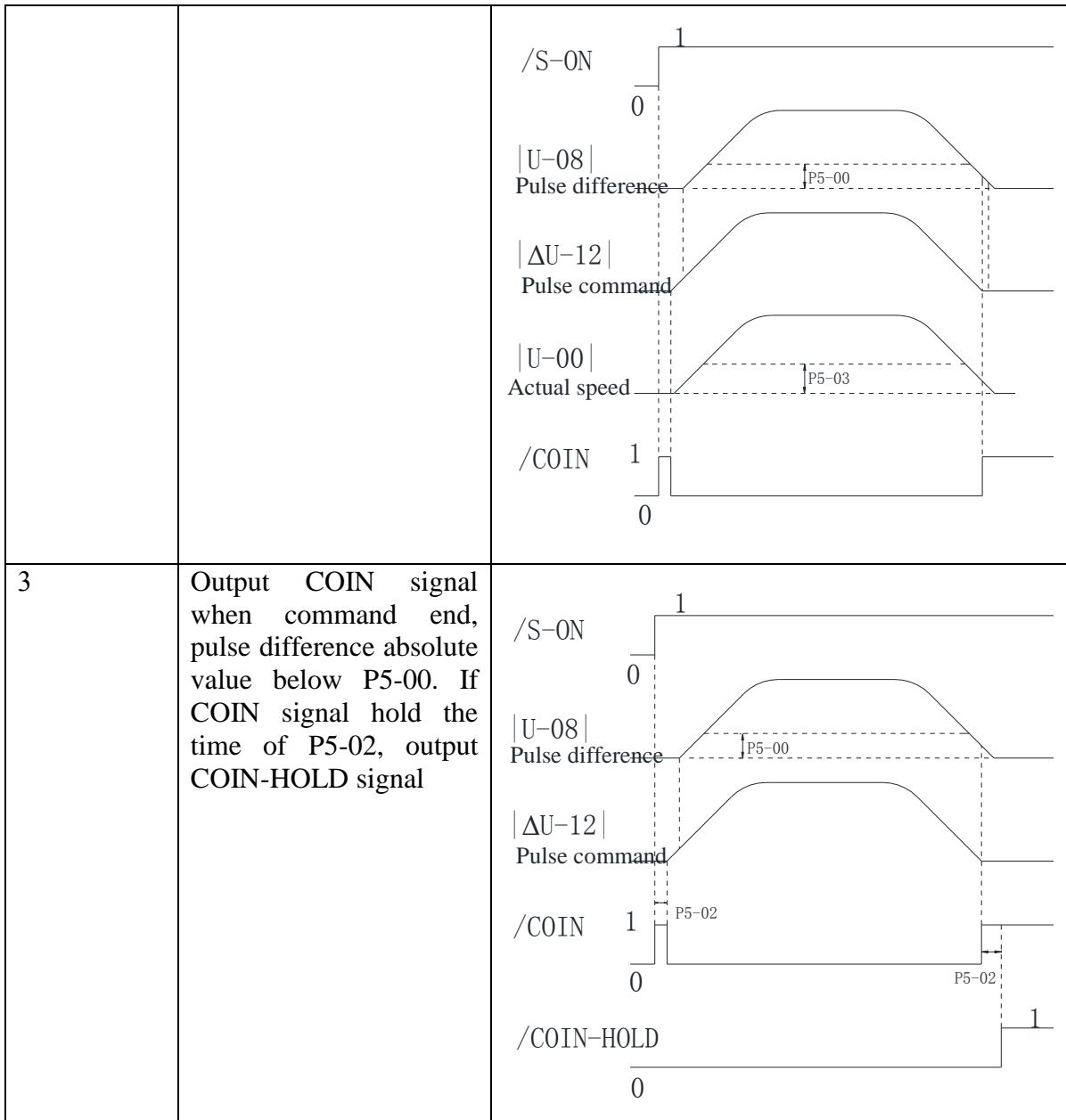
The output terminal distributed by function parameter cannot be same. Please refer to chapter 5-12-3.

P5-00	Width of positioning complete					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1 command unit	7	0~65535	5, 6	Servo OFF	Immediately

Function: when the pulse deviation value is lower than P5-00, output /COIN signal. Monitor the pulse deviation value via U0-08.

P5-01	Positioning complete detection mode						
	Default setting	Range	Suitable mode	Meaning	Change	Effective	
	0	0~3	6	Set the positioning complete detection mode	Servo OFF	At once	
P5-02	Positioning complete hold time						
	Unit	Default setting	Range	Suitable mode	Meaning	Change	effective
	ms	0	0~65535	6	COIN signal hold for the time of P5-02 then output signal COIN-HD	Servo OFF	At once

P5-01	Content	Diagram
0	Output COIN signal when difference absolute value below P5-00	<p>The diagram shows three signals over time. The top signal, /S-ON, is a constant high pulse. The middle signal, U-08 Pulse difference, is a trapezoidal pulse that rises, stays at a peak, and then falls. A horizontal dashed line labeled P5-00 indicates a threshold. The bottom signal, /COIN, is a high pulse that occurs when the pulse difference is below the P5-00 threshold.</p>
1	Output COIN signal when the difference below P5-00 after the command end	<p>The diagram shows three signals over time. The top signal, /S-ON, is a constant high pulse. The middle signal, U-08 Pulse difference, is a trapezoidal pulse. The bottom signal, ΔU-12 Pulse command, is a trapezoidal pulse that ends before the pulse difference. A horizontal dashed line labeled P5-00 indicates a threshold. The /COIN signal is a high pulse that occurs when the pulse difference is below the P5-00 threshold after the pulse command has ended.</p>
2	output COIN signal when the command end and motor speed below P5-03(rotation detection speed), pulse difference below P5-00	

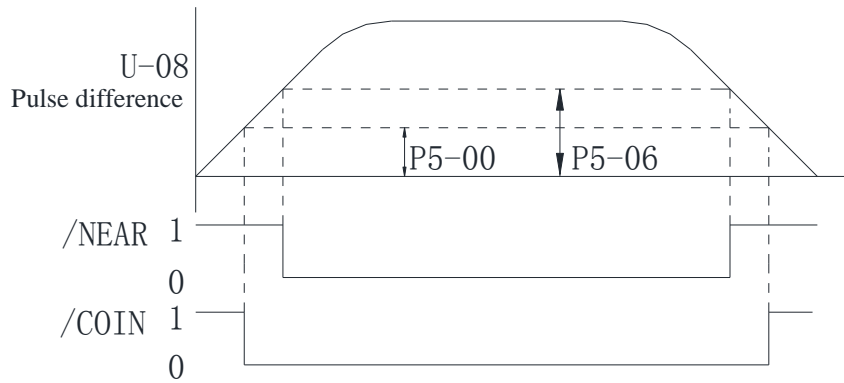


5-3-7. Positioning near (/NEAR)

Positioning near signal means the servo motor is near the positioning complete. It prompts the device to prepare the next operation.

Parameter	Signal	Default	Meaning	Modify		
P5-46	/NEAR	n.0000	Need to distribute	Range: 0000-0013, distribute to output terminal via P5-46. When it set to 0001, it means output from SO1.		
Note: /NEAR can be output from terminal by setting P5-46, please see chapter 5-12-3.						
P5-06	Width of positioning near signal					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1 command unit	50	0~65535	5, 6	Servo OFF	Immediately

Function: when the pulse difference signal is lower than P5-06, output /NEAR signal.
Set the parameter wider than positioning complete signal. Monitor the pulse difference value via U-08.



5-3-8. Command pulse prohibition (/INHIBIT)

To stop the command pulse input in position control mode. When /INHIBIT signal is ON, the command pulse stop counting.

Input signal setting:

Parameter	Signal	Default	Meaning	Modify
P5-32	/INHIBIT	n.0000	Need to distribute	Range: 0000-0015. When it set to 0001, it means input from SO1.

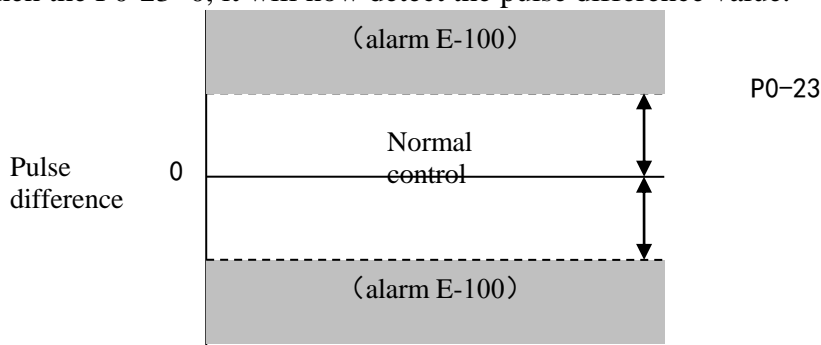
Note: /INHIBIT can be input from input terminal by setting P5-32. Please refer to chapter 5-12-1

5-3-9. Position pulse difference

When the pulse difference over the limit value in position control mode, servo will alarm. This limit value is pulse difference limit.

P0-23	Pulse difference limit					
	Unit	Default value	Range	Suitable mode	Change	Effective
	256 commands	100	0~65535	5, 6	Any	At once

When the P0-23=0, it will now detect the pulse difference value.



5-5. Speed control (analog voltage command)

Basic parameters		
Parameter	Name	Reference
P0-01	Select the control mode	5-5-1
P3-00	V-REF distribution	5-5-2
P3-01	Rated speed of the corresponding analog voltage	
P3-02	Analog voltage speed filter	
P3-03	Speed command input dead zone voltage	
P3-14	Forward direction max speed command limit	
P3-15	Reverse direction max speed command limit	
P5-10	Servo ON signal /S-ON	5-2-1

Other parameters			
Key words	Parameter	Name	Reference
Zero drift adjustment	F1-03	Analog voltage speed command offset auto-adjustment	5-5-3
Proportion action	P5-21	/P-CON	5-5-4
Zero clamp	P5-31	Zero clamp /ZCLAMP	5-5-5
	P3-12	Zero clamp mode	
	P3-13	Zero clamp speed	
Speed coincidence checking	P5-39	/V-CMP speed coincidence checking	5-5-6
	P5-04	Coincidence speed signal checking width/V-CMP	
Torque limit	P3-28	Forward torque limit	5-5-7
	P3-29	Reverse torque limit	
	P3-23	T-REF distribution	
	P3-30	Forward external torque limit	
	P3-31	Reverse external torque limit	
	P5-25	Forward external torque limit /P-CL	
	P5-26	Reverse external torque limit /N-CL	
	P5-42	Output when torque reaches limit value /CLT	
Soft start	P3-09	Soft start acceleration time	5-5-8
	P3-10	Soft start deceleration time	
Filter	P1-22	Speed command filter mode	5-5-9
	P1-23	Speed command filter time constant	
Speed reach detection	P5-51	Speed reach output /V-RDY	5-5-10
	P5-05	Reach detection speed	
Alarm speed	P3-21	Forward alarm speed	5-5-11
	P3-22	Reverse alarm speed	
/SPD-D direction selection	P5-17	Change the direction	5-6-3

5-5-1. Control mode selection

Parameter	Set value	Meaning	Modify	Effective
P0-01	4	Analog voltage command speed control	Servo OFF	Immediately
Function: control the speed by the signal (analog voltage command) input from V-REF terminal Note:direction switching: positive or negative voltage, SPD-D (P5-27).				

5-5-2. Analog value of rated speed

P3-00	Name	Set	Meaning		Change	Effective
	V-REF function distribution	0	V-REF input as speed command		Servo OFF	At once
P3-01	Analog value of rated speed					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.01V	1000	150~3000	1, 2, 4	Servo OFF	At once
<p>Function: the speed command voltage (V-REF) to run the servo motor at rated speed. Such as: P3-01=500 means the motor run at rated speed when analog input voltage = 5.00V P3-01=800 means the motor run at rated speed when analog input voltage = 8.00V. Note: Analog voltage command used for speed limit input without polarity. Whether it is positive voltage or negative voltage all take absolute value. This absolute value is fit for forward and reverse direction.</p>						
P3-02	analog voltage speed filter					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.01ms	0	0~10000	1, 2, 4	Servo OFF	At once
Analog command wiring diagram please refer to chapter 3-2-3						
P3-03	Speed command input dead zone voltage					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.01V	0	0~100	1, 2, 4	Servo OFF	At once
Note: when input speed command voltage is in the range of P3-03, it considers the input command is 0.						

Speed command limit

P3-14	Forward max speed command limit					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	1rpm	Motor rated	0~10000	3, 4, 5, 6, 7	Servo OFF	At once
P3-15	Reverse max speed command limit					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	1rpm	Motor rated	0~10000	3, 4, 5, 6, 7	Servo OFF	At once
<p>Note: P3-14 and P3-15 are effective in all the modes. These parameters are related to E-100. When the sending pulse frequency transformed to motor speed over these parameters, the actual speed is equal to these parameters speed. Then the pulse difference accumulated more and more and cause the E-100 alarm.</p>						

5-5-3. Speed command difference auto-adjustment (F1-03)

When the servo is in analog voltage speed mode, even if the command voltage is 0V, motor will run at very low speed. The micro-motion will happen when the command voltage micro-offset (mV) of host controller or external circuit occurs. Auto-adjust the command offset by operate panel of servo. Refer to chapter 4-4-2.

5-5-4. Proportion action command (/P-CON)

Parameter	Signal	Type	Default	State	Meaning	Modify	Effective
P5-21	/P-CON	Input	n.0000	Effective	Run in P control mode	Any	Re-power on
				Ineffective	Run in PI control mode		

1. /P-CON is the speed control mode signal selected from PI (proportion integral) and P (proportion).
2. If set to P control mode, the motor rotate and micro-vibration caused by speed command input drift can be decreased. But the servo stiffness will decrease.
3. /P-CON signal can be distributed to input terminal via parameter P5-21. Refer to chapter 5-12-1.

5-5-5. Zero clamp (/ZCLAMP)

(1) Function

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

(2) Input signal setting

Parameter	Signal	Type	Default	Meaning	Modify
P5-31	/Z-CLAMP	Input	n.0000	Need to distribute	Range: 0000-0015.

Note: /Z-CLAMP signal is distributed to input terminal by parameter P5-31, refer to chapter 5-12-1.

(3) Parameter setting

P3-13	Zero clamp speed					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	rpm	30	0~10000	3, 4	Any	At once

P3-12	Zero clamp mode					
	Default setting	Range	Suitable mode	Meaning	Change	Effective
	0	0~2	3, 4	Set zero clamp mode	Servo OFF	At once

P3-12 setting	Contents
0	ZCLAMP input signal is ON, forced speed command is 0, when the speed below P3-13, switch to position mode and the servo lock in this position.
1	ZCLAMP input signal is ON, forced set the speed command to 0.
2	ZCLAMP input signal is ON, the speed below P3-13, switch to position mode and the servo lock in the position.

5-5-6. Speed coincidence checking (/V-CMP)

When motor speed is equal to the command speed, servo outputs speed coincidence signal (V-CMP).

Parameter	Signal	Default	Meaning	Modify
P5-39	/V-CMP	n.0000	Need to distribute	Range: 0000-0013. Distribute to output terminal through P5-39. When it set to 0002, it means output from SO2.

P5-04	Speed coincidence signal width					
	Unit	Default	Range	Suitable mode	Modify	Effective
	rpm	50	0~10000	3, 4, 7	Servo OFF	Immediately

If the difference between motor speed and command speed is less than the value of P5-04, servo outputs /V-CMP signal.
There is default 10rpm hysteresis loop, please refer to chapter 5-11-4 for hysteresis loop.

5-5-7. Torque limit

1. Internal torque limit (output torque max value limit)

The function is to limit the max output torque by parameters.

P3-28	Internal Forward torque limit					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1%	300	0~300	All modes	Servo OFF	Immediately
P3-29	Internal Reverse torque limit					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1%	300	0~300	All modes	Servo OFF	Immediately

1. This parameter is always effective, if this parameter value is less than external torque limit value, the final limit value is this parameter.
2. The unit is percent of the motor rated torque; the default value is 300%. The real output torque is different for each type.

2. External torque limit (via input signal)

This function is used in machine motion or timing torque limit. For example: press stop action or robot workpiece protection.

The torque limit value will be effective when the input signal is ON.

P3-30	Forward external torque limit					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1%	300	0~300	2, 3, 4, 5, 6, 7	Any	Immediately
P3-31	Reverse external limit					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1%	300	0~300	2, 3, 4, 5, 6, 7	Any	Immediately

The unit is the percent of motor rated torque; the default value is 300%.

Parameter	Signal	Type	Default	Meaning	Modify
P5-25	/P-CL	Input	n.0000	Need to distribute	Range: 0000-0015.
P5-26	/N-CL	Input	n.0000	Need to distribute	Range: 0000-0015.

Notes: these parameters are the necessary conditions for using forward or reverse external torque limit. /P-CL, /N-CL can be distributed to input terminal by parameter P5-25, P5-26. Refer to chapter 5-12-1.

3. External torque limit (via analog voltage command)

This function controls the torque via analog voltage. T-REF terminal is used as analog voltage command terminal. Please note in external analog torque control mode, this function cannot be used.

Parameter	Function	Set value	Meaning	Modify	Effective
P3-23	Distribute function to T-REF	0	Make T-REF as external torque limit input	Servo OFF	At once

1. For analog voltage command input of torque limit. Get the absolute value of the voltage, the torque limit value based on the absolute value is suitable for forward and reverse direction.

2. When it is used as torque limit, the value is related to voltage command and P3-24. For example, P3-24=1000, T-REF voltage command is 5.0V, the torque limit value is 50% of rated torque.

4. Relationship of the parameters

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

TREF distribution	P-CL/N-CL status	Final forward torque	Final reverse torque
0	0	P3-28 decide	P3-29 decide
	1	The smaller one of internal forward torque limit and external forward torque limit	The smaller one of internal reverse torque limit and external reverse torque limit
1	No effect	The smaller one of internal forward torque limit and external analog torque	The smaller one of internal reverse torque limit and external analog torque
3	0	P3-28 decide	P3-29 decide
	1	The smaller one of internal forward torque limit and external analog torque	The smaller one of internal reverse torque limit and external analog torque

5. Output torque up to limit value signal

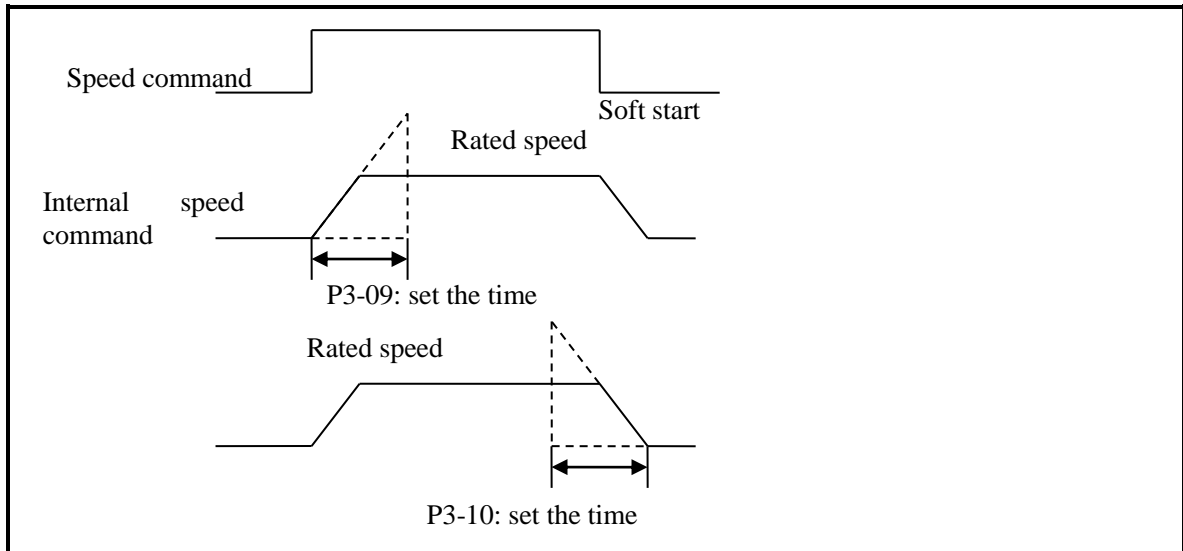
The signal means the motor output torque reaches limit value.

Parameter	Signal	Type	Default	Meaning	Modify
P5-42	/CLT	Output	n.0000	Need to distribute	Range: 0000-0013.

Note: /CLT signal can be distributed to output terminal by parameter P5-42. Refer to chapter 5-12-3.

5-5-8. Soft start

P3-09	Soft start acceleration time					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1ms	0	0~65535	3, 4, 7	Any	Servo OFF
P3-10	Soft start deceleration time					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1ms	0	0~65535	3, 4, 7	Any	Servo OFF
<p>1. Enable to do smooth speed control when input step speed command or choose internal speed. Other cases please set to 0.</p> <p>2. acceleration/deceleration time is from stop state to rated speed but not from current speed to target speed.</p> <p>P3-09: the time from stop state to rated speed.</p> <p>P3-10: the time from rated speed to stop state.</p>						



5-5-9. Filter

P1-22	Speed command filter mode					
	Default setting	Range	Suitable mode	Meaning	Change	Effective
	0	0	3, 4, 7	Filter certain frequency command pulse	Servo OFF	At once

P1-22 setting	Contents
0	First order low pass filter

P1-23	Speed command filter time					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1ms	0	0~65535	6	Any	At once

5-5-10. Speed reach signal (/V-RDY)

Output speed reach signal V-RDY when the motor speed is equal to reach speed.

P5-51	Name	Default setting	Meaning	Change
	/V-RDY	n.0000	Need to distribute to the terminal	Range: 0000-0013, distribute to the output terminal via P5-29. When P5-29=0002, it means output from SO2 terminal.



the output terminal only can have one function at the same time. Please refer to chapter 5-12-3.

P5-05	Reach detection speed					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	rpm	1000	0~10000	3, 4, 7	Servo OFF	At once

If the motor speed absolute value is larger than P5-05, output the signal /V-RDY.



there is default hysteresis loop 10rpm, please refer to chapter 5-11-4.

5-5-11. Alarm speed

P3-21	Forward alarm speed					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	1rpm	120% of rated speed	0~10000	All	Servo OFF	At once
P3-22	Reverse alarm speed					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	1rpm	120% of rated speed	0~10000	All	Servo OFF	At once
<p>Note: 1. the parameters P3-21 and P3-22 are effective in all the modes.</p> <p>2. the default value is 120% of rated speed. for example: rated speed is 1500, max speed is 1800; rated speed is 3000, max speed is 3600.</p> <p>3. these parameters are related to E-080. When the motor is out of control or the speed keeps rising caused by external force and over the alarm speed, servo will show E-080 alarm.</p>						

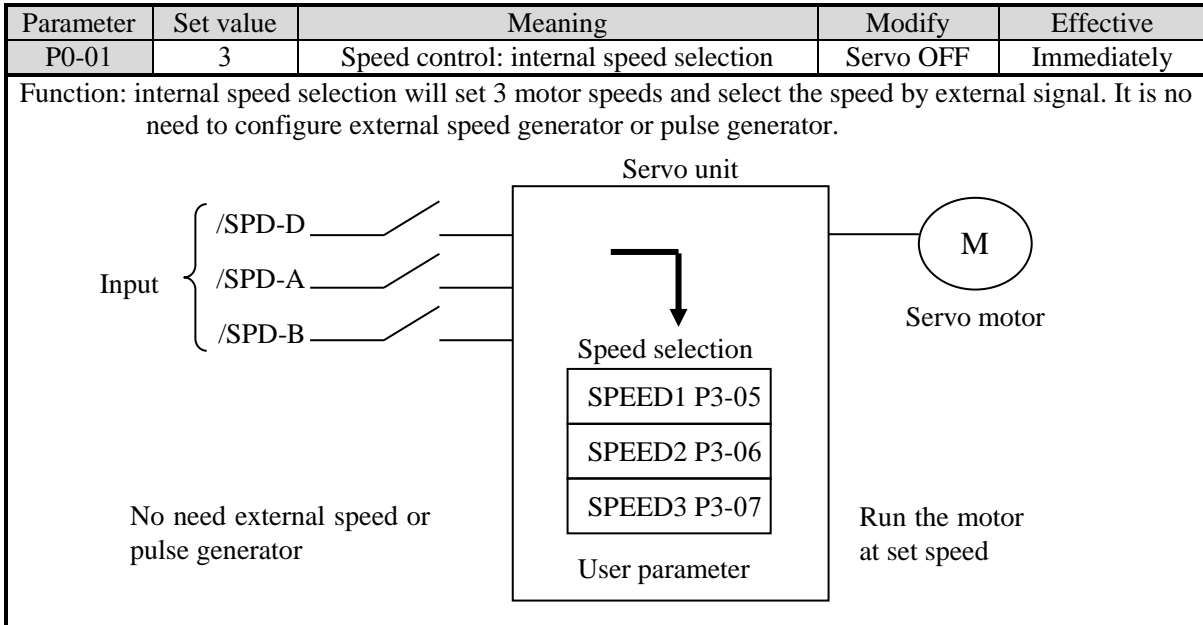
5-6. Speed control (internal speed)

Basic parameter		
Parameter	Name	Reference
P0-01	Control mode selection	5-6-1
P5-20	Servo ON signal /S-ON	5-2-1
P3-05	Internal speed 1	5-6-2
P3-06	Internal speed 2	
P3-07	Internal speed 3	
P5-27	/SPD-D internal speed direction selection	5-6-3
P5-28	/SPD-A internal speed direction selection	
P5-29	/SPD-B internal speed direction selection	

Other parameters			
Key word	Parameter	Name	Reference
Proportion action	P5-21	Proportion action command /P-CON	5-5-4
Zero clamp	P5-31	Zero clamp /ZCLAMP	5-5-5
	P3-12	Zero clamp mode	
	P3-13	Zero clamp speed	
Speed coincidence checking	P5-39	/V-CMP speed coincidence checking	5-5-6
	P5-04	speed coincidence checking signal width /V-CMP	
Torque limit	P3-28	Internal forward torque limit	5-5-7
	P3-29	Internal reverse torque limit	
	P3-23	T-REF distribution	
	P3-30	Forward external torque limit	
	P3-31	Reverse external torque limit	
	P5-25	Forward external torque limit /P-CL	
	P5-26	Reverse external torque limit /N-CL	
Soft start	P5-42	Torque up to limit value output /CLT	5-5-8
	P3-09	soft start acceleration time	
Filter	P3-10	soft start deceleration time	5-5-9
	P1-22	Position command filter mode	

	P1-23	Speed command filter time	
Speed reach detection	P5-51	Speed reach output /V-RDY	5-5-11
	P5-05	Reach detection speed	

5-6-1. Control mode selection



5-6-2. Internal speed setting

P3-05	Internal speed 1					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1rpm	0	-10000~+10000	3	Any	Immediately
P3-06	Internal speed 2					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1rpm	0	-10000~+10000	3	Any	Immediately
P3-07	Internal speed 3					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1rpm	0	-10000~+10000	3	Any	Immediately

5-6-3. Input signal setting

Switch the running speed by below input signal:

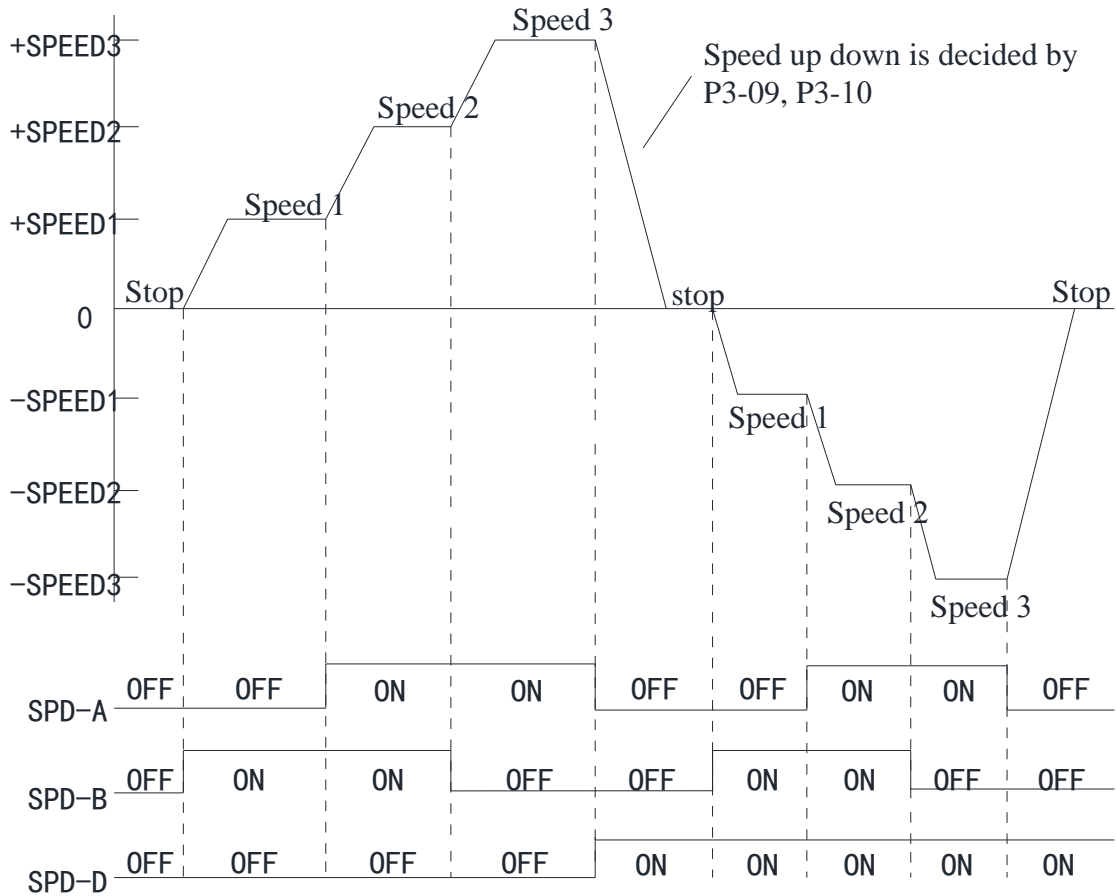
Parameter	Signal	Default	Meaning	Modify
P5-27	/SPD-D	n.0000	Need to distribute	Range: 0000-0015. Distribute to input terminal through P5-27.
P5-28	/SPD-A	n.0000	Need to distribute	Range: 0000-0015. Distribute to input terminal through P5-28.
P5-29	/SPD-B	n.0000	Need to distribute	Range: 0000-0015. Distribute to input terminal through P5-29.

(1) Function realization

Input signal			Direction	Running speed
/SPD-D	SPD-A	SPD-B		
0	0	0	Forward	Internal speed is zero
	0	1		P3-05: SPEED1
	1	1		P3-06: SPEED2
	1	0		P3-07: SPEED3

1	0	0	Reverse	Internal speed is zero
	0	1		P3-05: SPEED1
	1	1		P3-06: SPEED2
	1	0		P3-07: SPEED3

(2) Running example



5-7. Speed control (pulse frequency command)

Basic parameter		
Parameter	Name	Reference
P0-01	Control mode selection	5-7-1
P5-20	Servo ON signal /S-ON	5-2-1
P0-10	Pulse command form	5-3-2
P0-15	Command pulse frequency at rated speed	5-7-3
P0-16	Speed command pulse filter time	5-7-4

Other parameters			
Key word	Parameter	Name	Reference
Proportion action	P5-21	Proportion action command /P-CON	5-5-4
Zero clamp	P5-31	Zero clamp /ZCLAMP	5-5-5
	P3-12	Zero clamp mode	
	P3-13	Zero clamp speed	
Speed coincidence checking	P5-39	/V-CMP speed coincidence checking	5-5-6
	P5-04	speed coincidence checking signal width /V-CMP	
Torque limit	P3-28	Internal forward torque limit	5-5-7

	P3-29	Internal reverse torque limit	
	P3-23	T-REF distribution	
	P3-30	Forward external torque limit	
	P3-31	Reverse external torque limit	
	P5-25	Forward external torque limit /P-CL	
	P5-26	Reverse external torque limit /N-CL	
	P5-42	Torque up to limit value output /CLT	
Speed reach detection	P5-51	Speed reach output /V-RDY	5-5-11
	P5-05	Reach detection speed	

5-7-1. Control mode selection

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

5-7-2. Pulse frequency command

Pulse frequency command is the same as external pulse command position control (mode 6), refer to chapter 5-3-2.

5-7-3. Command pulse frequency at rated speed

P0-15	command pulse frequency at rated speed					
	Unit	Default	Range	Suitable mode	Modify	Effective
	100Hz	1000	1~10000	7	Servo OFF	Immediately
Note: the unit is 100Hz. Example: P0-15=300, command pulse frequency at rated speed=30kHz; P0-15=1000, command pulse frequency at rated speed= 100kHz.						

5-7-4. Speed command pulse filter time

P0-16	speed command pulse filter time					
	Unit	Default	Range	Suitable mode	Modify	Effective
	0.01ms	100	0~10000	7	Any	Immediately
When the command pulse frequency is low, setting a suitable value for this parameter can decrease the speed fluctuation.						

5-8. Torque control (analog voltage command)

Parameter		
Parameter	Name	Reference
P0-01	Control mode selection	5-8-1
P3-23	T-REF distribution	5-8-2
P3-24	The analog voltage of rated torque	
P3-25	Analog voltage torque command filter	

P3-26	Torque command input dead zone voltage	
P5-20	Servo ON signal /S-ON	5-2-1

Other parameters			
Key words	Parameter	Name	Reference
Zero drift adjustment	F1-04	Torque command offset auto-adjustment	5-8-3
Filter	P3-25	Torque command filter time	5-8-4
Speed limit	P3-00	V-REF distribution	5-8-5
	P3-16	Internal forward speed limit for torque control	
	P3-17	Internal reverse speed limit for torque control	
	P5-43	Speed reach limit output /VLT	
/SPD-D direction selection	P5-27	Speed direction changing	5-6-3

5-8-1. Control mode selection

Parameter	Set	Function	Modify	Effective
P0-01	2	Torque control: analog voltage command	Servo OFF	Immediately
Function: Control the torque by the analog voltage signal input from T-REF terminal. Direction switching: negative or positive voltage or SPD-D (P5-27).				

5-8-2. The analog value of rated torque

	Name	Default setting	Suitable mode	Meaning	Change	Effective
P3-23	T-REF distribution	0	All	T-REF input as speed command	Servo OFF	At once
P3-24	Analog value of rated torque					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.01V	1000	150~3000	All	Servo OFF	At once
Function: set the speed command voltage (T-REF) to run the servo motor at rated speed Example: P3-24=500, motor run at rated torque when analog input voltage is 5.00V P3-24=800, motor run at rated torque when analog input voltage is 8.00V Note: analog voltage command input for torque limit has no polarity. Get the absolute value whatever it is positive or negative voltage. The torque limit value based on this absolute value is fir for forward and reverse direction.						
P3-25	Analog voltage torque command filter					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.01ms	0	0~10000	All	Servo OFF	At once
The analog torque command input please refer to chapter 3-2-4						
P3-26	Torque command input dead zone voltage					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.01V	0	0~100	2	Any	At once
Note: when the input torque command voltage is smaller than this parameter, it considers the input torque command is 0.						

5-8-3. Torque command offset autoadjustment (F1-04)

The motor will run at microspeed even the command voltage is 0V in analog voltage torque mode. This situation will happen when host controller or the command voltage of external circuit has micro-offset (mV). Use the operate panel to auto-adjust the offset. Refer to chapter 4-4-2.

5-8-4. Torque command filter time

P3-25	torque command filter time					
	Unit	Default	Range	Suitable mode	Modify	Effective
	0.01ms	0	0~32767	All	Any	Immediately
1-time delay filter will smooth the torque command. If set the value too large, the reponse will be decreased.						

5-8-5. Torque limit

5-8-5-1. Internal speed limit

Limit the speed of torque control by setting below parameters:

P3-16	internal forward speed limit in torque control mode					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1rpm	Motor rated	0~10000	1, 2	Any	Immediately
Note: the actual speed is max speed even this parameter speed is larger than the max speed.						

P3-17	internal reverse speed limit in torque control mode					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1rpm	Motor rated	0~10000	1, 2	Any	Immediately
Note: the actual speed is max speed even this parameter speed is larger than the max speed.						

5-8-5-2. External speed limit

Limit the speed output of torque control mode by the analog voltage command input from V-REF terminal.

Parameter	Function	Set value	Meaning	Modify	Effective
P3-00	V-REF function distribution	1	Make V-REF as external speed limit input, actual speed limit depends on external analog speed limit	Servo OFF	Immediately
1. The analog voltage has no polarity. The absolute value of the voltage is suitable for forward and reverse direction. 2. The parameter value is related to voltage command and P3-01 when it is used as speed limit value. For example: P3-01=500 (voltage of rated speed is 5.0V), V-REF voltage command is 1.0V, the speed limit is 20% of rated speed.					

5-8-5-3. Speed up to limit value output

Parameter	Signal	Default	Meaning	Modify
P5-43	/VLT	n.0000	Need to distribute	Range: 0000-0013. Distribute to output terminal through P5-43. When it set to 0001, it means output from SO1.

5-9. Torque control (internal setting)

Basic parameter		
Parameter	Name	Reference
P0-01	Control mode selection	5-9-1
P5-20	Servo ON signal /S-ON	5-2-1
P3-33	Internal torque command	5-9-2

Other parameters			
Key words	Parameter	Name	Reference
Filter	P3-25	Torque command filter time	5-8-4
Speed limit	P3-16	Internal forward speed limit of torque control	5-8-5
	P3-17	Internal reverse speed limit of torque control	
	P3-14	Forward max speed limit	
	P3-15	Reverse max speed limit	
	P3-00	V-REF function distribution	
	P5-43	Speed up to limit value output	
/SPD-D direction selection	P5-27	Speed direction change	5-6-3

5-9-1. Control mode selection

Parameter	Set value	Function	Modify	Effective
P0-01	1	Torque control: internal setting	Servo OFF	Immediately

Function: Control the torque by internal torque command.

5-9-2. Internal torque command

P3-33	Internal torque command					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1% rated torque	0	-300~+300	1	Any	Immediately

The unit of this parameter is 1% of the rated torque.
 For example: P3-33=50, motor forward run with 50% of the rated torque;
 P3-33= -20, motor reverse run with 20% of the rated torque.

5-10. Switch the control mode

Servo can switch between submode 1 and 2 by external input signal.

(1) Switch signal

Parameter	Signal	Type	Default	Meaning	Modify
P5-30	/C-SEL	Input	n.0000	Need to distribute	Range: 0000-0015.

Note: /C-SEL can be distributed to input terminal via parameter P5-14, refer to chapter 5-12-1.

(2) Function realization

Signal	State	Control mode
/C-SEL	0	P0-01: submode 1
	1	P0-02: submode 2

5-11. Other output signals

5-11-1. /ALM and /ALM-RST

■ Servo alarm output /ALM

Parameter	Signal	Type	Default	Meaning
P5-47	/ALM	Output	n.0002	Output always open signal from SO2

■ Alarm reset /ALM-RST

Parameter	Signal	Type	Default	Meaning	Range
P5-24	/ALM-RST	Input	n.0002	Input always open signal from SI2	0000-0015
<ol style="list-style-type: none"> Find the alarm reason and fix it, then clear the alarm via this signal. /ALM-RST can be distributed to input terminal via this parameter. As the alarm signal is related to the safe running of servo, /ALM-RST signal cannot be set to always effective. (n.0010); The alarm related to encoder such as E-013□ (0, 1, 2), E-014□ (0, 1, 2) cannot be reset via /ALM-RST. /ALM-RST can be distributed to input terminal via parameter P5-14, refer to chapter 5-12-1. 					

5-11-2. /WARN

Set the warn output threshold. When the motor speed is larger than the threshold, output /WARN.

P3-19	Forward warn speed				
	Unit	Default setting	Range	Change	Effective
	1rpm	Related to the motor	0~10000	Servo OFF	At once
P3-20	Reverse warn speed				
	Unit	Default setting	Range	Change	Effective
	1rpm	Related to the motor	0~10000	Servo OFF	At once

Parameter	Signal	Type	Default	Meaning	Range
P5-45	/WARN	Output	n.0000	Need to distribute	0000-0013
When the warning happens, servo will not be forced OFF but output the warning. /WARN can be distributed to input terminal via parameter P5-45. Refer to chapter 5-12-3.					

5-11-3. Rotation checking (/TGON)

(1) Signal setting

Parameter	Signal	Type	Default	Meaning	Range
P5-40	/TGON	Output	n.0000	Need to distribute	0000-0013
<ol style="list-style-type: none"> The servo will be considered in the rotation when the servo motor speed is higher than P5-03. /TGON can be distributed to output terminal via parameter P5-40, refer to chapter 5-12-3. 					

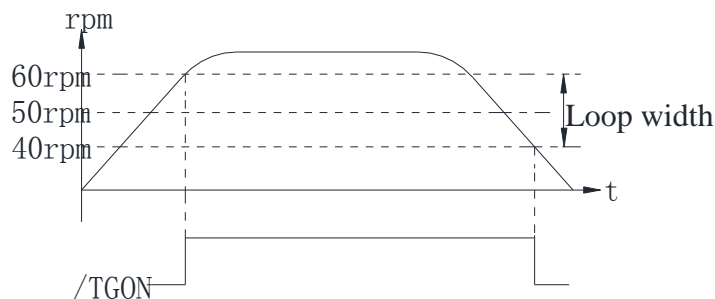
(2) Parameter setting

P5-03	Internal torque command setting					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1rpm	50	1~1000	All the modes	Servo OFF	Immediately

Set the range of rotation checking output. If servo motor speed is up to P5-03, the servo motor is considered to be running and output rotation checking signal (/TGON).
There is default 10rpm hysteresis loop, please refer to chapter 5-11-4.

5-11-4. Hysteresis loop

The hysteresis loop can prevent the system oscillation caused by parameter fluctuating around certain value. There is hysteresis loop width after setting the hysteresis loop value. It will act when the parameter is larger than certain value. It will release the action when the parameter is smaller than another value. The loop width decides the interval time of action. The action is sensitive and frequent for small loop width. The action is slow for large loop width. Please note that rotation detection speed (P5-03), same speed detection speed (P5-04), reach detection speed (P5-05) all have 10rpm hysteresis loop. For example, P5-03 set to 50, rotation detection/TGON output terminal is SO3.



5-11-5. Servo ready (/S-RDY)

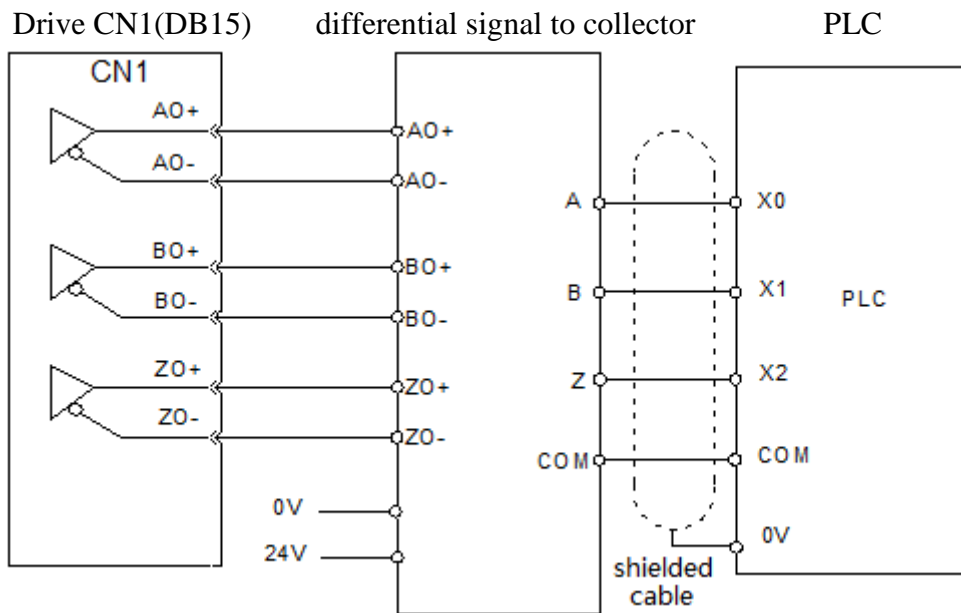
Parameter	Signal	Default	Meaning	Range
P5-41	/S-RDY	n.0003	SO3 and COM pass through when servo is ready	0000-0013 Refer to chapter 5-12-3.
		n.0013	SO3 and COM cut off when servo is ready	

5-11-6. ABZ phase feedback signal of encoder

1. Wiring diagram

DS3-2□P□-PQA and DS3-4□P□-PQA support differential output AB phase feedback signal.

Please see the following wiring diagram of DS3-21P5-PQA and Xinje PLC XC3-32RT-E.



2. Encoder feedback pulses per circle

P0-18	Encoder feedback pulse per circle (low bit)					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	1	2500	0~9999	All	Servo OFF	At once
P0-19	Encoder feedback pulse per circle (high bit)					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	10000	0	0~65535	All	Servo OFF	At once
P0-20	Encoder pulse frequency division (numerator)					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	—	1	0~65535	All	Servo OFF	At once
P0-21	Encoder pulse frequency division (denominator)					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	—	1	1~65535	All	Servo OFF	At once

Explanation:

1. encoder feedback pulse is decided by P0-18, P0-19. When P0-18=P0-19=0, encoder pulse frequency division will work. For example, the motor feedback 2500 pulses per circle, P0-18=P0-19=0 P0-20=1, P0-21=4, the calculation method is $(U2-21/22)*P0-20/P0-21$.
2. If it is single phase count, the count value is equal to setting value for motor rotating one circle. If it is AB phase count, the count value is 4 times of setting value for motor rotating one circle.
3. the feedback value should under 10000. If it is larger than 10000, the system will operate as 10000.

5-11-7. User-defined output signal

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

User-defined output 1:

P5-10	The trigger condition of user-defined output 1					
	Default trigger condition	Trigger condition setting	Unit	Suitable mode	Change	effective
	0	See below table	Related to trigger condition	All the modes	servo OFF	At once
P5-11	The comparison value for the trigger condition of user-defined output 1					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	-32768~32767	All the modes	Servo OFF	At once
P5-12	When $P5-10 \geq P5-11$ or $P5-10 < P5-11$, Sox output					
	Setting value	Function	Default value	Suitable mode	Change	Effective
	0	$P5-10 \geq P5-11$, Sox output	0	All the modes	Servo OFF	At once
	1	$P5-10 < P5-11$, Sox output				
	2	$P5-10$ absolute value $\geq P5-11$, SOx output				
3	$P5-10$ absolute value $\leq P5-11$, SOx output					
P5-13	User-defined output 1 hysteresis loop					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	-32768~32767	All the modes	Servo OFF	At once
P5-52	Output terminal setting of user-defined output 1					
	Signal name	Default setting	Meaning	Change		
	User-defined output 1	n.0000	Default setting is not distribute to the output terminal	Range 0000-0013, distribute to the output terminal through P5-52.		

User-defined output 2:

P5-14	The trigger condition of user-defined output 2					
	Default trigger condition	Trigger condition setting	Unit	Suitable mode	Change	Effective
	0	See below table	Related to trigger condition	All the modes	Servo OFF	At once
P5-15	The comparison value for the trigger condition of user-defined output 2					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	-32768~32767	All the modes	Servo OFF	At once
P5-16	When $P5-14 \geq P5-15$ or $P5-14 < P5-15$, SOx output					

Setting value	Function	Default setting	Suitable mode	Change	Effective	
0	P5-14 \geq P5-15, SOx output	0	All the modes	Servo OFF	At once	
1	P5-14<P5-15, SOx output					
2	P5-14 absolute value \geq P5-15, SOx output					
3	P5-14 absolute value < P5-15, SOx output					
P5-17	User-defined output 2 hysteresis loop					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to trigger condition	0	-32768~32767	All the modes	Servo OFF	At once
P5-53	Output terminal setting of user-defined output 2					
	Signal name	Default setting	Meaning	Change		
	User-defined output 2	n.0000	Default setting is not distribute to the output terminal	Range 0000-0013, distribute to the output terminal through P5-53		



please refer to chapter 5-11-4 for hysteresis loop.

- Trigger conditions for choice

Trigger condition no.	Meaning	Unit
0	-	-
202	Torque command	Rated torque %
205	Torque feedback	Rated current %
301	Speed command	rpm
302	Speed feedback	rpm
309	Speed offset	rpm
320	Speed feedforward	rpm
402	Position command	1 command
404	Position feedback	1 command
406	Position offset	1 command
502	Bus voltage	V
503	Drive internal temperature	0.1°C
506	Average output power	W
508	The average thermal power	W

5-11-8. IO filter time

P5-18	I/O filter time					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	ms	0	0~65535	All the modes	Servo OFF	At once

5-12. I/O signal distribution

5-12-1. Input signal distribution

Parameter range: P5-20~P5-36

Parameter meaning	Set value	Meaning	Terminal voltage	Terminal state	Signal state
n.00 y x 00: no meaning y: 0 always open 1 always close x: input terminal no.	n.0000	Not distribute to terminal input	-	-	0
	n.000x	Input always open signal from SIx	H	Disconnect to 0V	0
			L	Connect to 0V	1
	n.0010	Set the signal to be always valid	-	-	1
	n.001x	Input always close signal from SIx	H	Disconnect to 0V	1
			L	Connect to 0V	0

Note: if the distributed terminal has other signal, set the signal to other terminal or set to unused.

Example: take the input signal /CLR (P5-24) of DS3-21P5-PQA as an example to explain the terminal distribution.

Wiring example of input signal				
		DS3-21P5-PQA: CN0-11 is +24V terminal, CN0-7 is SI1 terminal. For the example, distribute /CLR signal to SI1.		
Parameter	Set value	Terminal state	Signal state	Meaning
P5-34	n.0001	Disconnect to 0V	0	Clear the pulse offset at the moment of SI1 and 0V pass through
		Connect to 0V	1	
	n.0011	Disconnect to 0V	1	Clear the pulse offset at the moment of SI1 and 0V cut off
		Connect to 0V	0	

Note: the default input of SI1 is /SON, make sure to distribute P5-20(/SON) to other terminal or set to unused.

5-12-2. Default setting of input terminal

Input Type	SI1	SI2	SI3	SI4	SI5
DS3-2□P□-PQA DS3-4□P□-PQA	/S-ON	/ALM-RST	/P-OT	/N-OT	Not distribute

Note: the same input terminal can distribute one function parameter. If more function parameters distribute to the same terminal, the system will delete the former setting and keep the present setting.

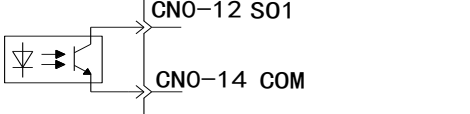
5-12-3. Output terminal distribution

Parameter range: P5-37~P5-47, P5-51

Parameter meaning	Set value	Meaning	Signal state	Terminal state
n.00 y x 00: pointless y: 0 always open 1 always close x: output terminal no.	n.0000	Not distribute to terminal input	-	-
	n.000x	Output always open signal from SOx	0	Cut off with COM
			1	Pass through with COM
	n.0010	Set the signal to be always valid	-	-
n.001x	output always close signal from SOx	0	Pass through with COM	
		1	Cut off with COM	

Note: If the distributed terminal has other signal, please set the signal to other terminal or set to unused.

Example: take /CLT signal of DS3-21P5-PQA as an example to explain output terminal distribution.

Output terminal wiring example				
		DS3-21P5-PQA: SO1 is CN0-12, COM is CN0-14.		
Parameter	Set value	/CLT	Terminal state	Meaning
P5-42	n.0001	0	SO1 and COM pass through	Output limit signal when motor torque reaches the set value
		1	SO1 and COM cut off	Output limit signal when motor torque reaches the set value

Note: the default output of SO1 is /COIN. Set the P5-38 (/COIN) to other terminal or unused in order to avoid terminal signal conflict.

5-12-4. Default setting of output terminal

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

Note: the same output terminal can distribute one function parameter. If more function parameters distribute to the same terminal, the system will delete the former setting and keep the present setting.

6 Servo gain adjustment

6-1. Gain parameter adjustment

The servo system contains position loop, speed loop, current loop which are the core of servo system. The parameters related to the three loops are gain(Kp), the integral time constant(Ki), response level, filter time, feedforward gain, etc. These parameters determine the performance of the entire system. DS3-PQA has two groups of gain parameters which can automatic switching. The switching condition can be set according to user requirements. The servo has the function of one-key setting rigid function and inertia switching.

6-1-1. Gain parameters

Some parameters may not fit the system requirements after the external load changed. There are two groups of parameters for users.

Group one:

P1-00	First Speed loop gain (Kp)					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1Hz	100	0~10000	3, 4, 5, 6, 7	Any	Immediately
P1-01	First Speed loop integral time constant (Ki)					
	Unit	Default	Range	Suitable mode	Modify	Effective
	0.1ms	400	0~10000	3, 4, 5, 6, 7	Any	Immediately

Speed loop gain

Speed feedback

To set the speed loop gain larger and the speed integral time constant smaller can realize high response speed controlling. But servo will restrict by machine performance. It will cancel the integral function when integral time constant is 0 or 10000. It will keep the integral when integral time constant is 9999.

P1-02	First Position loop gain (Kp)					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1/s	100	0~10000	5, 6	Any	Immediately

Position loop gain

Position feedback

To do position control with high response and less offset needs to set the position loop gain larger. But servo will restrict by machine performance.

P1-03	First speed feedback response level					
	Unit	Default	Range	Suitable mode	Modify	Effective
	Hz	4000	0~4000	All the modes	Any	Immediately
The larger the response level, the faster the response speed, but it will show vibration for low speed running.						
P1-04	First torque command filter time constant					
	Unit	Default	Range	Suitable mode	Modify	Effective
	0.01ms	0	0~3000	All the modes	Any	Immediately
Function: the larger the filter time, the smoother it is, but the response will delay						

Group two:

P1-05	Second Speed loop gain (Kp)					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1Hz	100	0~10000	3, 4, 5, 6, 7	Any	Immediately
P1-06	Second Speed loop integral time constant (Ki)					
	Unit	Default	Range	Suitable mode	Modify	Effective
	0.1ms	400	0~10000	3, 4, 5, 6, 7	Any	Immediately
<div style="text-align: center;"> <p style="text-align: center;">Speed loop gain</p> <p style="text-align: center;">Speed feedback</p> </div> <p>To set the speed loop gain larger and the speed integral time constant smaller can realize high response speed controlling. But servo will restrict by machine performance. It will cancel the integral function when integral time constant is 0 or 10000. It will keep the integral when integral time constant is 9999.</p>						

P1-07	Second Position loop gain (Kp)					
	Unit	Default	Range	Suitable mode	Modify	Effective
	1/s	100	0~10000	5, 6	Any	Immediately

P1-08	Second speed feedback response level					
	Unit	Default	Range	Suitable mode	Modify	Effective
	Hz	4000	0~4000	All the modes	Any	Immediately
The larger the response level, the slower the response speed, more stable						
P1-09	Second torque command filter time constant					
	Unit	Default	Range	Suitable mode	Modify	Effective
	0.01ms	0	0~3000	All the modes	Any	Immediately
Function: the larger the filter time, the smoother it is, but the response will delay						

6-1-2. Other parameters

Speed feedforward:

P1-10	Speed feedforward gain (Kp)					
	Unit	Default set	Range	Suitable mode	Change	Effective
	1%	0	0~1000	5, 6	Any	At once
Increase this parameter can improve the rigidity, but it maybe overshoot.						
P1-11	Speed feedforward filter time					
	Unit	Default set	Range	Suitable mode	Change	Effective
	0.01ms	10	0~10000	5, 6	Any	At once
P1-26	Speed feedforward limiting					
	Unit	Default set	Range	Suitable mode	Change	Effective

	rpm	Motor rated	Motor rated	5, 6	Any	At once
Limit the speed feedforward value in this range						

Torque feedforward:

P1-12	Torque feedforward gain (Kp)					
	Unit	Default set	Range	Suitable mode	Change	Effective
	1%	0	0~1000	5, 6	Any	At once
Increase this parameter can improve the rigidity, but it maybe overshoot.						
P1-13	Torque feedforward filter time					
	Unit	Default set	Range	Suitable mode	Change	Effective
	0.01ms	10	0~10000	5, 6	Any	At once
P1-27	Torque feedforward limiting					
	Unit	Default set	Range	Suitable mode	Change	Effective
	% of rated	100	0~100	5, 6, 7	Any	At once
	Limit the position feedforward value in this range					

6-2. Parameter switching

There are 6 switching modes for speed mode and position mode. It provides solution for the problem of external load changing but control parameters cannot change immediately.

Gain switching in position mode:

P1-14	Position gain switching mode					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	—	0	0~6	3, 4, 7	Any	At once
	mode	function	unit	Explanation		
	0	Group 1	—	Use group 1 parameters (P1-00~P1-04)		
	1	Group 2	—	Use group 2 parameters (P1-05~P1-09)		
	2	G-SEL signal	—	Choose the group through external terminal (chapter 6-2-1)		
	3	Torque command	% of rated	When torque command less than P1-16, use group 1; when torque command larger than P1-16, use group 2		
	4	Speed command	rpm	When speed command less than P1-16, use group 1; when speed command larger than P1-16, use group 2.		
5	Position offset	1 command	When position offset less than P1-16, use group 1; when position offset larger than P1-16, use group 2.			
6	Speed feedback	rpm	When speed feedback less than P1-16, use group 1; when speed feedback larger than P1-16, use group 2.			
P1-16	Position gain switching comparison value					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Rated to the mode	0	-32768~32767	3, 4, 7	Any	At once
P1-17	Position gain switching comparison value hysteresis loop					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to the mode	0	-32768~32767	3, 4, 7	Any	At once
	Note: hysteresis loop please refer to chapter 5-11-4					

Gain switching in speed mode:

P1-18	Speed gain switching mode					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	—	0	0~6	5, 6	Any	At once
	Mode	Function	Unit	Explanation		
	0	Group 1	—	Use group 1 parameters (P1-00~P1-04)		
	1	Group 2	—	Use group 2 parameters (P1-05~P1-09)		
	2	G-SEL signal	—	Choose the group through external terminal (chapter 6-2-1)		
	3	Torque command	% of rated	When torque command less than P1-20, use group 1; when torque command larger than P1-20, use group 2		
	4	Speed command	rpm	When speed command less than P1-20, use group 1; when speed command larger than P1-20, use group 2.		
5	Position offset	1 command	When position offset less than P1-20, use group 1; when position offset larger than P1-20, use group 2.			
6	Speed feedback	rpm	When speed feedback less than P1-20, use group 1; when speed feedback larger than P1-20, use group 2.			
P1-20	Speed gain switching comparison value					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Rated to the mode	0	-32768~32767	5, 6	Any	At once
P1-21	Speed gain switching comparison value hysteresis loop					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Related to the mode	0	-32768~32767	5, 6	Any	At once
	Note: hysteresis loop please refer to chapter 5-11-4					

6-2-1. G-SEL signal input

When the gain switching mode is 2, it can switch the parameter through /G-SEL input signal.

Parameter	Signal	Type	Default	Meaning	Suitable mode	Modify	Effective
P5-33	/G-SEL	Input	n.0000	Need to distribute	All the modes	Any	At once

/G-SEL can be distributed to input terminal via parameter P5-33. Refer to chapter 5-12-1.

Function realization:

Input signal	Signal state	Gain group
/G-SEL	0	Group 1
	1	Group 2

Note: the 0, 1 is signal state but not terminal state.

6-2-2. Gain filter time constant

P2-35	Speed loop gain filter time constant					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1ms	30	0~10000	3, 4, 5, 6	Any	At once
Function: make the speed loop gain switching smooth, decrease the vibration						
P2-36	Position loop gain filter time constant					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1ms	30	0~10000	5, 6	Any	At once
Function: make the position loop gain switching smooth, decrease the vibration						

6-3. Inertia ratio switching (I-SEL)

User can switch between two groups of inertia ratio according to the external load inertia changing.
 Inertia ratio = (load inertia/motor inertia) × 100%

P0-07	First inertia ratio						
	Unit	Default setting	Range	Suitable mode	Change	Effective	
	%	200	0~10000	All the modes	Any	At once	
P0-08	Second inertia ratio						
	Unit	Default setting	Range	Suitable mode	Change	Effective	
	%	200	0~10000	All the modes	Any	At once	
P1-36	/I-SEL signal						
	Signal	Type	Default setting	Using	Suitable mode	Change	Effective
	/I-SEL	Input	n.0000	Need to distribute	All the modes	Any	At once
	/I-SEL signal	Signal state	Inertia ratio				
		0	First inertia ratio				
		1	Second inertia ratio				
Note: the 0, 1 is signal state but not terminal state.							

6-4. Rigidity level adjustment

User can set the servo rigidity through P0-04. The rigidity level is from 0 to 31. Each level has 5 parameters. The default parameters will fill in P1-00~P1-04 after setting the rigidity level. User can change the default parameters at the selected level. The system will save the changed parameters. the higher the level, the stronger the rigidity.

Low ←mechanical rigidity→ high

Low ←servo gain→ high



Low ←reponse→ high



Changing the rigidity level will change the first group of parameters but will not change the second group of parameters. Each level parameters become default value after restoring factory default settings.

6-5. The experience of gain adjustment

First, it is important to know the mechanical structure. Common synchronous machine with driving has less rigidity, decrease the servo rigidity to match it. Large inertia mechanical system has long response time, it needs to decrease the servo rigidity and set more acceleration/deceleration time for speed command. For the mechanical system with small load inertia and strong rigidity such as coupling, it needs to increase the servo rigidity to improve the positioning efficiency.

Servo parameter adjustment method in position mode for typical mechanical system:

(1) Mechanical system: synchronous with coupling, large load inertia.

Servo system: decrease the rigidity, increase speed loop integral time (P1-01), decrease the position loop gain (P1-02). If the response is not enough after adjusting, increase the speed loop gain (P1-00).

Typical setting: P1-00=100, P1-01=1000, P1-02=50.

(2) Mechanical system: synchronous with coupling, small load inertia and load torque.

Servo system: follow the default parameter.

(3) Mechanical system: rigidity coupling, large load inertia.

Servo system: same to (1).

Typical setting: P1-00=100, P1-01=1000, P1-02=80.

(4) Mechanical system: rigidity coupling, small load inertia, strong rigidity.

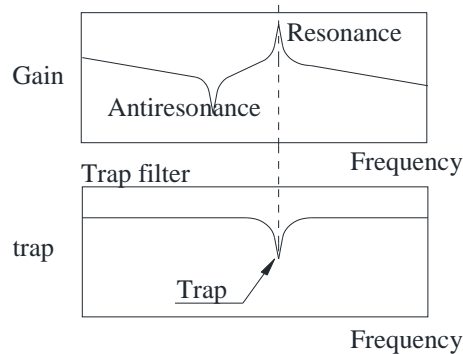
Servo system: P1-00=100, P1-01=300, P1-02=150. If it cannot meet the requirements, please increase the position loop feedforward, for example set P1-10 to 20.

Note: above typical settings only show the direction to adjust the parameters. The settings cannot be suitable for all the conditions.

7 Servo vibration suppression

7-1. Servo vibration suppression

There maybe one frequency equal to mechanical resonance frequency when servo is running. When the two frequencies are the same, the system will have serious vibration and noise. DS3-PQA servo has trap function. The servo can save the mechanical resonance frequency, and open the trap filter to suppress this frequency. The trap filter needs to set the trap frequency, trap attenuation and trap bandwidth.



P2-15	First trap frequency					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	4000	20~4000	All the modes	Any	At once
P2-16	First trap attenuation					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1dB	0	0~500	All the modes	Any	At once
P2-17	First trap bandwidth					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	2	0~20	All the modes	Any	At once
P2-18	Second trap frequency					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	4000	20~4000	All the modes	Any	At once
P2-19	Second trap attenuation					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1dB	0	0~500	All the modes	Any	At once
P2-20	Second trap bandwidth					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	2	0~20	All the modes	Any	At once
P2-21	Third trap frequency					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	4000	20~4000	All the modes	Any	At once
P2-22	Third trap attenuation					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1dB	0	0~500	All the modes	Any	At once
P2-23	Third trap bandwidth					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	2	0~20	All the modes	Any	At once
P2-24	Fourth trap frequency					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	4000	20~4000	All the modes	Any	At once
P2-25	Fourth trap attenuation					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1dB	0	0~500	All the modes	Any	At once
P2-26	Fourth trap bandwidth					

	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	2	0~20	All the modes	Any	At once
P2-27	Fifth trap frequency					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	4000	20~4000	All the modes	Any	At once
P2-28	Fifth trap attenuation					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1dB	0	0~500	All the modes	Any	At once
P2-29	Fifth trap bandwidth					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	2	0~20	All the modes	Any	At once
P2-30	Sixth trap frequency					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	4000	20~4000	All the modes	Any	At once
P2-31	Sixth trap attenuation					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	0.1dB	0	0~500	All the modes	Any	At once
P2-32	Sixth trap bandwidth					
	Unit	Default setting	Range	Suitable mode	Change	Effective
	Hz	2	0~20	All the modes	Any	At once



1. vibration suppression function needs to connect the servo software to set. When trap frequency is 4000, close the trap filter.
2. the larger the filter attenuation and bandwidth, the more obvious the vibration suppression effect. But the signal phase delay becomes larger and system response speed is slower.

8 Specification and dimension

8-1. Servo motor

8-1-1. Servo motor specification

Please refer to this chapter when selecting the servo drive.

Voltage level		220V				
Motor type MS-	60ST-			80ST-		
	M00630	M01330		M02430		M03520
	□□-20P2	□□-20P4		□□-20P7		
Motor code	1003	0004	1004	0011	1011	0012
Rated power (KW)	0.2	0.4	0.4	0.75		
Rated current (A)	1.8	2.5	1.8	3.0	2.6	3.0
Rated speed (rpm)	3000	3000	3000	3000	3000	2000
Max speed (rpm)	4000	4000	4000	4000	4000	2500
Rated torque (N m)	0.637	1.27	1.27	2.39	2.39	3.5
Peak torque (N m)	1.91	3.8	3.8	7.1	7.1	10.5
Back EMF constat (V/krpm)	26	28	162	48	56.6	71
Torque coefficient (N m/A)	0.37	0.5	0.68	0.8	0.92	1.17
Rotor inertia (Kg m ²)	0.18×10 ⁻⁴	0.438×10 ⁻⁴	0.53×10 ⁻⁴	1.82×10 ⁻⁴	0.65×10 ⁻³	2.63×10 ⁻⁴
Winding resistor (Ω)	3.5	3.49	3.8	2.88	2.7	3.65
Winding inductance (mH)	8.32	8.47	11.51	6.40	6.25	8.80
Electrical time constant (ms)	2.38	2.4	3.03	2.22	2.3	2.41
Weight (Kg)	1.1	1.78	1.72	2.9	2.87	3.7
Encoder ppr (PPR)	2500					
Pole pairs	4					
Motor insulation level	Class B (130°C)					
Protection level	IP64	IP64				
Ambient	Temperature	-20°C ~ +50°C				
	Humidity	Relative humidity < 90% (no condensation)				

Voltage level		220V			
Motor type MS-	90ST-	110ST-		130ST-	
	M02430	M04030	M05030	M06025	
	□□-20P7	□□-21P 2	□□-21P5	□□-21P5	
Motor code	0021	0031	0032	0042	1042
Rated power (KW)	0.75	1.2	1.5	1.5	1.5
Rated current (A)	3.0	5.0	6.0	6.0	7.4
Rated speed (rpm)	3000	3000	3000	2500	2500

Max speed (rpm)	4000	3500	3500	3000	3000
Rated torque (N m)	2.4	4	5	6	6
Peak torque (N m)	7.1	12	15	18	18
Back EMF const (V/krpm)	51	54	62	65	82
Torque coefficient (N m/A)	0.8	0.8	0.83	1.0	0.81
Rotor inertia (Kg m ²)	2.45×10 ⁻⁴	0.54×10 ⁻³	0.63×10 ⁻³	1.26×10 ⁻³	0.84×10 ⁻³
Winding resistor (Ω)	3.20	1.09	1.03	1.21	0.7
Winding inductance (mH)	7.00	3.30	3.43	3.87	5.07
Electrical time constant (ms)	2.19	3.03	3.33	3.20	7.5
Weight (Kg)	3.4	5.5	6.1	8.9	7.16
Encoder ppr (PPR)	2500				
Pole pairs	4				
Motor insulation level	Class B (130°C)				
Protection level	IP64				
Ambient	Temperature	-20°C ~ +50°C			
	Humidity	Relative humidity < 90% (no condensation)			

Voltage level	220V		
Motor type MS-	130ST-		
	M10015	M07725	M15015
	□□-21P5	□□-22P0	□□-22P3
Motor code	0044	0043	0046
Rated power (KW)	1.5	2.0	2.3
Rated current (A)	6.0	7.5	9.5
Rated speed (rpm)	1500	2500	1500
Max speed (rpm)	2000	3000	2000
Rated torque (N m)	10	7.7	15
Peak torque (N m)	25	22	30
Back EMF const (V/krpm)	103	68	114
Torque coefficient (N m/A)	1.67	1.03	1.58
Rotor inertia (Kg m ²)	1.94×10 ⁻³	1.53×10 ⁻³	2.77×10 ⁻³
Winding resistor (Ω)	1.29	1.01	1.10
Winding inductance (mH)	5.07	2.94	4.45
Electrical time constant (ms)	3.93	2.91	4.05
Weight (Kg)	11.5	10.0	14.4
Encoder ppr (PPR)	2500		
Pole pairs	4		
Motor insulation level	Class B (130°C)		
Protection level	IP64		
Ambient	Temperature	-20°C ~ +50°C	
	Humidity	Relative humidity < 90% (no condensation)	

Voltage level	380V					
Motor type MS-	110ST-		130ST-		130ST-	180ST-
	M04030	M05030	M06025	M10015	M10030	M19015
	□□-41P2	□□-41P5	□□-41P5		□□-43P0	
Motor code	0131	0132	0142	0144	1148	0156
Rated power (KW)	1.2	1.5	1.5	1.5	3.0	3.0
Rated current (A)	3.0	3.9	3.7	3.5	6.4	7.5
Rated speed (rpm)	3000	3000	2500	1500	3000	1500
Max speed (rpm)	3500	3500	3000	2000	3500	2000
Rated torque (N m)	4	5	6	10	10	19
Peak torque (N m)	12	15	18	25	25	47
Back EMF constat (V/krpm)	89	90	110	177	88.3	158
Torque coefficient (N m/A)	1.33	1.11	1.62	2.86	1.56	2.53
Rotor inertia (Kg m ²)	0.54×10 ⁻³	0.63×10 ⁻³	1.26×10 ⁻³	1.94×10 ⁻³	1.125×10 ⁻³	3.8×10 ⁻³
Winding resistor (Ω)	3.30	2.28	3.50	4.37	0.46	1.15
Winding inductance (mH)	8.78	7.40	10.75	15.00	1.52	6.40
Electrical time constant (ms)	2.66	3.25	3.07	3.46	3.33	5.57
Weight (Kg)	5.5	6.1	8.9	11.5	11.4	20.5
Encoder ppr (PPR)	2500					
Pole pairs	4					
Motor insulation level	Class B (130°C)					
Protection level	IP64					
Ambient	Temperature	-20°C ~ +50°C				
	Humidity	Relative humidity < 90% (no condensation)				

■ 60, 80 and 90 series servomotors winding connector

Motor Winding connector	Winding Name	U	V	W	PE
	Connector	1	3	2	4

■ 60, 80 and 90 series servo motor encoder connector

Signal	5V	0V	B+	Z-	U+	Z+	U-	A+	V+	W+	V-	A-	B-	W-	PE
Connector	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1

■ 110, 130, 180 series servo motor winding connector

Motor Winding connector	Winding Name	U	V	W	PE
	Connector	2	3	4	1

■ 110, 130, 180 series servo motor encoder connector

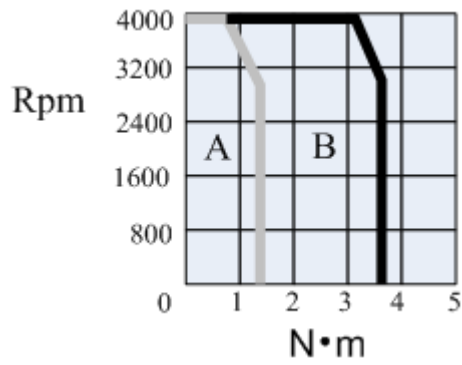
Signal	5V	0V	A+	B+	Z+	A-	B-	Z-	U+	V+	W+	U-	V-	W-	PE
Connector	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1

8-1-2. Torque-Speed Feature

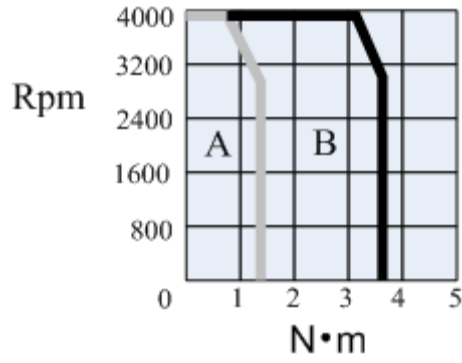
A: continuous using area

B: repeated using area

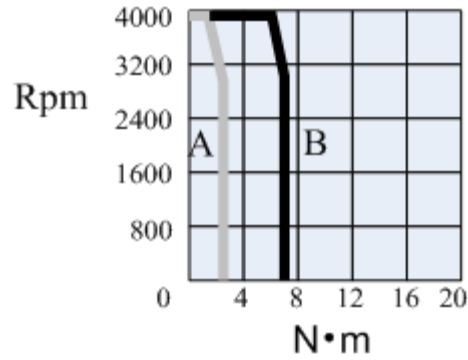
MS-60ST-M00630□□-20P2



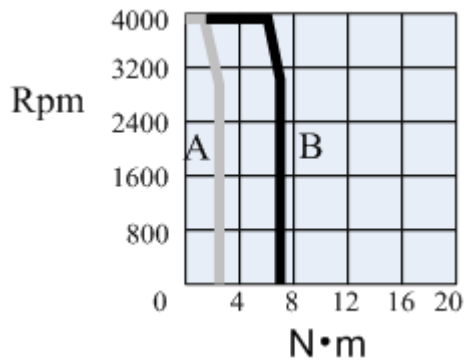
MS-60ST-M01330□□-20P4



MS-80ST-M02430□□-20P7

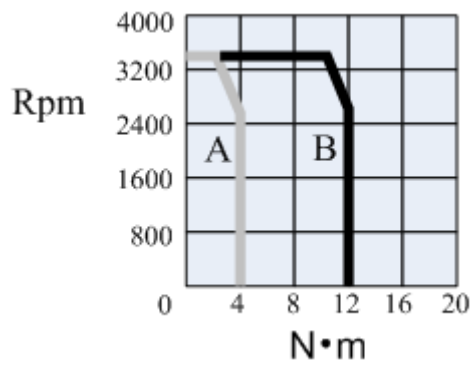


MS-90ST-M02430□□-20P7



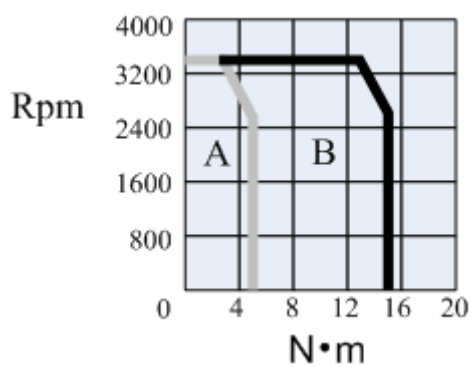
MS-110ST-M04030□□-21P2

MS-110ST-M04030□□-41P2

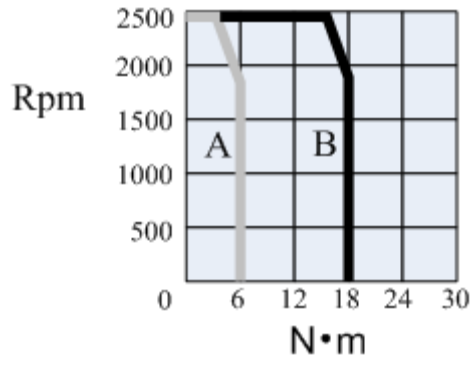


MS-110ST-M05030□□-21P5

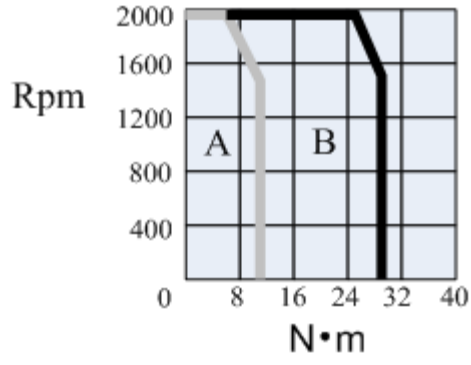
MS-110ST-M05030□□-41P5



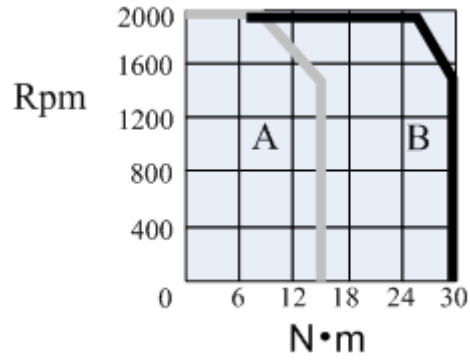
MS-130ST-M06025□□-21P5
 MS-130ST-M06025□□-41P5



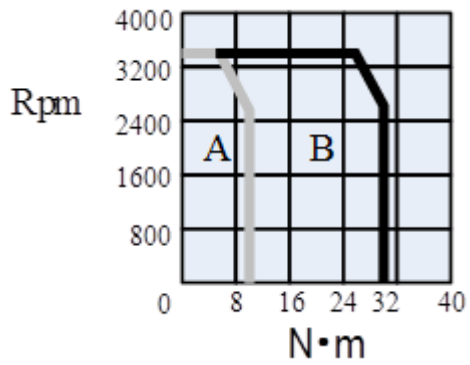
MS-130ST-M10015□□-21P5
 MS-130ST-M10015□□-41P5



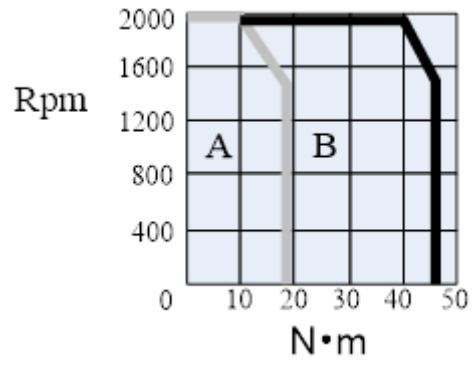
MS-130ST-M15015□□-22P3



MS-130ST-M10030□□-43P0

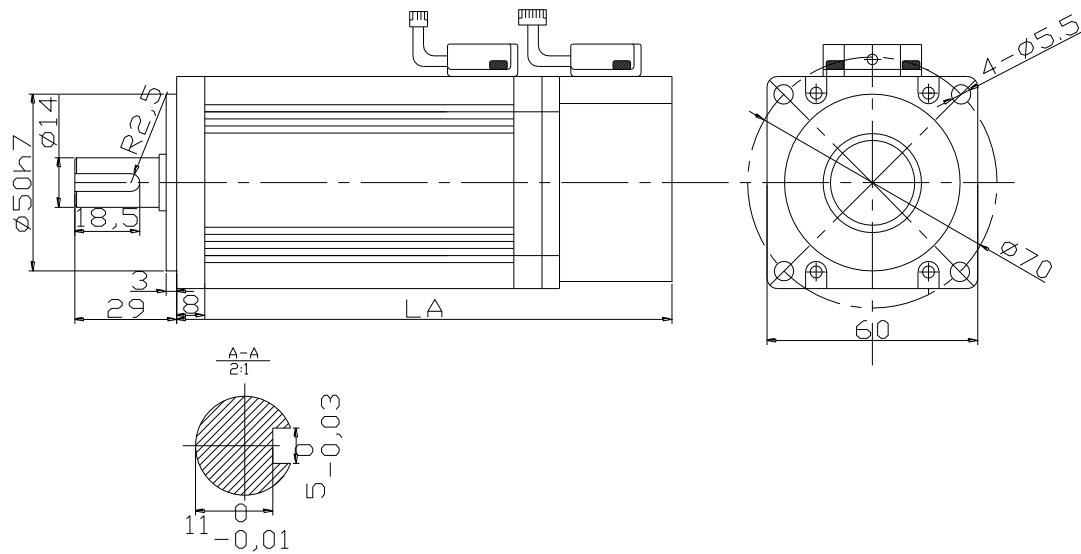


MS-180ST-M19015□□-43P0



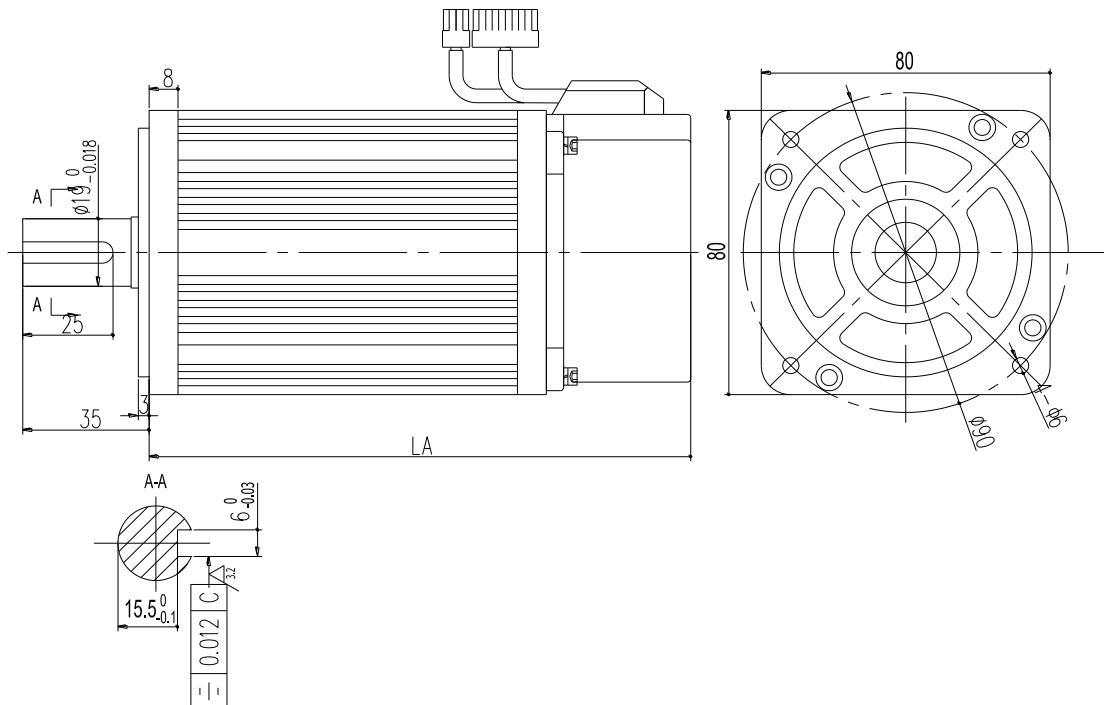
8-1-3. Servo motor dimensions

■ Dimensions of 60 series servo motors (unit: mm)



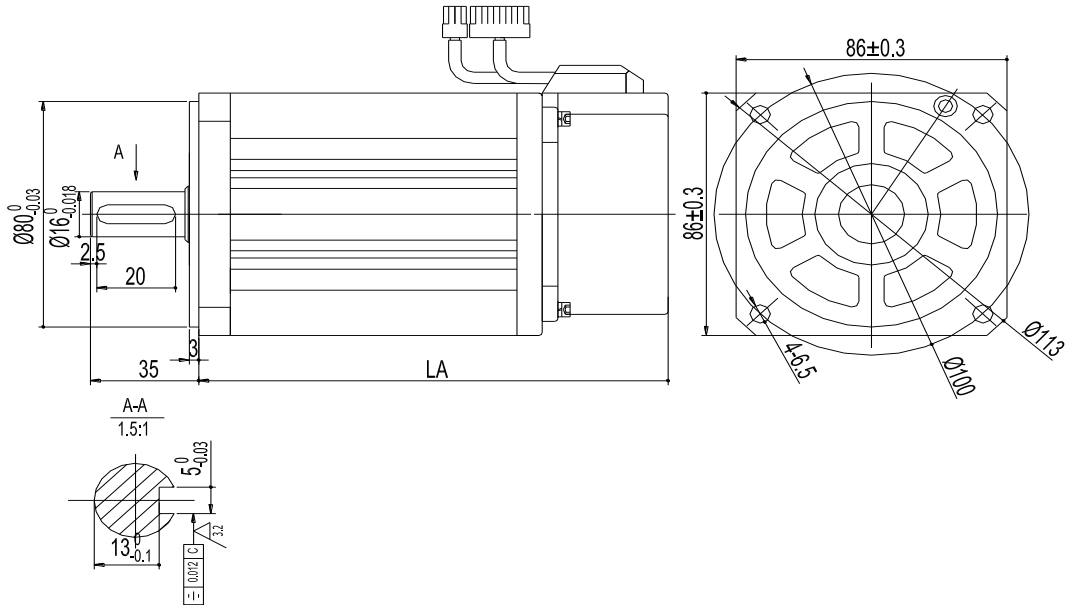
Motor type	LA	
	Normal	With brake
MS-60ST-M00630□□-20P2	110	
MS-60ST-M01330□□-20P4	141	189

■ Dimensions of 80 series servo motors (unit: mm)



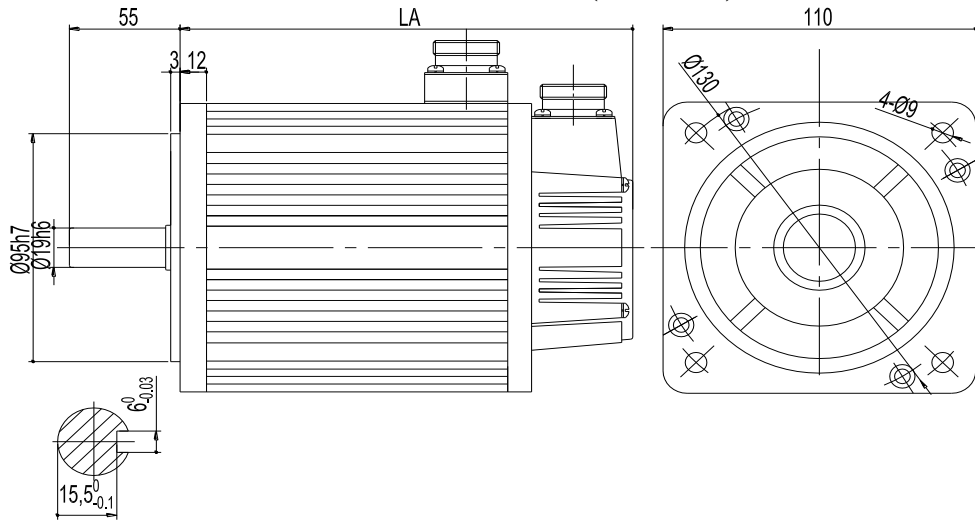
Type	LA	
	Normal	With brake
MS-80ST-M02430□□-20P7	150	191
MS-80ST-M03520□□-20P7	178	219

■ Dimensions of 90 series servo motors (unit: mm)



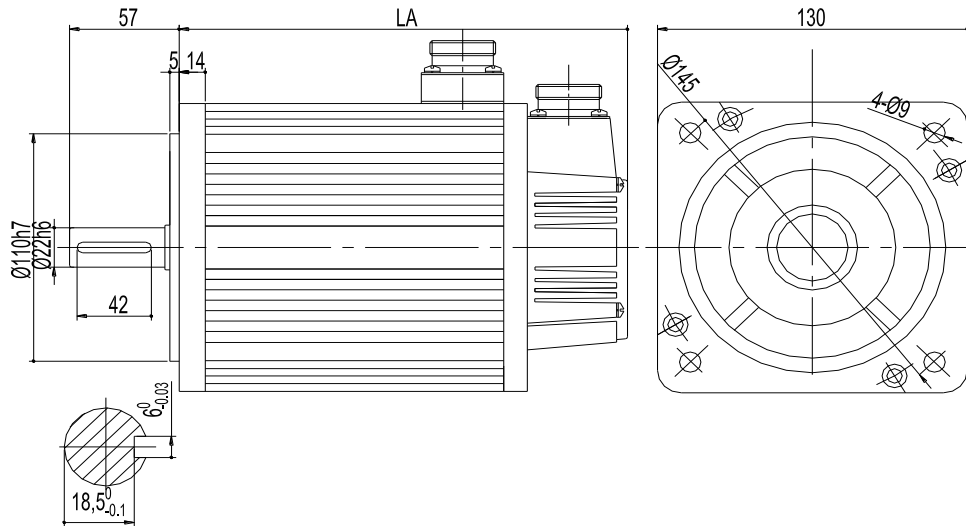
Type	LA	
	Normal	With brake
MS-90ST-M02430□□-20P7	149	194

■ Dimensions of 110 series servo motors (unit: mm)



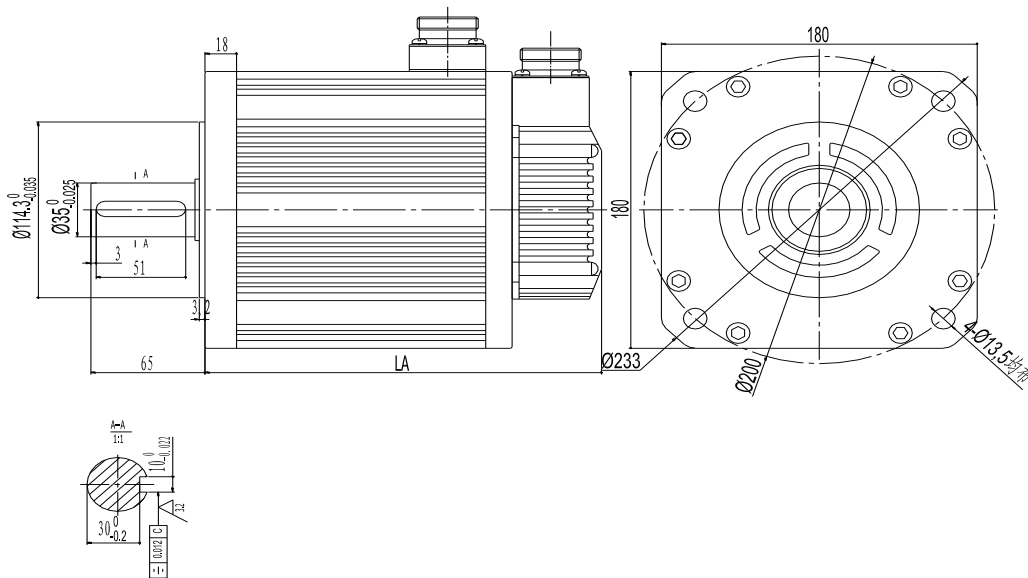
Type	LA	
	Normal	With brake
MS-110ST-M04030□□-21P2	189	263
MS-110ST-M04030□□-41P2		
MS-110ST-M05030□□-21P5	204	278
MS-110ST-M05030□□-41P5		

■ Dimensions of 130 series servo motors (unit: mm)



Type	LA	
	Normal	With brake
MS-130ST-M06025□□-21P5	179	236
MS-130ST-M06025□□-41P5		
MS-130ST-M10015□□-21P5	213	270
MS-130ST-M10015□□-41P5		
MS-130ST-M07725□□-22P0	192	249
MS-130ST-M15015□□-22P3	241	298
MS-130ST-M10030□□-43P0	230	288

■ Dimensions of 180 series servo motors (unit: mm)



Type	LA	
	Normal	With brake
MS-180ST-M19015□□-43P0	232	289

8-2. Servo drives

8-2-1. General specification

Servo unit		DS3-PQA series servo drive
Encoder		Incremental encoder (2500 ppr)
Input power		DS3-20P2-PQA~DS3-20P7-PQA :single phase/3 phase AC200~240V, 50/60Hz DS3-21P5-PQA~DS3-22P3-PQA: 3 phase AC200~240V, 50/60Hz DS3-41P5-PQA~DS3-47P5-PQA: 3 phase AC380V, 50/60Hz
Control mode		3-phase full-wave rectifier control IPM PWM sine-wave current dirve
Using	Temperature	0 ~ +50 °C/-20 ~ +85 °C
	Humidity	Below 90% RH (no condensation)
	Vibration /impact resistance	4.9m/s ² / 19.6m/s ²
Structure		Base installation

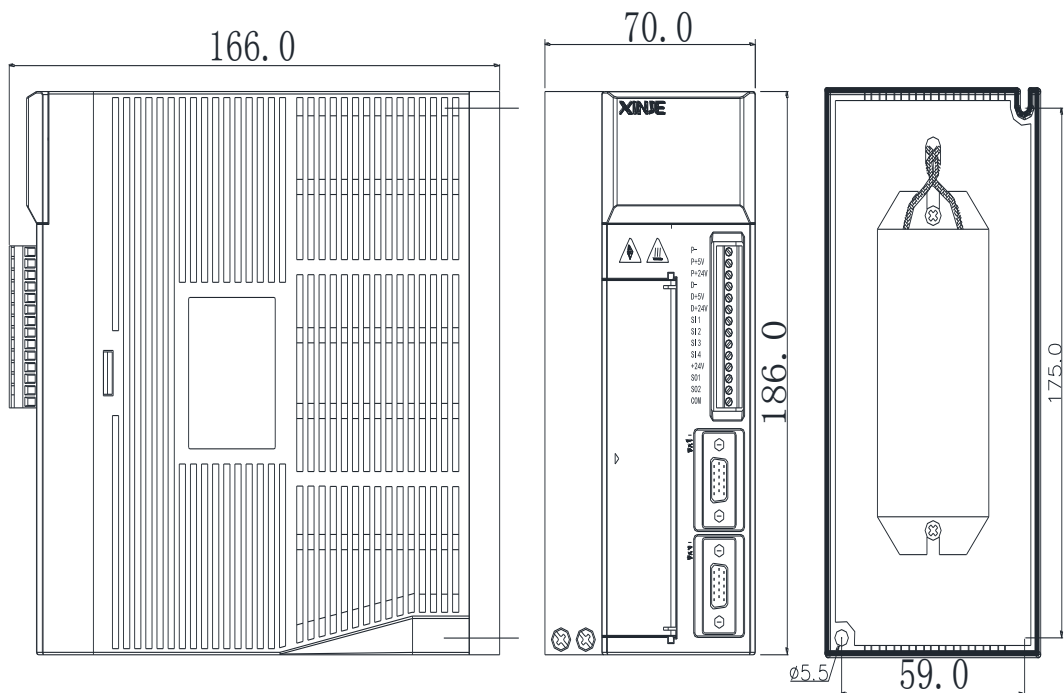
8-2-2. Performance specification

Servo drive type		DS3-PQA series servo drive		
Speed torque control mode	Performance	Speed control range	1: 4000 (the lower limit of speed control range, not stop at rated load torque)	
		Speed change rate	Load change rate	0~100% load: below $\pm 0.01\%$ (rated speed)
			Voltage change rate	Rated voltage $\pm 10\%$: 0% (rated speed)
			Temperature change rate	20 \pm 25°C: below $\pm 0.1\%$ (rated speed)
		Frequency feature	250Hz (JL \leq JM)	
		Soft start time	0~65535ms (set acceleration, deceleration individually)	
		Position control mode	Performance	Feedforward compensation
Positioning finished width	0~250 command unit (resolution is 1 command unit)			
Input signal	Command pulse		Input pulse type	Sign+pulse, CW, CCW mode, AB phase
			Input pulse state	Collector (+24V), differential signal input
			Input pulse frequency	Open collector input: 200kbps Differential input: 500kbps
Control signal	Clear signal (/CLR)			
I/O signal	Encoder feedback output		Differential output	
	Input signal	External input	5	
		Changeable signal distribution	/S-ON, /P-CON, /P-OT, /N-OT, /ALM-RST, /PCL, /NCL, /SPD-D, /SPD-A, /SPD-B, /C-SEL, /ZCLAMP, /CLR, /G-SEL, /CHGSTP, /I-SEL	
	Output signal	External output	3	
Changeable		/COIN, /V-CMP, /TGON, /S-RDY, /CLT, /VLT, /BK, /WARN,		

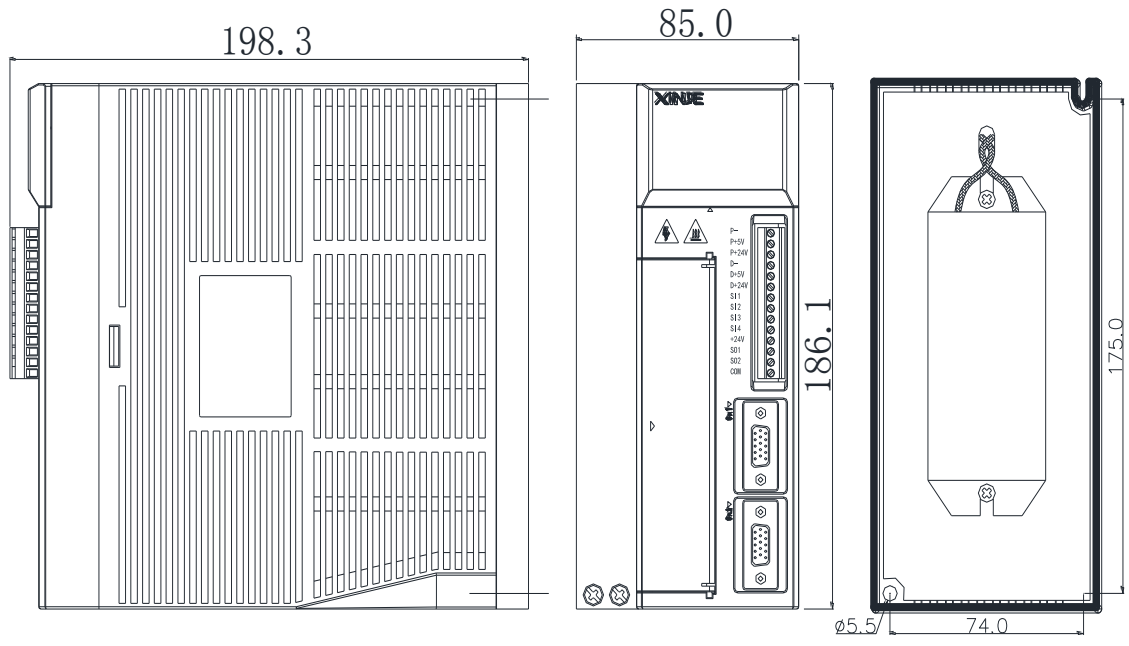
		signal distribution	/NEAR, /ALM, /COIN_HD, /V-RDY, /user-defined output 1, /user-defined output 2		
Built-in function	Dynamic brake (DB)		No		
	Regeneration		internal regenerative resistor		
	Regenerative frequency (s/minute discharging)		DS3-21P5-PQA: 2.5 s/min DS3-20P4-PQA/DS3-20P7-PQA: 1.6 s/min		
	Over range (OT) protection		For P-OT, N-OT action, deceleration stop or inertia stop		
	Electronic gear		$0.01 \leq B/A \leq 100$		
	Protection		Program error, parameter error, overvoltage, undervoltage, regeneration error, overtemperature, overcurrent, overspeed, analog input error, position offset overflow, output shorting, current error, encoder cut, encoder error, overload, power off when running, write parameter error...		
	LED display		Charge, power supply, 7-segment LED $\times 5$ (built-in digital operate)		
	communication	COM1	Connector	RS232, connect to PC	
			Serial parameter	Baud rate 19200; data bit 8; stop bit 1; communication protocol: ModbusRTU slave; Modbus station No.1	
			Function	Debug online	
COM2		Connector	RS485, connect to PLC, HMI, PC and other devices		
		Serial parameter	Serial parameter can be set; communication protocol: Modbus RTU slave; Modbus station No. can be set		
		Function	State display, user constant setting, monitor display, alarm display, alarm display, special control, online debug		

8-2-3. Servo drive dimensions

- DS3-20P2-PQA/ DS3-20P4-PQA/DS3-20P7-PQA (unit: mm)



■ DS3-21P5-PQA/DS3-22P3-PQA/DS3-41P5-PQA



9 Alarm Information

DS3-PQA series alarm code format is E-XX□, XX is main category, □ is sub categories.

XX	□	Alarm	Explanation	Reasons	Solution
01	0	E-010	Hardware version not match	The hardware version is error	Contact us
	2	E-012	System loading error	The program damaged	Contact us
	3	E-013	FPGA loading error	1. program damaged 2. hardware damaged	Contact us
	4	E-014	FPGA visiting error	1. program damaged 2. hardware damaged 3. external interference is too serious	Contact us
	5	E-015	Program running error	Program damaged	Contact us
	6	E-016	CPU running error	Hardware damaged	Contact us
	7	E-017	CPU running overtime	Program damaged	Contact us
	8	E-018	FPGA running overtime	Program damaged	Contact us
	9	E-019	System password error	Program damaged	Contact us
02	0	E-020	Parameter loading error	Parameter self-checking cannot pass	Re-power the servo to restore default setting or contact us
	1	E-021	Parameter out of range	The setting value out of range	Check the parameters and set again
	2	E-022	Parameter conflict	TREF or VREF function setting conflict	Check the TREF or VREF setting
	3	E-023	Sampling channel setting error	User-defined output trigger channel or data monitor channel setting error	Check the setting parameter
03	0	E-030	Bus overvoltage	1. power grid voltage too high 2. not connect regenerative resistor 3. regenerative resistor broken or value too large	1. check the power grid 2. connect the regenerative resistor 3. check the regenerative resistor value and the power configuration
04	0	E-040	Bus undervoltage	Power grid voltage too low	Check the power grid
	1	E-041	Drive power off	Drive power cut off	Check the power supply
06	0	E-060	Module temperature too high	1. long time running with large load 2. environment temperature too high 3. cooling fan broken	1. decrease the load 2. good ventilation 3. change the cooling fan
	1	E-061	Motor temperature too high	1. long time running with large load 2. environment temperature too high	1. decrease the load 2. good ventilation

07	0	E-070	U phase current too large	1. drive U output short circuit 2. motor fault	Change the broken motor, check the motor UVW wiring
	1	E-071	V phase current too large	1. drive V output short circuit 2. motor fault	Change the broken motor, check the motor UVW wiring
	2	E-072	W phase current too large	1. drive W output short circuit 2. motor fault	Change the broken motor, check the motor UVW wiring
	3	E-073	Torque current too large	1. drive UVW output short circuit 2. motor code error 3. motor fault	1. check motor UVW wiring 2. confirm the motor code 3. change the damaged motor
	4	E-074	Excitation current too large	1. drive UVW output short circuit 2. motor code error 3. motor fault	1. check motor UVW wiring 2. confirm the motor code 3. change the damaged motor
08	0	E-080	Over speed	1. Motor speed too fast 2. motor UVW wiring error	1. check if there is external force make the motor over speed 2. check motor UVW wiring
	1	E-081	Speed offset too large	The difference between motor actual speed and setting speed is too large	Check the wiring, whether the motor stall
09	2	E-092	TREF zero calibration value error	Hardware damaged	Contact us
	3	E-093	VREF zero calibration value error	Hardware damaged	Contact us
10	0	E-100	Position offset too large	The difference between setting position and actual position is over the limit	1. check whether the motor stall, decrease the position setting speed 2. increase the offset pulse limit P0-23
11	0	E-110	Motor UVW short circuit	External short circuit	Check the UVW wiring, change the damaged motor
12	0	E-120	Current sensor error	Current sensor damaged or external interference too large	Check the ground wiring or contact us
	1	E-121	U phase current sampling zero calibration value error	Current sensor damaged or external interference too large	Check the ground wiring or contact us
	2	E-122	V phase current sampling zero calibration value error	Current sensor damaged or external interference too large	Check the ground wiring or contact us
	3	E-123	W phase current sampling zero calibration value error	Current sensor damaged or external interference too large	Check the ground wiring or contact us
13	0	E-130	Motor quadrature encoder AB or UVW broken circuit	AB or UVW broken circuit	Cut off the drive power, Check the wiring, then repower the drive
14	2	E-142	Motor encoder Z phase disconnected	Z phase disconnected	Cut off the drive power, Check the wiring, then repower the drive
15	0	E-150	Motor encoder U	U phase disconnected	Check the wiring

			phase disconnected		
	1	E-151	Motor encoder V phase disconnected	V phase disconnected	Check the wiring
	2	E-152	Motor encoder W phase disconnected	W phase disconnected	Check the wiring
16	0	E-160	Motor output power overload	Motor output power over the rated power	1. Change larger power motor 2. Check the motor shaft wiring
	1	E-161	The heating power overload	Motor overheating	1. Change larger power motor 2. Check the motor shaft wiring
	4	E-164	The bus capacitor overload	Power supply not stable, motor load too large, cause the bus capacitor charge frequently	1. use 3 phase 220V power supply for 220V drive 2. change larger power motor
17	0	E-170	Motor undervoltage when running	Bus voltage too low when running	1. check the power grid voltage fluctuation 2. wait the bus voltage stable, then repower
20	0	E-200	Regenerative resistor overload	Regenerative resistor discharging power over the rated	Change larger power regenerative resistor
	1	E-201	Regenerative resistor discharge too long time	Regenerative resistor connection error or value too large	Change small value resistor and check the wiring
21	0	E-210	Dynamic brake resistor connection error	Dynamic brake resistor not work	Check the dynamic brake resistor connection
	1	E-211	Dynamic brake resistor overload	Dynamic brake resistor heating power over the rated	Use external dynamic brake resistor, change larger power dynamic brake resistor
22	0	E-220	Encoder communication error	The encoder communication with drive failed	Check the encoder wiring
	1	E-221	Encoder parameter error	Encoder parameter checking	Repower on to return default setting, or contact us
	2	E-222	Encoder battery low	Absolution value encoder battery low	Change the battery
	3	E-223	Encoder return data error	Encoder communication error	Check the encoder wiring
	4	E-224	Encoder speed too fast when power on	Motor run fast by external force when the drive power on	Repower when the motor stop
	5	E-225	Encoder accelerated speed error	Motor vibration serious or encoder damaged	Repower when the motor stop or contact us
	6	E-226	Encoder temperature too high	Motor temperature too high, the heat transfer to the encoder	Decrease the load, change larger power motor, good ventilation
	7	E-227	Encoder overcurrent	Encoder hardware error	Contact us
23	0	E-230	Second position feedback AB phase or UVW disconnected	AB phase or UVW circuit broken	Check the connection
	5	E-235	Second position feedback Z phase disconnected	Z phase circuit broken	Check the connection

24	0	E-240	Second position feedback communication error	Drive cannot communicate with encoder	Check the encoder wiring
	1	E-241	Second position feedback parameter error	Encoder parameters checking	Repower on to return default setting, or contact us
	2	E-242	Second position feedback battery low	Absolute value encoder battery low	Change the battery
	3	E-243	Second position feedback data error	Encoder communication error	Check the encoder wiring
	4	E-244	Second position feedback speed too fast when power on	Motor run fast by external force when the drive power on	Repower on when motor stop
	5	E-245	Second position feedback accelerated speed error	Motor vibration serious or encoder broken	Repower on when motor stop, or contact us
	6	E-246	Second position feedback temperature too high	Motor temperature too high, the heat transfer to the encoder	Decrease the load or change larger power motor, enhance the ventilation
	7	E-247	Second position feedback overcurrent	Encoder hardware fault	Contact us
26	0	E-260	Over range alarm	Check the over range signal and the over range mode is alarm	If it no need to alarm after over range, user can change the over range signal mode
	1	E-261	Over range signal connection error	1. motor run forward and encounter the reverse over range signal 2. motor run reverse and encounter the forward over range signal	Check the over range connection and over range terminal distribution
	2	E-262	Control stop over time	1. inertia too big 2. stop overtime too short 3. brake torque too small	1. decrease the inertia or use motor with brake 2. increase stop overtime P0-30 3. increase brake torque P3-32
28	0	E-280	Vibration too serious	Motor vibration too serious	Decrease servo position loop or speed loop gain, check the motor shaft connection
30	0	E-300	Motion bus lose synchronization	Motion bus communication error	Check the motion bus connection
31	0	E-310	Motor code error	Motor code error	Set the correct motor code

Appendix 1 Parameter list

○ means the parameter can be modified when the servo is OFF, and effective when servo is ON.

● means the parameter can be modified any time, and effective when re-power on the servo.

√ means the parameter can be modified any time, and effective immediately.

Adding “n.” before the parameter means the value is hex.

Parameter: PX-XX = n.xx xx

PX-XX.H ← | → PX-XX.L

P0: function selection

P0-	Function	Unit	Default	Range	Effective	Suitable mode	Chapter
01	Submode 1 1: torque (command) 2: torque (analog) 3: speed (command) 4: speed (analog) 5: position (internal) Note: hardware versoin v3.2.1 and above support this mode 6: position (pulse) 7: speed (pulse)	-	6	1~7	○	All the modes	5-1
02	Submode 2 1: torque (command) 2: torque (analog) 3: speed (command) 4: speed (analog) 5: position (internal) Note: hardware versoin v3.2.1 and above support this mode 6: position (pulse) 7: speed (pulse)	-	0	1~7	○	All the modes	5-1
03	Enable mode: 0: not enable 1: IO/SON input signal 2: software enable(panel/Modbus) panel F1-05 write in 1; Modbus write 1 to register 0x2105. Write 0 cancel enable. 3: bus enable (support motion bus model)	-	1	0~2	○	All the modes	5-2-1
04	Rigidity level 0~31, the higher the level, the stronger the rigidity	-	15	0~31	○	All the modes	6-4
05	Rotation direction selection	-	0	0, 1	○	All the modes	5-2-2
07	First inertia ratio I-SEL control the switching of first inertia ratio and second inertia ratio	-	200	0~10000	√	All the modes	6-3
08	Second inertia ratio	-	200	0~10000	√	All the modes	6-3
09	Input pulse command positive direction	-	0	0-1	○	6, 7	5-3-2
10 xxx□	0: CW/CCW 1: AB 2: P+D	-	2	0~2	○	6, 7	5-3-2
10 xx□x	0: falling edge is effective 1: rising edge is effective	-	0	0~1	○	6, 7	5-3-2

11	Pulses per circle low bit×1	-	0	0~9999	√	6	5-3-3
12	Pulses per circle high bit×10000	-	1	0~65535	√	6	5-3-3
13	Numerator of Electronic gear ratio	-	1	1~65535	√	6	5-3-3
14	Denomination of electronic gear ratio	-	1	1~65535	√	6	5-3-3
15	Pulse frequency corresponding to speed mode rated speed	*100 Hz	1000	0~10000	○	7	5-7-3
16	Speed command pulse filter time	0.01ms	100	0~10000	○	7	5-7-4
18	Encoder feedback pulse per circle×1	1	2500	0~9999	○	3, 4, 5, 6, 7	5-11-6
19	Encoder feedback pulse per circle×10000	10000	0	0~65535	○	3, 4, 5, 6, 7	5-11-6
20	Encoder pulse frequency division (numerator)	-	1	0~65535	○	3, 4, 5, 6, 7	5-11-6
21	Encoder pulse frequency division (denomination)	-	1	0~65535	○	3, 4, 5, 6, 7	5-11-6
23	Pulse offset limit	*256 command unit	100	0~65535	√	All the modes	5-3-9
24	Discharge resistor type 0: internal 1: external	-	0	0~1	○	All the modes	3-4
25	Discharge resistor power	W	40	0~65535	√	All the modes	3-4
26	Discharge resistor value	Ω	25	0~65535	√	All the modes	3-4
27	Servo OFF stop mode 0: inertia running stop, keep the inertia running state after stop 2: deceleration running stop, keep inertia running state after stop	-	0	0, 2	○	All the modes	5-2-3
28	Servo over range stop mode 0: deceleration stop, over range direction torque is 0 after stop, receive command 1: inertia stop, over range direction torque is 0 after stop, receive command 2: deceleration stop, over range direction not receive command after stop 3: alarm (E-260)	-	2	0~3	○	All the modes	5-2-3
29	Servo alarm stop mode 0: inertia stop, keep inertia running state after stop 2: deceleration stop, keep inertia running state after stop	-	0	0, 2	○	All the modes	5-2-3
30	Stop overtime time	ms	2000	0~65535	○	All the modes	5-2-3
33	Motor code	-		0~65535	●	All the modes	4-7

P1: control parameters

P1-	Name	Unit	Default	Range	Effective	Suitable mode	Chapter
00	The gain of first speed loop	Hz	100	0~10000	√	3,4,5,6,7	6-1-1
01	First speed loop integral time	0.1ms	400	0~10000	√	3,4,5,6,7	6-1-1
02	The gain of first position loop	1/s	100	0~10000	√	5, 6	6-1-1
03	First speed feedback response level	Hz	50	0~4000	√	All the modes	6-1-1
04	First torque command filter time	0.01ms	0	0~3000	√	All the modes	6-1-1
05	Second speed loop gain	Hz	100	0~10000	√	3,4,5,6,7	6-1-1
06	Second speed loop integral time	0.1ms	400	0~10000	√	3,4,5,6,7	6-1-1
07	Second position loop gain	1/s	100	0~10000	√	5, 6	6-1-1
08	Second speed feedback response level	Hz	50	0~100	√	All the modes	6-1-1
09	Second torque command filter time	0.01ms	0	0~3000	√	All the modes	6-1-2
10	Speed Feedforward gain	1%	0	0~1000	√	5, 6	6-1-2
11	Speed feedforward filter time	0.01ms	10	0~10000	√	5, 6	6-1-2
12	Torque feedforward	1%	0	0~1000	√	5, 6	6-1-2
13	Torque feedforward filter time	0.01ms	10	0~10000	√	5, 6	6-1-2
14	Position gain switching mode	-	0	0~6	√	7	6-2
16	Position gain switching comparison value 0: fixed the first group 1: fixed the second group 2: G-SEL signal 3: torque command 4: speed command 5: position offset 6: speed feedback	Related to the mode	0	-32768~32767	√	7	6-2
17	Position gain switching comparison value hysteresis loop	Related to the mode	0	-32768~32767	√	7	6-2
18	Speed gain switching mode	-	0	0~6	○	5, 6	6-2
20	Speed gain switching level 0: fixed the first group 1: fixed the second group 2: G-SEL signal 3: torque command 4: speed command 5: position offset 6: speed feedback	Related to the mode	0	-32768~32767	√	5, 6	6-2
21	Speed gain switching comparison value hysteresis loop	Related to the mode	0	-32768~32767	√	5, 6	6-2
22	Speed command filter zero order/first order low-pass filter	-	0	0	○	3, 4, 7	5-5-9
23	Speed command filter time	0.1ms	0	0~65535	√	3, 4	5-5-9
24	Position command filter zero order/first order low-pass filter	-	0	0	○	5, 6	5-3-4
25	Position command filter time	0.1ms	0	0~3000	√	5, 6	5-3-4
26	Speed feedforward limit	rpm	Motor rated	Motor rated	○	5, 6	6-1-2
27	Torque feedforward limit	% of rated	100	100	○	5, 6, 7	6-1-2
32	First position loop integral time	0.1ms	0	0~10000	√	5, 6	

33	First position loop differential gain	Hz	0	0~10000	√	5, 6	
34	Second position loop integral time	0.1ms	0	0~10000	√	5, 6	
35	Second position loop differential gain	Hz	0	0~10000	√	5, 6	

P2: vibration suppression parameters

P2-XX	Function	Unit	Default value	Range	Effective	Suitable mode	Chapter
15	First trap wave frequency	Hz	4000	20~4000	√	5, 6	7-1
16	First trap wave attenuation	0.1dB	0	0~500	√	5, 6	7-1
17	First trap wave bandwidth	Hz	2	0~20	√	5, 6	7-1
18	Second trap wave frequency	Hz	4000	20~4000	√	5, 6	7-1
19	Second trap wave attenuation	0.1dB	0	0~50	√	5, 6	7-1
20	Second trap wave bandwidth	Hz	2	0~20	√	5, 6	7-1
21	Third trap wave frequency	Hz	4000	20~4000	√	5, 6	7-1
22	Third trap wave attenuation	0.1dB	0	0~500	√	5, 6	7-1
23	Third trap wave bandwidth	Hz	2	0~20	√	5, 6	7-1
24	Fourth trap wave frequency	Hz	4000	20~4000	√	5, 6	7-1
25	Fourth trap wave attenuation	0.1dB	0	0~500	√	5, 6	7-1
26	Fourth trap wave bandwidth	Hz	2	0~20	√	5, 6	7-1
27	Fifth trap wave frequency	Hz	4000	20~4000	√	5, 6	7-1
28	Fifth trap wave attenuation	0.1dB	0	0~500	√	5, 6	7-1
29	Fifth trap wave bandwidth	Hz	2	0~20	√	5, 6	7-1
30	Sixth trap wave frequency	Hz	4000	20~4000	√	5, 6	7-1
31	Sixth trap wave attenuation	0.1dB	0	0~500	√	5, 6	7-1
32	Sixth trap wave bandwidth	Hz	2	0~20	√	5, 6	7-1
33	Reserved						
34	Reserved						
35	Speed loop gain filter time	0.1ms	30	0~10000	√	3,4,5,6	6-2-2
36	Position loop gain filter time	0.1ms	30	0~10000	√	5, 6	6-2-2

P3: speed control

P3-XX	Name	Unit	Default value	Range	Effective	Suitable mode	Chapter
00	V-REF function distribution 0: V-REF is speed command input 1: V-REF is external speed limit input, actual speed limit depend on external analog speed limit	—	0	0~1	○	1, 2, 4	5-5-2/ 5-8-5
01	Rated speed corresponding to analog voltage	0.01V	1000	150~3000	○	1, 2, 4	5-5-2
02	Analog voltage speed filter	0.01ms	0	0~10000	√	1, 2, 4	5-5-2
03	Speed command input dead area voltage	0.01v	0	0~100	○	1, 2, 4	5-5-2

05	Preset speed 1	rpm	0	-10000 ~ +1000 0	√	3	5-6-2
06	Preset speed 2	rpm	0	-10000 ~ +1000 0	√	3	5-6-2
07	Preset speed 3	rpm	0	-10000 ~ +1000 0	√	3	5-6-2
09	Acceleration time	ms	0	0~ 65535	○	3, 4, 7	5-5-8
10	Deceleration time	ms	0	0~ 65535	○	3, 4, 7	5-5-8
11	Reserved						
12	Zero speed clamp mode 0: ZCLAMP input signal is ON, forced speed command is 0. When the speed below P3-13, switch to position mode and the servo locked in this position 1: ZCLAMP input signal is ON, forced set speed command to 0 2: ZCLAMP input signal is ON, speed below P3-13 switch to position mode and the servo locked in this position	—	0	0~2	○	3, 4, 7	5-5-5
13	Zero speed clamp speed	rpm	30	10~ 10000	√	3, 4	5-5-5
14	Forward max speed command limit	rpm	Rated	0~ 10000	○	3, 4	5-5-2
15	Reverse max speed command limit	rpm	Rated	0~ 10000	○	3,4,5,6,7	5-5-2
16	Internal forward speed limit in torque control mode	rpm	Related to the motor	0~ 10000	√	1, 2	5-8-5
17	Internal reverse speed limit in torque control mode	rpm	Related to the motor	0~ 10000	√	1, 2	5-8-5
18	Jog speed	rpm	100	0~ 1000	○	All the modes	4-4-2
19	Forward warning speed	rpm	Related to the motor	0~ 10000	○	All the modes	5-11-2
20	Reverse warning speed	rpm	Related to the motor	0~ 10000	○	All the modes	5-11-2
21	Forward alarm speed	rpm	Related to the motor	0~ 10000	○	All the modes	5-5-11
22	Reverse alarm speed	rpm	Related to the motor	0~ 10000	○	All the modes	5-5-11
23	T-REF function distribution	—	0	0, 1, 3	○	All the	5-5-7/

	Set to 1 and 3, T-REF is the necessary condition of external torque limit input					modes	5-8-2
24	Rated torque corresponding to the analog value	0.01V	1000	150~3000	○	All the modes	5-8-2
25	Analog voltage torque filter	0.01ms	0	0~10000	√	All the modes	5-8-2
26	Torque command input dead area voltage	0.01V	0	0~100	√	All the modes	5-8-2
28	Internal forward torque	%	300	0~300	√	All the modes	5-5-7
29	Internal reverse torque	%	300	0~300	√	All the modes	5-5-7
30	External forward torque	%	300	0~300	√	2,3,4,5,6,7	5-5-7
31	External reverse torque	%	300	0~300	√	2,3,4,5,6,7	5-5-7
32	Brake torque	%	100	0~300	√	All the modes	5-2-3
33	Preset torque 1 (V3.2.1 and higher version, choose the torque through SPD-A/SPD-B, the mode is same to speed mode 3)	%	0	-300~300	√	1, 2	5-9-2
34	Preset torque 2 (V3.2.1 and higher version, choose the torque through SPD-A/SPD-B, the mode is same to speed mode 3)	%	0	-300~300	√	1, 2	5-9-2
35	Preset torque 3 (V3.2.1 and higher version, choose the torque through SPD-A/SPD-B, the mode is same to speed mode 3)	%	0	-300~300	√	1, 2	5-9-2

P4: internal position parameters (reserved)

P4-XX	Name	Unit	Default value	Range	Effective	Suitable mode	Chapter
00~31	-	-	-	-	-	-	-

P5: signal parameter setting

P5-	Name	Unit	Default	Range	Effective	Suitable mode	Chapter
00	Positioning finished width /COIN	Command pulse	7	0~65535	○	5, 6	5-3-6
01	Positioning finished checking mode 0: offset absolute value below P5-00, output COIN signal 1: offset below P5-00 after command finished, output COIN signal 2: command finished, motor speed below P5-03 and offset absolute value below	-	0	0~3	○	5, 6	5-3-6

	P5-00, output COIN signal 3: command finished, offset absolute value below P5-00, output COIN signal. If COIN keeps the time P5-02, output COIN-HOLD signal.						
02	Positioning finished hold time	ms	0	0~65535	○	5, 6	5-3-6
03	Rotation checking speed	rpm	50	1~10000	○	All the modes	5-11-3
04	Same speed checking speed	rpm	50	1~10000	○	3, 4, 7	5-5-6
05	Reach checking speed	rpm	1000	0~10000	○	3, 4, 7	5-5-10
06	Positioning near output width	Command unit	50	0~65535	○	5, 6	5-3-7
07	Servo OFF delay time	ms	0	0~65535	○		5-2-5
08	Brake command output speed	rpm	30	0~10000	○	All the modes	5-2-5
09	Brake command waiting time	ms	500	0~1000	○	All the modes	5-2-5
10	User-defined output 1 trigger condition	-	0	0~1000	○	All the modes	5-11-7
11	User-defined output 1 trigger condition comparison value	Related to the trigger condition	0	-32768~32767	○	All the modes	5-11-7
12	0: P5-10 \geq P5-11, output SOx 1: P5-10<P5-11, output SOx 2: P5-10 absolute value \geq P5-11, output SOx 3: P5-10 absolute value <P5-11, output SOx	-	0	0~3	○	All the modes	5-11-7
13	User-defined output 1 hysteresis loop	Related to the trigger condition	0	-32768~32767	○	All the modes	5-11-7
14	User-defined output 2 trigger condition	-	0	0~1000	○	All the modes	5-11-7
15	User-defined output 2 trigger condition comparison value	Related to the trigger condition	0	-32768~32767	○	All the modes	5-11-7
16	0: P5-14 \geq P5-15, output SOx 1: P5-14 \leq P5-15, SOx output 2: P5-14 absolute value \geq P5-15, output SOx 3: P5-14 absolute value <P5-15, output SOx	-	0	0~3	○	All the modes	5-11-7
17	User-defined output 2 hysteresis loop	Related to the trigger condition	0	-32768~32767	○	All the modes	5-11-7
18	IO filter time	ms	0	0~65535	○	All the modes	5-11-8
20	/S-ON servo signal	—	※1	※3	○	All the	5-2-1

	0000: signal is always invalid 0001: input positive signal from SI1 0002: input positive signal from SI2 0003: input positive signal from SI3 0004: input positive signal from SI4 0010: signal is always valid 0011: input negative signal from SI1 0012: input negative signal from SI2 0013: input negative signal from SI3 0014: input negative signal from SI4					modes	
21	/P-CON proportion action command Ditto	—	※1	※3	○	All the modes	5-5-4
22	/P-OT forward drive ban ditto	—	※1	※3	○	All the modes	5-2-4
23	/N-OT reverse drive ban ditto	—	※1	※3	○	All the modes	5-2-4
24	/ALM-RST alarm clean ditto	—	※1	※3	○	All the modes	5-11-1
25	/P-CL forward side external torque limit ditto	—	※1	※3	○	All the modes	5-5-7
26	/N-CL reverse side external torque limit ditto	—	※1	※3	○	All the modes	5-5-7
27	/SPD-D internal speed direction choice ditto	—	※1	※3	○	1,2,3,4	5-6-3
28	/SPD-A internal setting speed choice ditto	—	※1	※3	○	3,5,6	5-6-3
29	/SPD-B internal setting speed choice ditto	—	※1	※3	○	3,5,6	5-6-3
30	/C-SEL control mode choice ditto	—	※1	※3	○	All the modes	5-10
31	/ZCLAMP zero clamp ditto	—	※1	※3	○	3,4,7	5-5-5
32	/INHIBIT command pulse ban ditto		※1	※3	○	5, 6	5-3-8
33	/G-SEL gain switching ditto	—	※1	※3	○	All the modes	6-2-1
34	/CLR pulse offset clean ditto	—	※1	※3	○	5, 6	5-3-5
35	/CHGSTP change step	—	※1	※3	○	5	

	signal ditto						
36	/I-SEL inertia ratio switching		※1	※3	○	All the modes	
37	/COIN_HD positioning finished hold 0000: not output to the terminal 0001: output positive signal from SO1 0002: output positive signal from SO2 0003: output positive signal from SO3 0011: output negative signal from SO1 0012: output negative signal from SO2 0013: output negative signal from SO3		※2	※4	○	5, 6	5-3-6
38	/COIN positioning finished ditto	—	※2	※4	○	5, 6	5-3-6
39	/V-CMP same speed checking ditto	—	※2	※4	○	3,4,5,6,7	5-5-6
40	/TGON rotation checking ditto	—	※2	※4	○	All the modes	5-11-3
41	/S-RDY ready ditto	—	※2	※4	○	All the modes	5-11-4
42	/CLT torque limit ditto	—	※2	※4	○	3,4,5,6,7	5-5-7
43	/VLT speed limit checking ditto	—	※2	※4	○	1,2,5,6	5-8-5
44	/BK brake lock ditto	—	※2	※4	○	All the modes	5-2-5
45	/WARN warning ditto	—	※2	※4	○	All the modes	5-11-2
46	/NEAR near ditto	—	※2	※4	○	5, 6	5-3-7
47	/ALM alarm ditto	—	※2	※4	○	All the modes	5-11-1
51	/V-RDY speed arrived	—	※2	※4	○	3, 4, 7	5-5-10
52	/user-defined output 1 terminal setting	—	※2	※4	○	All the modes	5-11-7
53	/user-defined output 2 terminal setting	—	※2	※4	○	All the modes	5-11-7

※1 servo drives input terminal default value: refer to chapter 5-12-2.

※2 servo drive output terminal default value: refer to chapter 5-12-4.

※3 servo drive input terminal distribution: refer to chapter 5-12-1.

※4 servo drive output terminal distribution: refer to chapter 5-12-3.

P6: signal parameters (reserved)

P6-XX	Name	Unit	Default value	Range	Effective	Suitable mode	Chapter
00~04	-	-	-	-	-	-	-

P7: communication parameters

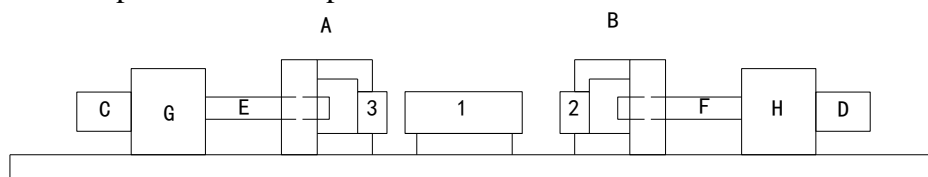
P7-XX	Name	Unit	Default value	Range	Effective	Chapter
00	Station no.	—	1	1~255	√	3-1-5
01	RS485 parameters	—	2206		√	3-1-5
11	RS232 parameters		2206		√	3-1-5

Modbus address (Hex)

Parameter	Modbus address	Explanation
P0-00~P0-33	0x0000~0x0021	Modbus address adding 1 from 0x0000, for example P0-23 Modbus address is 0x0017
P1-00~P1-28	0x0100~0x011C	Modbus address adding 1 from 0x0100, for example P1-10 Modbus address is 0x010A
P2-15~P2-36	0x020F~0x0224	Modbus address adding 1 from 0x020F, for example P2-16 Modbus address is 0x0210
P3-00~P3-36	0x0300~0x0324	Modbus address adding 1 from 0x0300, for example P3-13 Modbus address is 0x030D
P4-00~P4-31	0x0400~0x041F	Modbus address adding 1 from 0x0400, for example P4-25 Modbus address is 0x0419
P5-00~P5-53	0x0500~0x0535	Modbus address adding 1 from 0x0500, for example P5-20 Modbus address is 0x0514 0x0514 is the address of /SON, write 1 to 0x0514 to open the enable, write 0 to close the enable. Input terminal can be write and read, output terminal can read but cannot write. I/O terminal only have two states which are 0 and 1.
P6-00~P6-xx	0x0600~0x06xx	Reserved
P7-00~P7-15	0x0700~0x070F	Modbus address adding 1 from 0x0700, for example P7-11 Modbus address is 0x070B
U0-00~U0-53	0x1000~0x1035	Modbus address adding 1 from 0x1000, for example U0-05 Modbus address is 0x0514
U1-00~U1-25	0x1100~0x1119	Modbus address adding 1 from 0x1100, for example U1-14 Modbus address is 0x110E
U2-00~U2-20	0x1200~0x1214	Modbus address adding 1 from 0x1200, for example U2-08 Modbus address is 0x1208
F0-00~F0-02	0x2000~0x2002	Modbus address adding 1 from 0x2000, for example F0-01 Modbus address is 0x2001
F1-00~F1-05	0x2100~0x2105	Modbus address adding 1 from 0x2100, for example F1-03 Modbus address is 0x2103

Appendix 2 Application

Mode 6: pulse command position mode



Equipment introduction:

This is a welder. Workpiece 1, 2, 3 are the object to be operated. 2 and 3 is fixed on B and A individually. A and B can whole move and be pushed by ball screw E and F. The screw pitch is 5mm. C and D is servo motor. G and H is reducer. The deceleration ratio is 40.

It needs to adjust the machine with standard dimension workpiece and find the origin of A and B.

Workpiece 1 lies on the worktable and moves left and right. Its dimension is positive tolerance, cannot shorter than standard workpiece. The process to put the workpiece is random. It requires that the left and right soldering is symmetrical.

A and B move toward 1 with 3 and 2 at the same speed. Whatever the position of 1, 2 or 3 will touch 1 at first and push 1 to another side until 2 and 3 all touch 1. The result is the motor torque will increase. At this time, 1 will at the symmetrical position.

A and B will return to the origin position after soldering is finished.

Analysis

1. Make sure the work mode: 6
2. It needs to judge whether 2 and 3 touch 1 when finding the symmetrical point. The sign is servo output torque will increase. It needs to use torque limit (P4-02, P4-03) and torque limit output signal /CLT.
3. As the dimension of workpiece is larger than standard, offset pulse will remain in servo when the symmetrical point is found. /CLR signal can clear the pulse. The servo motor running distance is different from PLC pulse number. If it needs to know the actual distance, servo encoder feedback /A+, /A-, /B+, /B- and AB phase count are needed.
4. The motion direction of A and B.

Signal and terminal

/COIN positioning finished signal: SO1

/CLT torque up to upper limit output: SO2

/CLR pulse offset clear input: SI1

Encoder feedback signal /A+, /A-, /B+, /B-

Calculate the electronic gear ratio

Step	Explanation	Ball screw
1	Confirm the mechanical specification	Ball screw pitch: 5mm Reduction ratio: 40/1
2	Confirm the encoder pulse number	2500P/R
3	Decide the command unit	1 command unit: 0.001mm
4	Calculate the motion value of load shaft rotate 1 circle	5mm/0.001mm = 5000
5	Calculate the electronic gear ratio	$\frac{B}{A} = \frac{2500 \times 4}{5000} \times \frac{40}{1} = \frac{80}{1}$

6	Set the user parameters	P0-13=80	P0-14=1
---	-------------------------	----------	---------

Parameter setting

Running mode: P0-01=6

Pulse command state: P0-10=2

Electronic gear ratio: P0-11=0 P0-12=0 P0-13=80 P0-14=1

Forward torque limit: P3-28=150

Reverse torque limit: P3-29=150

Positioning finished width: P5-00=7

/S-ON: P5-20=0010

/CLR: P5-34=0001

/COIN: P5-38=0001

/CLT: P5-42=0002

Debug

1. Initial debug

(a) Connect the cables correctly. Connect U, V, W, PE one-to-one, don't cross them.

(b) open-loop test-running: power on, set F1-01=1, check if the motor can work normally. If yes, enter F1-00. If not, check the cables.

(c) Jog test-running: enter F1-00. Press ENTER to enable the motor. Press INC for forward jog, press DEC for reverse jog. Press STATUS/ESC to quit the jog running.

4 states when jogging:

State	Panel display	State	Panel display
Idle		Forward run	
Enable		Reverse run	

(d) Current check offset auto-adjustment

Enter F1-02, it shows rEF.

Press ENTER, it shows rEF and flickers.

After 5s the auto-adjustment finished, it shows donE.

Press STATUS/ESC to exit.

2. Debug the motor with machine

(a) Check the motor rotation direction, if it is reverse from the actual needs, set servo force OFF. Then set P0-05 to 1, re-power on the servo.

(b) Check the servo stability and response, adjust the servo gain.

3. Debug with PLC program.

XINJE

WUXI XINJE ELECTRIC CO., LTD.
4th Floor, Building 7th, No.100 Dicui
Rd, Wuxi, China
Tel: 86-0510-85134139
Fax: 86-0510-85111290
www.xinje.com
Email: cheerfiona@gmail.com