DS5K2 Series Servo Driver
User's Manual

WUXI XINJE ELECTRIC CO., LTD.

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XINJE

DS5K2 Series Servo Driver User's Manual

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Basic Explanation

- Thank you for purchasing XINJE DS5K2 series servo driver products.
- This manual mainly introduces the product information of DS5K2 series servo driver and MS6 series servo motor.
- Before using the product, please read this manual carefully and connect the wires on the premise of fully understanding the contents of the manual.
- Please deliver this manual to the end user.

This manual is suitable for the following users

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

Get the Manual

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

Declaration of Liability

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

Contact Way

If you have any questions about using this product, please contact the agent or office that purchased it, or directly contact XINJE Company.

- Website: https://en.XINJE.com/web/ index
- Email: sales@XINJE.com tech@XINJE.com
- Whats APP: +86 1806833 9655
- Address: No.816, Jianzhu West Road, Binhu District, Wuxi City, Jiangsu Province

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Safety Precautions

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

To ensure safe operation, please strictly abide by the safety labels pasted on the equipment. Do not damage or remove the safety labels. The instructions are as follows:

 Danger	Never fail to connect Protective Earth(PE) terminal.Read the manual and follow the safety instructions before use.
 Hazardous Voltage	The equipment is powered by 220V/380V at high voltage.Please do not touch terminals within 15 minutes after disconnect the power, risk of electric shock.
 High Temperature	Do not touch the radiator after electrification, risk of scald.
 Indoor Only	Please install it indoors without sun and rain.

The problems that may arise during the use of the product are basically included in the safety precautions. For other unfinished matters, please follow the basic electrical operation procedures.

 Product Confirmation Notes

1. Damaged drives, drives lacking components, or drives of models that do not meet the requirements should not be installed.
2. When used incorrectly, it may cause danger, and there is a possibility of moderate or minor injury, as well as property damage.

 Installation Notes

1. Before installing the wiring, please be sure to disconnect the power supply to prevent the risk of electric shock.
2. Do not expose this product to places with water vapor, corrosive gases, flammable gases or other substances for use, as it may cause electric shock and fire hazards.
3. Do not touch the conductive parts of the product directly, as it may cause false operation or malfunction.
4. When used incorrectly, it may cause danger, resulting in personal injury or death, serious injury, and may also cause severe property damage.

 Cautions for wiring

1. Please correctly connect the AC power supply to the dedicated power terminal L/N, L1/L2/L3 or R/S/T of the driver. Do not connect the output terminals U, V and W of the driver to the three-phase

power supply.
2. Please connect the ground wire correctly. Poor grounding may cause electric shock. Please ground the grounding terminal of the driver using a 2mm ² wire.
3. Please tighten the fixing screws of the terminals; otherwise, it may cause a fire.Be sure to disconnect all external power supply before wiring the driver.
4. Before wiring the driver, please be sure to disconnect all external power sources.
5. When wiring, please ensure that the encoder lines and power lines are in a loose state and not taut to avoid cable damage.



Operation Cautions

1. After the driver is running, do not touch the rotating parts of the motor as there is a risk of injury.
2. Please note that when conducting a trial run of the motor once, do not connect it to the machinery as there is a possibility of injury.
3. .After connecting the machinery, please set the appropriate parameters first before running it; otherwise, it may cause the machinery to lose control or malfunction.
4. Do not touch the radiator during operation as there is a risk of getting burned.
5. Do not change the wiring when the power is on, as there is a risk of injury.
6. Please do not frequently switch the power on and off. If you need to do it multiple times, please control it to once every 2 minutes.



Maintenance and Inspection

1. Do not touch the interior of the servo driver and servo motor, otherwise it may cause electric shock.
2. When the power is turned on, do not remove the driver panel; otherwise, it may cause electric shock.
3. Do not touch the terminal blocks within 10 minutes after the power is turned off; otherwise, the residual voltage may cause electric shock.



Wiring Attention

1. Please do not pass the power line and the control signal line through the same pipe, nor bind them together. The power line and the control signal line should be at least 30 centimeters apart.
2. For signal lines and encoder (PG) feedback lines, please use multi-strand twisted wires and multi-core twisted integral shielded wires. For the wiring length, the maximum length of the signal input line is 3 meters, and that of the PG feedback line is 20 meters.

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►► Confirmation on product arrival

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

Items	Notes
Does the product on arrival match the specified model?	Please confirm according to the nameplate of servo motor and servo unit.
Does the servomotor shaft rotate smoothly?	The servo motor shaft is normal if it can be turned smoothly by hand. Servo motors with brakes, however, cannot be turned manually.
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Are there any loose screws?	Check screws for looseness using a screw drive.
Is the motor code the same with the code in drive?	Check the motor code marked on the nameplates of the servomotor and the parameter **U3-00** on the servo drive.

If any of the above is faulty or incorrect, contact XINJE or an authorized distribute

1. Selection of Servo Systems

1.1 Selection of Servo Drive

1.1.1 Model Naming

DS 5□-2 □P□ - PTA

Name	Product Name
DS	Servo Drive

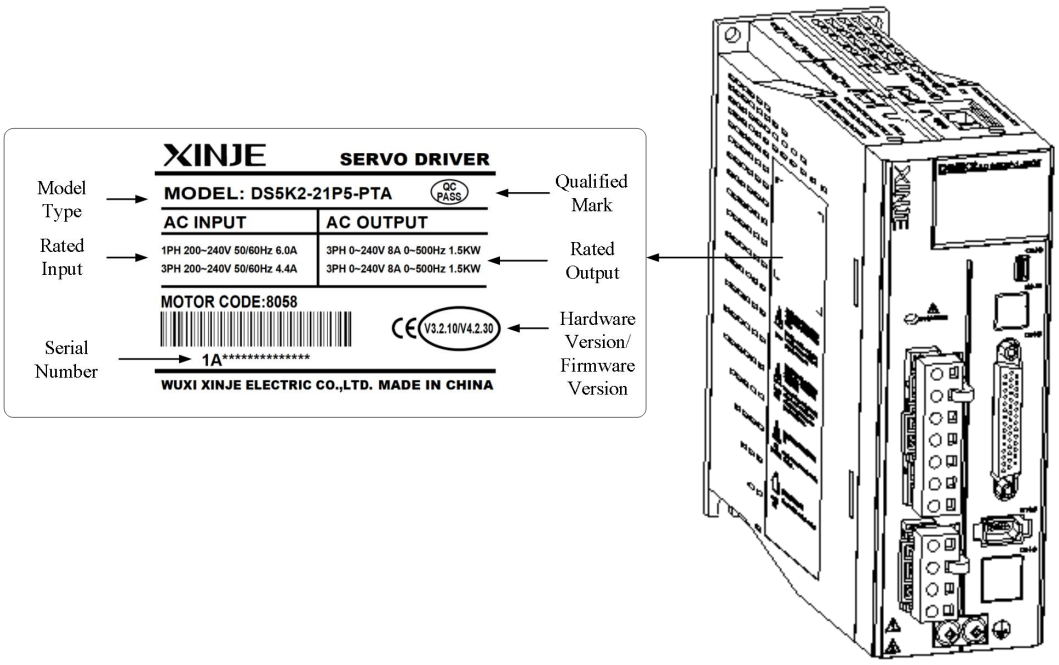
Name	Product Series
5K2	Full-function Type

Name	Rated Input Voltage
2	AC220V
4	AC380V

Code	Encoder Type
T	Communication Encoder

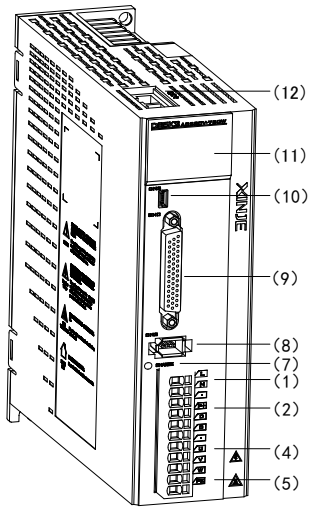
Code	Rated Output Power	Code	Rated Output Power
0P1	100W	2P6	2.6KW
0P4	400W	3P0	3.0KW
0P7	750W	5P5	5.5KW
1P0	1.0KW	7P5	7.5KW
1P5	1.5KW	22P0	22KW
2P3	2.3KW	32P0	32KW

1.1.2 Label Description

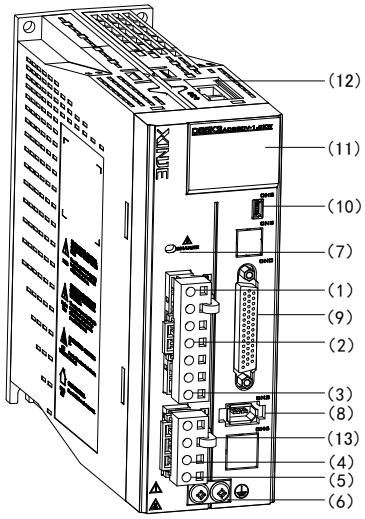


1.1.3 Description of Each Section

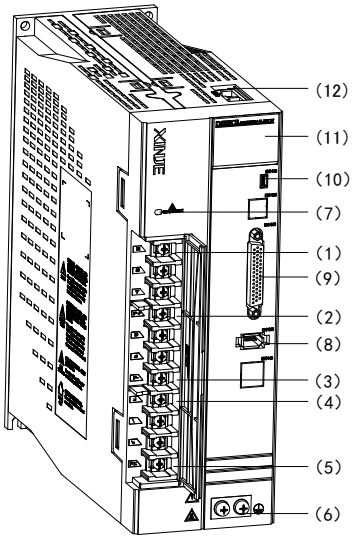
- 0.1 kW ~ 7.5 kW servo driver



0.1~0.75kW



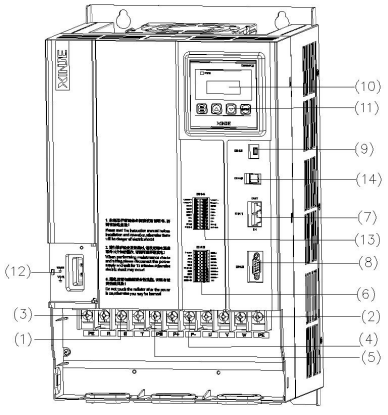
1~3kW



5.5/7.5kW

NO.	Name	NO.	Name
(1)	Power input terminals for the main circuits: L/N, L1/L2/L3, R/S/T	(8)	CN2: Encoder Communication Port
(2)	Connection terminals for the P+, D, and C brake resistors	(9)	CN0: Input/Output Control Port
(3)	P+ and P-busbar terminals	(10)	CN3: RS232 Communication Port
(4)	U, V, W servo motor power terminals	(11)	Driver Display Panel
(5)	PE Motor Grounding Terminal	(12)	CN4: RS485 Communication Port
(6)	Drive Ground Terminal	(13)	Wiring Assistance Clip
(7)	CHARGE Busbar Voltage Indicator Light		

- 22 kW and 32 kW servo drivers



NO.	Name	Explain
(1)	R/S/T Main Circuit Power Input Terminal	Reference drive nameplate rated voltage level: Input main circuit power supply: R/S/T: Powered by a three-phase 380V main circuit.
(2)	U, V, W servo motor power terminals	Connect the servo motor to the U/V/W phases.
(3)	PE earth terminal	Connect to the motor's grounding terminal to complete the grounding process. Connect to external grounding stakes for proper grounding. Connect to the power ground terminal for grounding.
(4)	P+ and P-busbar terminals	Driver bus terminal.
(5)	PB terminal	When using an external braking resistor, connect it to the P+ and PB terminals.
(6)	CN0: Input/Output Control Port	Port for terminal command input signals and other input/output signals.
(7)	CN1: RJ45 network port	Supports low-speed 485 communication and CANopen communication.
(8)	CN2: Encoder Communication Port	Connect to the motor encoder terminals.
(9)	CN3: RS232 Communication Port	RS232 communication interface for connecting with the servo controller's debugging software.
(10)	Driver Display Panel	Five 8-digit LED displays for showing the servo's operating status and parameter settings.
(11)	Panel Operation Button	Four panel operation buttons for viewing the servo's operating status and setting parameters.
(12)	EMC grounding; lightning protection grounding	EMC grounding: suppresses electromagnetic interference to ensure proper equipment operation and signal integrity; Lightning protection grounding: Discharges lightning current to prevent equipment damage and personal injury.
(13)	CN4: Pulse, Analog Signal, Encoder Differential Feedback Function Terminals	Pulse signals, analog signals, encoder differential feedback function terminals
(14)	CN5: STO Safety Function Terminal (Reserved)	STO Functional Safety Terminal for safety function applications and external safety signal input (not enabled yet)

1.1.4 Performance Specifications

Service Unit	DS5K2 Series Servo Drivers
Apply Encoder	Specifications: 17-bit/19-bit/23-bit communication encoder (firmware version <4230 compatible with servo drivers supporting CN and TH encoder types; firmware version ≥4230 compatible with servo drivers supporting CS, CM, CN, TL, and TH encoder types).
Power Input	DS5□-2□P□-PTA: Operates on single-phase or three-phase AC 200–240 V, 50/60 Hz (for single-phase power supply, connect to L1 and L3;

		otherwise parameter memory may be affected during power loss). DS5□-4□P□-PTA: Three-phase AC 380–440 V, 50/60 Hz
Control Method		Three-phase full-wave rectification IPM PWM control using sine wave current drive method
The product meets the standards.		EN 61800-5-1:2007/A11:2021
Protection Level		Class I
Connect to the power grid system		TN/TT
Conditions of use	End-use Temperature	-10 ~ +40 ℃
	Storage Temperature	-20 ~ +60 ℃
	Ambient Humidity	Below 90% RH (no condensation)
	Vibration Resistance	4.9m/s2
	Altitude	Do not exceed 1000 m; if higher, use at a reduced rate (1% reduction per 100 m increase in height).

1.1.5 Electrical Specifications

Drive Model	Drive Power (kW)	Continuous Output Current (A)	Maximum Output Current (A)	Power Supply Input Current (A)	Power Supply Voltage	Cooling Way
DS5K2-20P1-PTA	0.1	0.9	3.15	1.3	Single phase AC200 ~ 240V , 50/60Hz	Self-cooling
DS5K2-20P4-PTA	0.4	2.8	9.8	4		Self-cooling
DS5K2-20P7-PTA	0.75	4.8	16.8	5.5		Forced air cooling
DS5K2-21P0-PTA	1.0	6	18	6(1PH) 4.4(3PH)	Single-phase/triple-phase AC 200–240 V, 50/60 Hz	Forced air cooling Forced air cooling
DS5K2-21P5-PTA	1.5	8	20	7.4(1PH) 5.1(3PH)		Forced air cooling Forced air cooling
DS5K2-22P3-PTA	2.3	9	18	8(1PH) 7.4(3PH)		Forced air cooling Forced air cooling
DS5K2-22P6-PTA	2.6	10.5	29.93	8(1PH) 7.4(3PH)		Forced air cooling

Drive Model	Drive Power (kW)	Continuous Output Current (A)	Maximum Output Current (A)	Power Supply Input Current (A)	Power Supply Voltage	Cooling Way
						Forced air cooling
DS5K2-41P0-PTA	1.0	3.2	9.6	4	three-phase AC380～440V, 50/60Hz	Forced air cooling
DS5K2-41P5-PTA	1.5	5.5	13.75	4		Forced air cooling
DS5K2-42P3-PTA	2.3	8.5	21.25	6.8		Forced air cooling
DS5K2-43P0-PTA	3.0	11	29.7	8		Forced air cooling
DS5K2-45P5-PTA	5.5	20	50	16		Forced air cooling
DS5K2-47P5-PTA	7.5	25	62.5	20		Forced air cooling
DS5K2-422P0-PTA	22	43.5	108.75	35		Forced air cooling
DS5K2-432P0-PTA	32	62	124	50		Forced air cooling

1.2 Servo Motor Selection

1.2.1 Model Naming

■ MS6 Motor

MS6S - 80 CN 30 B Z 3 - 2 1P0 - □

Name	Interia
MS6S	Low inertia
MS6H	High inertia
MS6G	Medium inertia

Name	Seat number
40	40 seat
60	60 seat
80	80 seat
130	130 seat
180	180 seat
200	200 seat
265	265 seat

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

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

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

Name	Type
S	Short Frame
Empty	None

Name	Rated output power	Name	Rated output power
0P1	100W	3P0	3kW
0P2	200W	4P4	4.4kW
0P4	400W	5P5	5.5kW
0P7	750W	7P0	7kW
1P0	1kW	7P5	7.5kW
1P5	1.5kW	21	21kW
1P8	1.8kW	27	27kW
2P3	2.3kW	30	30kW
2P6	2.6kW		

Name	Voltage level
2	220V
4	380V

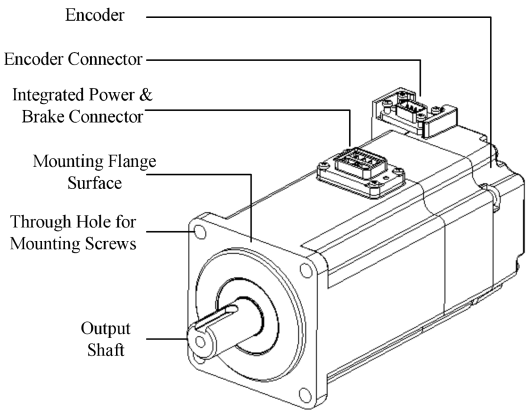
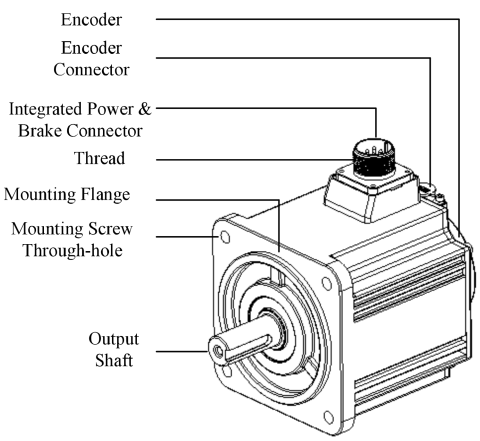
Name	Motor connector type
2	Aviation plug
3	Waterproof connector
4	Waterproof connector to Anpu plug

Name	Power-off brake
Empty	Without
Z	With

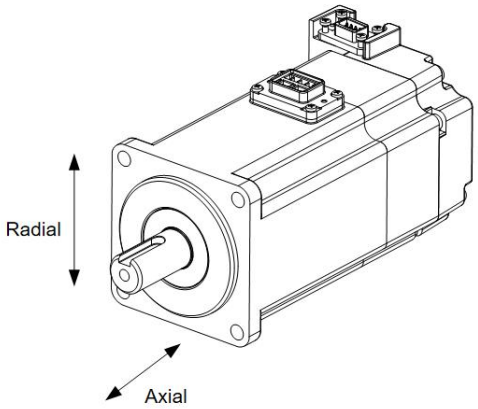
DS5K2 series (firmware version <4230) servo drivers compatible with servo motors using CN or TH encoders;

DS5K2 series servo drivers (firmware version ≥ 4230) are compatible with servo motors using encoder types CS, CM, CN, TL, and TH.

1.2.2 Description of Each Section

Motor with B3 plug type	B2 plug type motor
	

1.2.3 Axial Load & Radial Load



Seat No	40	60	80	100	110	130	180
axial loading	54N	74N	147N	196N	147N	196N	400N
Radial load	78N	245N	392N	500N	392N	686N	800N

1.3 Cable Selection

1.3.1 Model Naming

■ Encoder Cable Model

CP T - SC T - B - 03

Name	Cable type
CP	Encoder cable

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

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

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

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

Name	Plug type
T	Threaded buckle type
Empty	Buckle type

■ Power cable model

CM T - E 05 A - 03

Nane	Cable Type
CM	Power Cable (Without Brake)
CMB	Power Cable (With Brake)

Name	Cable Type
T	High-flex Type
G	High-flex Oil-resistant Type
Empty	Standard Type

Name	Motor Connector Type
E	B3 Straight Outlet Connector (Motor Side)
F	B3 Reverse Outlet Connector (Motor Side)
L	4-Core Mini Aviation Connector
XL	4-Core Medium Aviation Connector

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

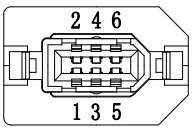
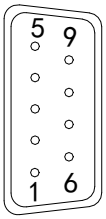
Name	Drive-side Terminals
A/B	Pin Terminals
T	Pin Terminals
Empty	U-terminals / O-terminals

Name	Wire Cross-sectional (mm²)	Name	Wire Cross-sectional (mm²)
03	0.3	20	2.0
05	0.5	60	6.0
15	1.5		

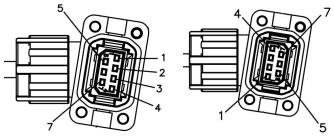
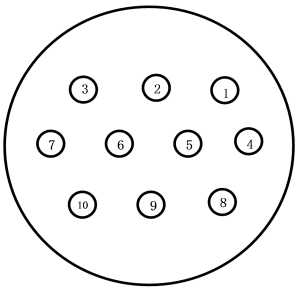
1.3.2 Explanation of Cable Pin Definitions

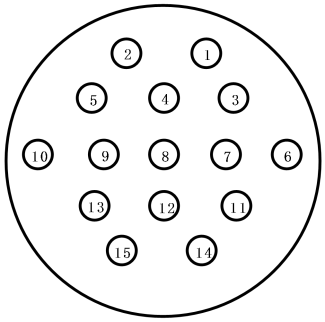
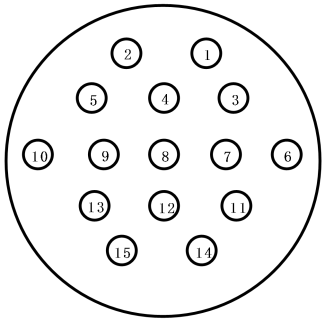
■ Encoder Cable

(1) Definition of soldering pin positions for encoder cables on the servo driver side

Connector Appearance (7.5 kW and below)	Interface Pin Definitions			
	NO.	Definition	NO.	Definition
	1	5V	4	/
	2	GND	5	485-A
	3	/	6	485-B
	-	-	-	-
	NO.	Definition	NO.	Definition
	1	temperature -	6	GND
	2	temperature +	7	GND
	3	485-B	8	5V
	4	485-A	9	5V
	5	PE		

(2) Definition of soldering pin positions for encoder cables on the servo motor side

Motor Model	Connector Pin	Interface Pin Definitions	
		NO.	Definition
MS6-40,60,80 base models with B3 motor	 Front outlet Back outlet (View)	1	5V
		2	GND
		3	BAT+
		4	BAT-
		5	485-A
		6	485-B
		7	Shielding layer
MS6-130 Machine Base B2 Motor		NO.	Definition
		1	/
		2	5V
		3	GND
		4	485-A
		5	485-B
		6	Battery +
		7	Battery -
		8	/
		9	/
		10	Shield line

<table>
<tr><th>Motor Model</th><th>Connector Pin</th><th colspan="2">Interface Pin Definitions</th></tr>
<tr><td rowspan="11">MS6-180 Machine Base with B2 Motor</td><td rowspan="11">  </td><td>NO.</td><td>Definition</td></tr>
<tr><td>1</td><td>Shield line</td></tr>
<tr><td>2</td><td>/</td></tr>
<tr><td>3</td><td>485-B</td></tr>
<tr><td>4</td><td>485-A</td></tr>
<tr><td>5</td><td>/</td></tr>
<tr><td>6</td><td>GND</td></tr>
<tr><td>7</td><td>Battery -</td></tr>
<tr><td>8</td><td>5V</td></tr>
<tr><td>9</td><td>Battery +</td></tr>
<tr><td>10-15</td><td>/</td></tr>
<tr><td rowspan="16">MS6G-200 and MS6G-265 machine bases with B2 motors</td><td rowspan="16">  </td><td>NO.</td><td>Definition</td></tr>
<tr><td>1</td><td>Shield line</td></tr>
<tr><td>2</td><td>/</td></tr>
<tr><td>3</td><td>485-B</td></tr>
<tr><td>4</td><td>485-A</td></tr>
<tr><td>5</td><td>/</td></tr>
<tr><td>6</td><td>GND</td></tr>
<tr><td>7</td><td>Battery -</td></tr>
<tr><td>8</td><td>5V</td></tr>
<tr><td>9</td><td>Battery +</td></tr>
<tr><td>10-13</td><td>/</td></tr>
<tr><td>14</td><td>Temperature -</td></tr>
<tr><td>15</td><td>Temperature +</td></tr>
</table>

Battery Case Specifications:

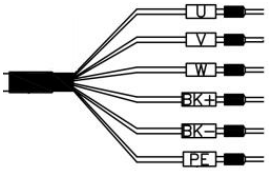
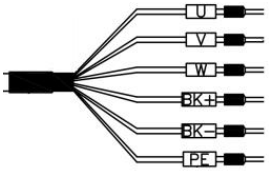
1) The cable with pin definitions for Battery+ and Battery− in the aforementioned encoder is designed for absolute motors; non-absolutely controlled motors do not have these pins.

2) Only absolute value motors require an externally mounted battery box with a built-in 3.6 V/2.7 Ah high-capacity battery and battery replacement capability while powered on; the service life shall be ≥2 years, with battery replacement procedures following Section 5.6.2.

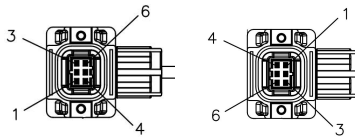
Currently available encoder cable lengths include 2m, 3m, 5m, 8m, 10m, 12m, 16m, 20m, 25m, 30m, 35m, 40m, 45m, and 50m.

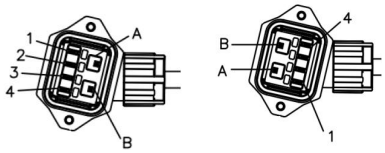
■ Power cable

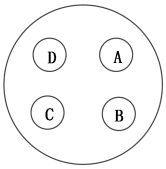
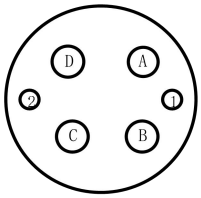
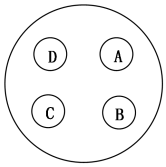
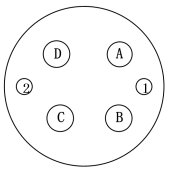
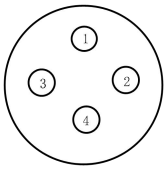
(1) Power line pin configuration on the servo driver side (pin terminals connected using snap-fit clips)

Motor Model	Connector Appearance	Interface Pin Definitions	
MS6-40, 60, and 80 base-mounted motors		Color	Definition
		Red	U
		White	V
		Black	W
		Greenish-yellow	PE
		Blue	BK+
		Brown	BK-
MS6-130 Machine Base Motor		Color	Definition
		Brown	U
		Black	V
		Blue	W
		Greenish-yellow	PE
		Red	BK+
		Black	BK-
MS6-180 Base Motor		Color	Definition
		Brown/Red	U
		Black/Yellow	V
		Blue	W
		Greenish-yellow	PE
		Red	BK+
		Black/White	BK-
MS6-200 and MS6-265 base-mounted motors		Color	Definition
		Red	U
		Huang	V
		Blue	W
		Greenish-yellow	PE

(2) Definition of welding pins for power cables on the motor side

Motor Model	Connector Pin	Interface Pin Definitions	
MS6-40 Base with B3 Motor	 Front outlet Back outlet (View)	NO.	Definition
		1	W
		2	V
		3	U
		4	PE
		5	BK+
		6	BK-
		7	Shielding layer

<table>
<tr><th>Motor Model</th><th>Connector Pin</th><th colspan="2">Interface Pin Definitions</th></tr>
<tr><td rowspan="7">MS6-60 and MS6-80 machine bases with B3 motors</td><td rowspan="7"> 

Front outlet Back outlet
(View)</td><td>NO.</td><td>Definition</td></tr>
<tr><td>1</td><td>U</td></tr>
<tr><td>2</td><td>V</td></tr>
<tr><td>3</td><td>W</td></tr>
<tr><td>4</td><td>PE</td></tr>
<tr><td>A</td><td>BK+</td></tr>
<tr><td>B</td><td>BK-</td></tr>
<tr><td rowspan="5">MS6G-130 Machine Base Non-braked Motor</td><td rowspan="5"> 
</td><td>NO.</td><td>Definition</td></tr>
<tr><td>A</td><td>W</td></tr>
<tr><td>B</td><td>V</td></tr>
<tr><td>C</td><td>U</td></tr>
<tr><td>D</td><td>PE</td></tr>
<tr><td rowspan="7">MS6G-130 Base Brake Motor</td><td rowspan="7"> 
</td><td>NO.</td><td>Definition</td></tr>
<tr><td>A</td><td>W</td></tr>
<tr><td>B</td><td>V</td></tr>
<tr><td>C</td><td>U</td></tr>
<tr><td>D</td><td>PE</td></tr>
<tr><td>1</td><td>BK+</td></tr>
<tr><td>2</td><td>BK-</td></tr>
<tr><td rowspan="5">MS6G-180 Machine Base Non-braked Motor</td><td rowspan="5"> 
</td><td>NO.</td><td>Definition</td></tr>
<tr><td>A</td><td>PE</td></tr>
<tr><td>B</td><td>W</td></tr>
<tr><td>C</td><td>V</td></tr>
<tr><td>D</td><td>U</td></tr>
<tr><td rowspan="7">MS6G-180 Base Brake Motor</td><td rowspan="7"> 
</td><td>NO.</td><td>Definition</td></tr>
<tr><td>A</td><td>PE</td></tr>
<tr><td>B</td><td>W</td></tr>
<tr><td>C</td><td>V</td></tr>
<tr><td>D</td><td>U</td></tr>
<tr><td>1</td><td>BK+</td></tr>
<tr><td>2</td><td>BK-</td></tr>
<tr><td rowspan="5">MS6H-180 Motor Base (Non-braked Motor)</td><td rowspan="5"> 
</td><td>NO.</td><td>Definition</td></tr>
<tr><td>1</td><td>PE</td></tr>
<tr><td>2</td><td>U</td></tr>
<tr><td>3</td><td>V</td></tr>
<tr><td>4</td><td>W</td></tr>
<tr><td rowspan="5">MS6H-200 and MS655 base-mounted motors</td><td rowspan="5">  </td><td>Color</td><td>Definition</td></tr>
<tr><td>Red</td><td>U</td></tr>
<tr><td>Huang</td><td>V</td></tr>
<tr><td>Blue</td><td>W</td></tr>
<tr><td>Greenish-yellow</td><td>PE</td></tr>
</table>

Brake engagement pin description:

The cable with pin definitions including BK+ and BK-is designed for brake-equipped motors; non-brake-equipped motors do not require these pins.



Currently, power line cables are available in lengths of 2 m, 3 m, 5 m, 8 m, 10 m, 12 m, 16 m, 20 m, 25 m, 30 m, 35 m, 40 m, 45 m, and 50 m.

1.4 Selection of Other Accessories

1.4.1 Selection of Brake Resistance

When the servo motor operates in generator mode, power is returned to the servo amplifier side—a process known as regenerative power. This regenerative power is absorbed by charging the smoothing capacitor within the servo amplifier. Any excess energy beyond what can be stored is then dissipated through the braking resistor.

The process by which the servo generates renewable power is as follows:

- During deceleration operation or during the period of deceleration stop;
- When the vertical axis runs downward;
- When an external load drives the motor to rotate.

Servo Driver Model	Braking resistor connection terminal
DS5K2-((P□-PTA	1) Use the built-in braking resistor by shorting terminals P+ and D, and disconnecting P+ from terminal C. 2) For drivers with built-in braking resistors, when using an external braking resistor, connect it to terminals P+ and C while disconnecting the shorting wires between P+ and D; P0-25 represents the power value, and P0-26 represents the resistance value.

The table below lists the recommended specifications for external braking resistors for each motor model.

Servo Driver Model	Built-in resistance for braking	Minimum Resistance Value (Not less than this value)	External braking resistor (Recommended Resistance Value)	External braking resistor (Recommended Power Value)
DS5K2-20P1-PTA	/	80Ω	80Ω-100Ω	Over 200W
DS5K2-20P2-PTA	/			
DS5K2-20P4-PTA	/			
DS5K2-20P7-PTA	80W50Ω	50Ω	50Ω-100Ω	Over 600W
DS5K2-21P0-PTA	80W45Ω	35Ω	35Ω-75Ω	Above 800W
DS5K2-21P5-PTA	80W50Ω	30Ω	30Ω-50Ω	Over 1000W
DS5K2-22P3-PTA	80W50Ω			
DS5K2-22P6-PTA	80W50Ω	25Ω	25Ω-50Ω	
DS5K2-41P0-PTA	80W100Ω	120Ω	120Ω-150Ω	Above 800W
DS5K2-41P5-PTA	80W100Ω	75Ω	75Ω-120Ω	Over 1000W

DS5K2-42P3-PTA	80W60Ω	55Ω	55Ω-75Ω	Over 1000W
DS5K2-43P0-PTA	80W60Ω	50Ω	50Ω-75Ω	Above 1200W
DS5K2-45P5-PTA	/	25Ω	25Ω-65Ω	Over 2000W
DS5K2-47P5-PTA	/	22Ω	22Ω-50Ω	Above 2500W
DS5K2-422P0-PTA	/	20Ω	20Ω-25Ω	Over 3000W
DS5K2-432P0-PTA	/	20Ω	20Ω-30Ω	Over 5000W

- The smaller the resistance value, the faster the discharge rate; however, values that are too small may cause the resistor to break down. Therefore, during selection, aim for a value as close as possible to the lower limit rather than below it.
- When wiring, use high-temperature resistant flame-retardant cables and ensure the surface of the braking resistor does not come into contact with the cable.

1.5 Selection of Peripheral Components

Peripheral Components	Compatible Devices	Explain
Fuse	All	Used for circuit overcurrent protection: when the current exceeds the rated value for a specified duration, the internal metal wire of the fuse melts, cutting off the circuit to prevent equipment damage or fire.
Circuit breaker		It features both overload and short-circuit protection, automatically tripping to disconnect the circuit when detecting abnormal currents (e.g., overcurrent or short circuit), thereby safeguarding the wiring and equipment.
Electromagnetic contactor		It controls the main circuit's on/off state via an electromagnetic coil, suitable for applications requiring frequent motor startups/stopdowns or high-power loads.
EMC filter		Mitigate electromagnetic interference (EMI) between the power grid and equipment.
Magnetic ring, magnetic clip		Utilizes high-frequency impedance characteristics to absorb common-mode noise in cables and suppress electromagnetic interference (EMI).

1.5.1 Fuses

Servo Driver Model	Drive Power (kW)	Rated Current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	Model	Rated current (A)
DS5K2-20P1-PTA	0.1	0.9	3.15	Bussmann	FWP-5B	5
DS5K2-20P4-PTA	0.4	2.8	9.8		FWP-10B	10
DS5K2-20P7-PTA	0.75	4.8	16.8		FWP-20B	20
DS5K2-21P0-PTA	1.0	6	18		FWP-20B	20
DS5K2-21P5-PTA	1.5	8	20		FWP-20B	20
DS5K2-22P3-PTA	2.3	9	18		FWP-20B	20
DS5K2-22P6-PTA	2.6	10.5	29.93		FWP-20B	20
DS5K2-41P0-PTA	1.0	3.2	9.6		FWP-10B	10
DS5K2-41P5-PTA	1.5	5.5	13.75		FWP-10B	10
DS5K2-42P3-PTA	2.3	8.5	21.25		FWP-15B	15
DS5K2-43P0-PTA	3.0	11	29.7		FWP-20B	20
DS5K2-45P5-PTA	5.5	20	50		FWP-35B	35
DS5K2-47P5-PTA	7.5	25	62.5		FWP-40B	40
DS5K2-422P0-PTA	22	43.5	108.75		FWP-90B	100
DS5K2-432P0-PTA	32	62	124		FWP-125A	125

1.5.2 Circuit Breaker

Servo Driver Model	Drive Power (kW)	Rated Current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	Model	Rated current (A)
DS5K2-20P1-PTA	0.1	0.9	3.15	Chint	NXB-63 2P C6	6
DS5K2-20P4-PTA	0.4	2.8	9.8		NXB-63 2P C10	10
DS5K2-20P7-PTA	0.75	4.8	16.8		NXB-63 2P C16	16
DS5K2-21P0-PTA	1.0	6	18		NXB-63 3P C20	20
DS5K2-21P5-PTA	1.5	8	20		NXB-63 3P C20	20
DS5K2-22P3-PTA	2.3	9	18		NXB-63 3P C20	20
DS5K2-22P6-PTA	2.6	10.5	29.93		NXB-63 3P C20	20

Servo Driver Model	Drive Power (kW)	Rated Current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	Model	Rated current (A)
DS5K2-41P0-PTA	1.0	3.2	9.6		NXB-63 3P C10	10
DS5K2-41P5-PTA	1.5	5.5	13.75		NXB-63 3P C10	10
DS5K2-42P3-PTA	2.3	8.5	21.25		NXB-63 3P C16	16
DS5K2-43P0-PTA	3.0	11	29.7		NXB-63 3P C16	16
DS5K2-45P5-PTA	5.5	20	50		NXB-63 3P C25	25
DS5K2-47P5-PTA	7.5	25	62.5		NXB-63 3P C32	32
DS5K2-422P0-PTA	22	43.5	108.75		NXB-125G 3P C80	80
DS5K2-432P0-PTA	32	62	124		NXB-125G 3P C100	100

1.5.3 Electromagnetic Contactor

Servo Driver Model	Drive Power (kW)	Rated Current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	Model	Rated current (A)
DS5K2-20P1-PTA	0.1	0.9	3.15	Schneider	LC1 D09	9
DS5K2-20P4-PTA	0.4	2.8	9.8		LC1 D09	9
DS5K2-20P7-PTA	0.75	4.8	16.8		LC1 D012	12
DS5K2-21P0-PTA	1.0	6	18		LC1 D018	18
DS5K2-21P5-PTA	1.5	8	20		LC1 D025	25
DS5K2-22P3-PTA	2.3	9	18		LC1 D025	25
DS5K2-22P6-PTA	2.6	10.5	29.93		LC1 D032	32
DS5K2-41P0-PTA	1.0	3.2	9.6		LC1 D09	9
DS5K2-41P5-PTA	1.5	5.5	13.75		LC1 D09	9
DS5K2-42P3-PTA	2.3	8.5	21.25		LC1 D012	12
DS5K2-43P0-PTA	3.0	11	29.7		LC1 D018	18
DS5K2-45P5-PTA	5.5	20	50		LC1 D025	25
DS5K2-47P5-PTA	7.5	25	62.5		LC1 D032	32
DS5K2-422P0-PTA	22	43.5	108.75		LC1D65A	65
DS5K2-432P0-PTA	32	62	124		LC1D95	95

1.5.4EMC filter

- Shawferner

Servo Driver Model	Drive Power (kW)	Rated Current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	Model	Rated current (A)
DS5K2-20P1-PTA	0.1	0.9	3.15	Shawferner	FN 2090-8-06	6
DS5K2-20P4-PTA	0.4	2.8	9.8		FN 2090-10-06	10
DS5K2-20P7-PTA	0.75	4.8	16.8		FN 2090-16-06	16
DS5K2-21P0-PTA	1.0	6	18		FN3287-16-44-C33-R65	20
DS5K2-21P5-PTA	1.5	8	20		FN3287-16-44-C33-R65	20
DS5K2-22P3-PTA	2.3	9	18		FN3287-16-44-C33-R65	20
DS5K2-22P6-PTA	2.6	10.5	29.93		FN3287-16-44-C33-R65	20
DS5K2-41P0-PTA	1.0	3.2	9.6		FN3287-10-44-C28-R65	10
DS5K2-41P5-PTA	1.5	5.5	13.75		FN3287-10-44-C28-R65	10
DS5K2-42P3-PTA	2.3	8.5	21.25		FN3287-16-44-C33-R65	16
DS5K2-43P0-PTA	3.0	11	29.7		FN3287-16-44-C33-R65	16
DS5K2-45P5-PTA	5.5	20	50		FN3287-25-33-C33-R65	25
DS5K2-47P5-PTA	7.5	25	62.5		FN3287-40-33-C33-R65	40
DS5K2-422P0-PTA	22	43.5	108.75		FN3287-80-34-C33-R65	80
DS5K2-432P0-PTA	32	62	124		FN3287-100-35-C33-R65	100

- Fiot single-phase AC three-stage filtering system / three-phase four-wire three-stage filtering system

Servo Driver Model	Drive Power (kW)	Rated Current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	Model	Rated current (A)
DS5K2-20P1-PTA	0.1	0.9	3.15	Fiott	FT130-6	6
DS5K2-20P4-PTA	0.4	2.8	9.8		FT130-10	10
DS5K2-20P7-PTA	0.75	4.8	16.8		FT130-10	20
DS5K2-21P0-PTA	1.0	6	18		FT430-20	20
DS5K2-21P5-PTA	1.5	8	20		FT430-25	25
DS5K2-22P3-PTA	2.3	9	18		FT430-25	25
DS5K2-22P6-PTA	2.6	10.5	29.93		FT430-30	30
DS5K2-41P0-PTA	1.0	3.2	9.6		FT430-10	10
DS5K2-41P5-PTA	1.5	5.5	13.75		FT430-10	10
DS5K2-42P3-PTA	2.3	8.5	21.25		FT430-20	20
DS5K2-43P0-PTA	3.0	11	29.7		FT430-20	20
DS5K2-45P5-PTA	5.5	20	50		FT430-30	30
DS5K2-47P5-PTA	7.5	25	62.5		FT430-40	40
DS5K2-422P0-PTA	22	43.5	108.75		FT430-80	80
DS5K2-432P0-PTA	32	62	124		FT430-100	100

1.5.5 Magnetic Rings and Magnetic Clips

Magnetic rings are typically installed near the drive's input or output side, and it is recommended to install them as close as possible to the drive body.

When configured on the input side, its primary function is to eliminate conductive electromagnetic interference in power lines; when installed on the output side, it effectively suppresses high-frequency radiated interference generated during driver operation while simultaneously reducing parasitic currents in motor bearings.

To address issues such as abnormal leakage currents under specific operating conditions and electromagnetic interference on control signal lines, ring-shaped magnetic cores or snap-fit magnetic core assemblies can be employed. The former is suitable for winding installation, while the latter facilitates rapid deployment onto cables.

2. Installation of the Servo System

2.1 Installation of the Servo Driver

2.1.1 Installation Site

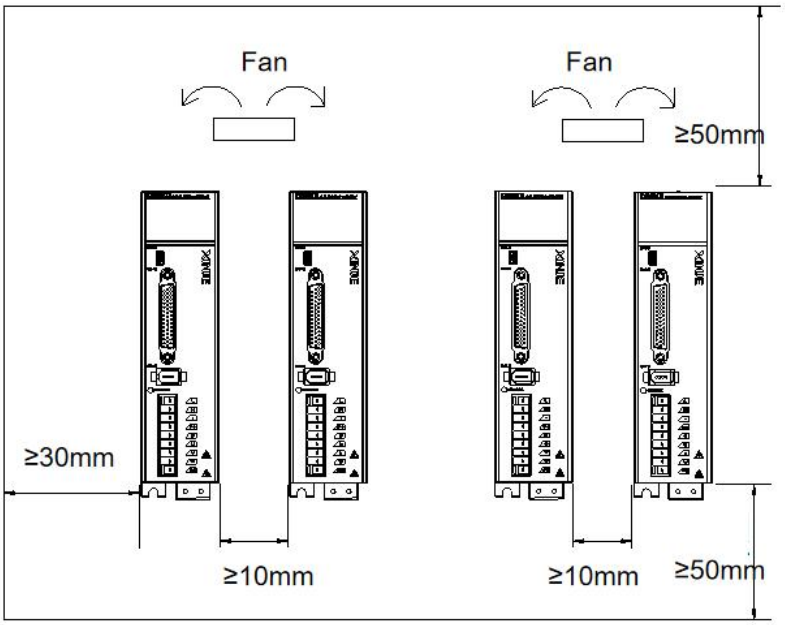
- Install in a cabinet protected from sunlight and rain.
- Do not use this product in environments containing corrosive or flammable gases such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gases, acids, alkalis, salts, or near combustible materials.
- Do not install in environments with high temperatures, humidity, dust, or metal particles.
- Install the drive in a vibration-free location.

2.1.2 Environmental Conditions

Project	Description
Use Ambient Temperature	-10°C to 40°C (must not exceed 45°C; for every 5°C increase in ambient temperature above 45°C, the performance rating shall be reduced by 5% to 10%).
Environmental Humidity	20–90% RH (no condensation)
Storage Temperature	-20~60℃
Storage Humidity	20–90% RH (no condensation)
Vibration Resistance	No more than 4.9 m/s²
Altitude	Do not exceed 1000 m; if higher, use at a reduced rate (1% reduction per 100 m increase in height).

2.1.3 Installation Standards

Please strictly adhere to the installation standards shown in the figure below for the control cabinet, which apply when installing multiple servo drives side by side inside the control cabinet (hereinafter referred to as "side-by-side installation").
Taking drivers with 3 kW or less as an example:



■ When installed side by side

As shown in the figure above, when installing drives side by side inside the cabinet:

- For drivers rated 3 kW or below, ensure a clearance of at least 10 mm on each lateral side and 50 mm on each longitudinal side.
- The 5.5 kW−7.5 kW driver requires a clearance of at least 40 mm on each lateral side and at least 80 mm on each longitudinal side.
- For drivers rated at 22 kW or higher, the horizontal distance between both sides must be at least 50 mm from the mounting cabinet, and the vertical distance must be at least 100 mm.

Additionally, to prevent localized overheating of the servo driver's operating environment, the temperature inside the control cabinet must be maintained uniformly.

■ Orientation of the servo driver

During installation, orient the front of the servo driver (the actual mounting surface for the operator) toward the operator and keep it perpendicular to the wall. For drivers with a braking resistor at the bottom, ensure proper heat dissipation on the mounting surface to prevent overheating and fire hazards.

■ Cooling

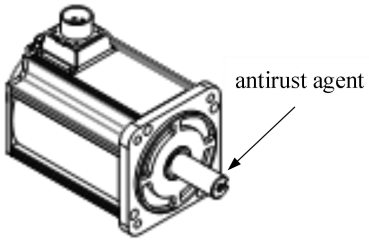
To ensure proper cooling via fans and natural convection, leave sufficient space around the servo driver as shown in the figure above.

■ Environmental conditions inside the control cabinet

- Operating temperature range for the servo driver: -10°C to 40°C (not exceeding 45°C); if the ambient temperature exceeds 45°C, the performance must be reduced by 5%－10% for each additional 5°C increase.
- Humidity: below 90% RH (relative humidity).
- Vibration: 4.9 m/s².
- Avoid freezing, condensation, or similar phenomena.
- To ensure long-term reliability, use the device in environments with temperatures below 50°C.

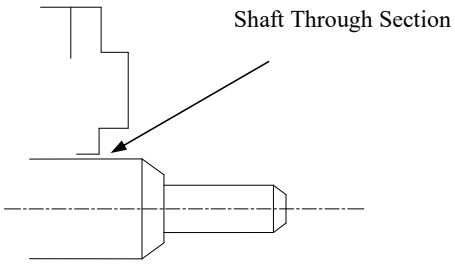
2.2 Installation of Servo Motors

MS6 series servo motors can be installed horizontally or vertically. However, incorrect installation or placement in inappropriate locations may shorten the motor's lifespan or cause unexpected accidents. Follow the instructions below for proper installation.

Pay Attention to
1. A rust inhibitor has been applied to the shaft end. Before installing the motor, wipe off the inhibitor using a cloth soaked in a diluent. 2. When applying the rust inhibitor, avoid letting the diluent come into contact with other parts of the servo motor. 

2.2.1 Environmental Conditions

When used in areas with water or oil droplets, the motor can be protected by appropriate treatment. However, when sealing the shaft penetration section, use a motor equipped with an oil seal. Install the connector facing downward.



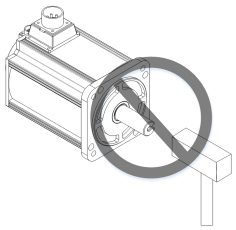
The MS6 series servo motors are designed for indoor use. Please operate them in environments that meet the following installation requirements:

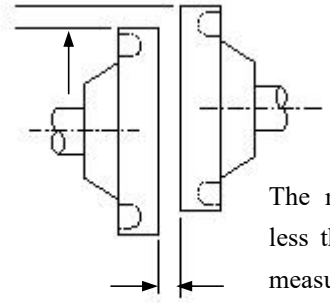
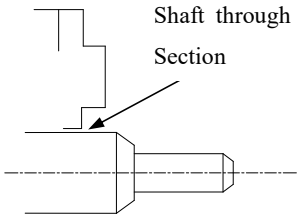
Project	Description
Use Ambient Temperature	-10℃ to 40℃ (no freezing)
Environmental Humidity	20%–90% RH (no condensation)
Storage Temperature	-20℃~60℃

Storage Humidity	20%–90% RH (no condensation)
Vibration-resistant (vibration acceleration)	Radial: 49 m/s² Axial: 24.5 m/s²
Altitude	No more than 1000 m; if exceeding this height, use at a reduced rate (1% reduction per 100 m increase)
Cooling-down Method	Air cooling/Liquid cooling/Natural cooling
Levels of protection	IP67 (for MS6 series B3 motors and MS6G series B2 motors) IP65 (MS6H series B2 motor) IP54 (for motors with a mounting base size of 200 mm or larger)

To achieve the required protection level, ensure the motor is correctly connected to the appropriate cable and securely locked.

2.2.2 Installation Notes

Project	Description
Rust Prevention	◆ Before installation, wipe off the rust inhibitor from the extended end of the servo motor shaft and apply appropriate rust prevention treatment.
Encoder Notes	◆ During installation, avoid impacting the shaft extension end; doing so may cause the internal encoder to fracture. 
	◆ When installing a pulley on a servo motor shaft with keyways, use a threaded hole at the shaft end. To mount the pulley, first insert a double-ended pin into the shaft's threaded hole, place a washer on the coupling surface, and gradually tighten the nut to secure the pulley. ◆ For servo motor shafts with keyways, install using the screw holes at the shaft ends. For shafts without keyways, use friction coupling or similar methods. ◆ When removing the pulley, use a pulley remover to prevent severe impact on the bearing.

Project	Description
	◆ To ensure safety, install a protective cover or similar device in the rotating area, such as a pulley mounted on the shaft.
Settle Your Mind	◆ When installing the servo motor, ensure it meets the centering accuracy requirements shown in the figure. Insufficient centering may cause vibration and potentially damage components such as bearings and encoders. During coupling installation, avoid direct impact on the motor shaft to prevent damage to the encoder mounted on the opposite shaft end of the load. The maximum and minimum deviations are less than 0.03mm (rotated with the coupling) measured at four locations in a circle.  The maximum and minimum deviations are less than 0.03mm (rotated with the coupling) measured at four locations in a circle.
Installation Direction	◆ The servo motor can be installed horizontally or vertically.
Oil and Water Management Strategy	If the installation environment poses a water droplet risk (excluding the motor shaft end), verify that the motor's protection rating meets operational requirements; when the motor shaft may come into contact with oil splashes, use a servo motor equipped with an oil seal; the oil seal comes with factory-applied lubricating grease and must be replaced after 5,000 hours of normal operation.  Operating conditions for servo motors with oil seals: ◆ When in use, ensure the oil level is below the lip of the oil seal. ◆ Use when the oil seal maintains optimal oil mist retention. When installing the servo motor vertically upward, ensure that no oil accumulates on the oil seal lip.
The Stress State of the Cable	◆ Avoid bending or applying excessive tension to electrical wires, especially signal lines with core diameters of 0.2 mm or 0.3 mm—these are extremely thin. During installation, never pull them too tightly.
Connector parts processing	For the connector section, please note the following: ◆ When connecting the connector, ensure there are no debris or foreign objects such as metal pieces inside.

Project	Description
	◆ When connecting the connector to the servo motor, always connect it from the main circuit cable side first, and ensure the ground wire of the main cable is securely connected. Connecting from the encoder cable side may cause the encoder to malfunction due to a potential difference between PE lines. ◆ When wiring, ensure the pin arrangement is correct. The connector is made of resin. Do not apply impact to prevent damage. When handling the cable while it remains connected, always grip the servo motor body. Handling only the cable may damage the connector or sever the cable. ◆ When using a curved cable, exercise caution during wiring operations and avoid applying stress to the connector. Applying stress to the connector may cause damage.

2.2.3 Installation Site

- Do not use this product in environments containing corrosive or flammable gases such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gases, acids, alkalis, salts, or near combustible materials.
- In environments containing grinding fluids, cutting fluids, oil contaminants, or metal dust, select a motor with an oil seal.
- Keep away from heat sources such as stoves when in use.
- Do not use the motor in enclosed environments. This can cause the motor to overheat and shorten its lifespan.

2.3 Installation of Servo Cables

DS5 series servo motors utilize communication-type encoders, which may experience unpredictable performance issues due to improper operation or environmental factors. When installing optional power cables and encoder cables, please adhere to the following guidelines.

2.3.1 Optional XINJE Cable

Our company's standard cable materials include conventional cables and high-flexibility cables. For motors with 80-type bases or smaller, the compatible cable connectors are available in aviation-type and AMP-type; for motors above 80-type bases, only the aviation-type connector is applicable.
When customers select cables independently, they must define the actual operating conditions on site.
For standard applications, select cables from other manufacturers strictly in accordance with XINJE's specifications (see 2.3.2 XINJE Cable Specifications). For non-standard applications, choose cables that exceed XINJE's current specifications based on actual operating conditions.

1. In routine settings, the following points should be noted:

- The cable for pulse command signals must be used for wiring lengths of no more than 3 meters.
- Encoder cables should be limited to 20 meters in length; for lengths exceeding this, specialized cables are recommended. The cable diameter depends on the actual usage length—longer cables exhibit higher resistance, leading to greater voltage attenuation or signal distortion, which may result in signal loss or failure to detect signals. Therefore, custom-made specialized cables should generally be used for applications beyond 20 meters.
- The wire diameter depends on the motor's current rating; typically, it should be set at 1/10 of the motor's maximum current. For example, if the motor's maximum current is 60 A, a 6 mm^2 wire diameter is recommended.
- If interference issues occur, ensure separation between high-voltage and low-voltage circuits; it is recommended to isolate power lines from encoder and signal lines.
- Ensure proper grounding of the servo driver and servo motor. The grounding resistance must not exceed 4 Ω, and the grounding depth should be greater than 2 meters. It is recommended to use 4 × 40 mm angle-zinc-coated steel bars or 40 mm diameter galvanized steel pipes.
- When customers install cables themselves, they must select appropriate cable specifications (refer to Section 2.3.2 for XINJE Cable Specifications). During installation, ensure reliable welding by avoiding poor connections, bridging, miswelding, or missed welds; conduct a continuity test at both cable ends after welding is complete.

2. In unconventional settings, the following precautions should be observed:

1) Applications for cable pulling and bending

- Do not bend or subject the cable to tension. Since the core wire diameter of signal cables is only 0.2 mm or 0.3 mm, they are prone to breaking; exercise caution during use.
- Use flexible cables when moving cables, as standard cables are prone to damage from prolonged bending. Built-in cables for low-power motors (below 80-watt models) should not be used for cable relocation.
- When using a cable protection chain, ensure:

① The bending radius of the cable shall be at least 10 times its outer diameter;

② Do not secure or bundle the wiring within the cable protection chain; it may only be connected to two fixed points on the chain.

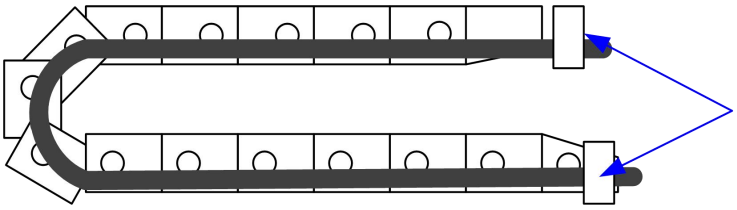
The end of the cable is secured by bundling.

③ Avoid winding or twisting the cable;

④ The duty cycle within the cable protection chain shall be maintained below 60%.

⑤ Do not mix cables with significantly different appearances for wiring to prevent the thick wire from breaking the thin one; if mixing is absolutely necessary, take appropriate precautions.

A partition device is installed in the middle of the cable.



2) Oil-contaminated environments and humid environments

- It is recommended to use cables with aviation plugs as connectors; Amp interface cables are not advised.
- Existing Ampere interface cables at the site require appropriate protection (e.g., apply silicone sealant or tie insulating cloth, etc
- Use special cables.

3) Interference-prone environments or high-current/high-power applications (e.g., welding equipment)

- The motor is properly grounded.
- High-current equipment should be grounded separately.
- Rational wiring, such as separating power and non-power cables.
- Protect the encoder cable with a metal shielding layer or add a magnetic ring for interference suppression.

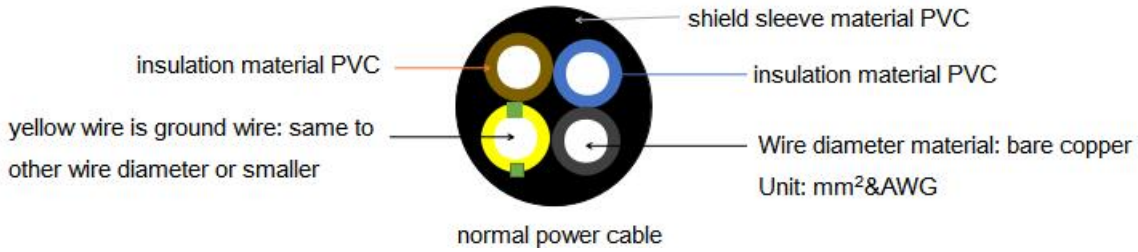
4) Low-temperature/high-temperature environments

- Select cables that meet the usage requirements (special cables).

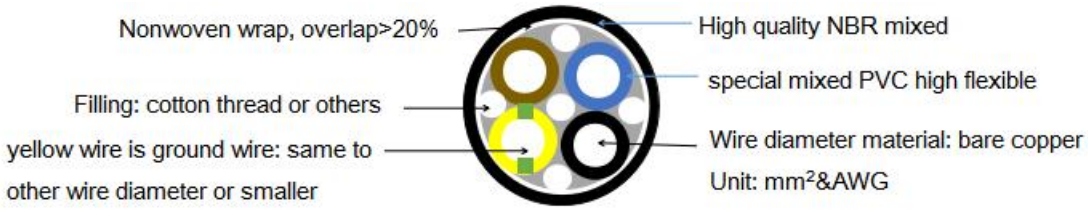
2.3.2 Specifications of XINJE Cables

1. Material Composition of XINJE Cable

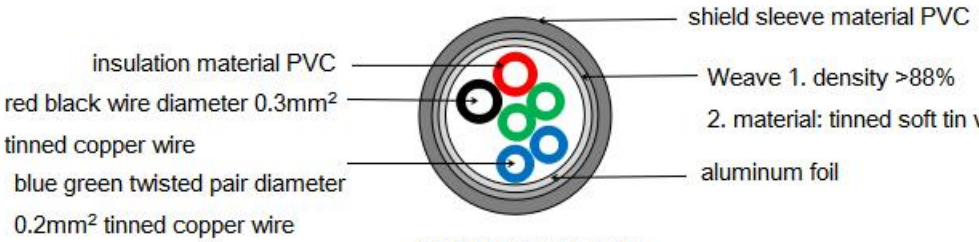
Cross-sectional diagram of cables (encoder cables, power cables), with detailed specifications for the insulation material, wire diameter, core material, and shielding layer material in the internal view.



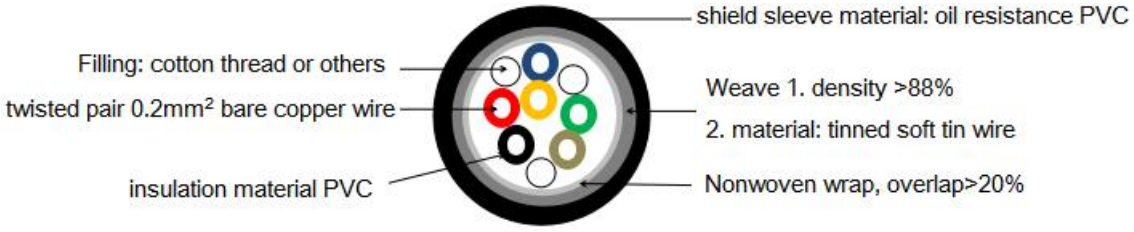
normal power cable



high flexible power cable



normal encoder cable



high flexible encoder cable

2. Wire Diameter Specifications

Seat No.	Encoder Wire Diameter		Power Cable Diameter		
	Overall Wire Diameter (mm)	Single Cable Cross-Sectional Area (mm²)	Total Wire Diameter (mm) (Not braked / Braked)	Power cable core Wire Diameter (mm²)	Brake cable core Wire Diameter (mm²)
40 Machine Bases	6 mm	Below 15 m: 3P*0.2 mm²	Standard High Flexibility: 5.2/5.8 mm	4*0.3 mm²	2*0.3 mm²
60,80 Machine Bases			Standard High Flexibility: 6.2/6.5 mm	4*0.5 mm²	
130 Machine Base	6.2 mm	15m~30m:	Standard: 9.4/9.4 mm High Flexibility: 9.6/9.6	4*1.5 mm²	

		2P*0.2 mm²+ 1P*0.34 mm² 30m~50m: 2P*0.2 mm²+ 1P*0.4 mm²	mm		
180 Machine Base, 3 kW			Standard: 9.7/9.8 mm High Flexibility: 9.8/9.8 mm	4*2.0 mm²	
180-inch chassis, capacity above 3 kW			Standard: 14.5/14.5 mm High Flexibility: 15.8/15.8 mm	4*6.0 mm²	
200 units, each with a power output of 21 kW	7.9 mm		Standard: 19.6 mm	4*10.0mm²	
200 units, each with a power output of 27 kW			Standard: 20 mm	3*12.0mm²+ 1*4 mm²	
265 Machine Base, 30 kW			Standard: 22 mm	4*16.0mm²	

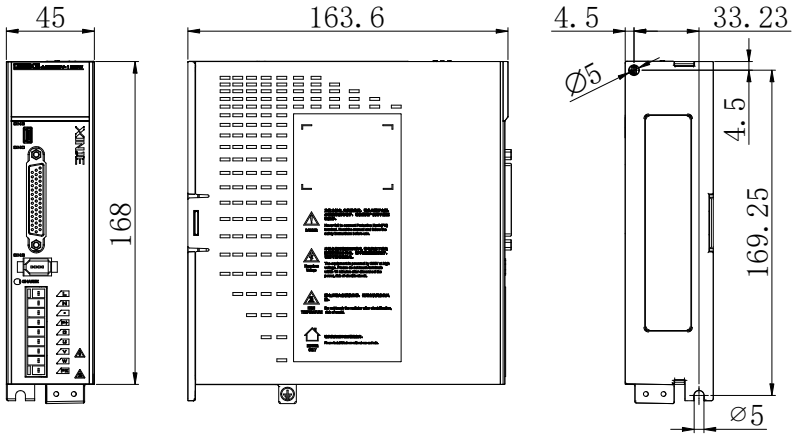
For encoder cables of 15 meters or longer, the power lines (5V and GND) must have thicker conductors to prevent voltage attenuation caused by long cable runs from interfering with encoder signal transmission.

3. Cable Technical Specifications

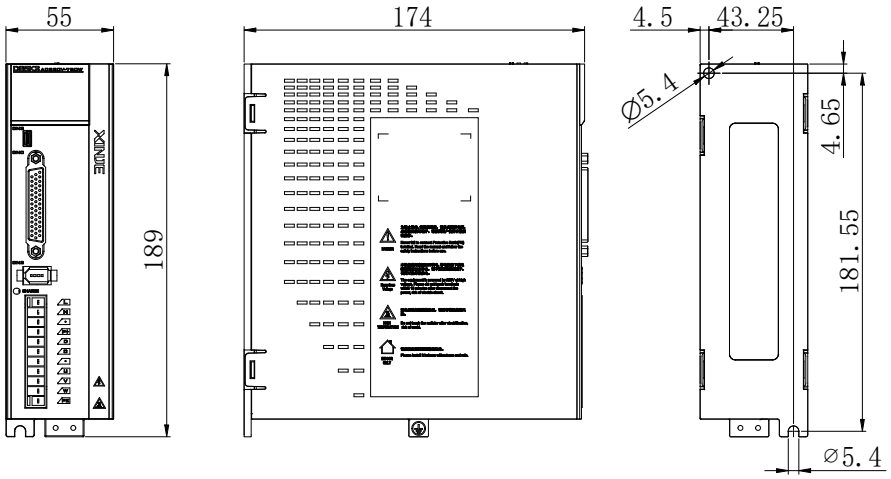
Cable Type	Cable Performance Specifications		Cable Installation Specifications	
	Temperature Resistance	Withstand Voltage	Fixed Installation	Mobile Installation
Standard Cable	-20℃~80℃	2000V/min	≥5*D	/
High Flexibility Cable	-20℃~80℃	2000V/min		If the travel distance is ≤2 m and R ≥ 7.5 × D, then N ≥ 3 million trips. If the travel distance is ≤2 m and R ≥ 10 × D, then N ≥ 5 million times.
Note: D represents the finished wire diameter, R represents the bending radius, and N represents the number of bending cycles.				

2.4 Physical Dimensions of the Servo Driver

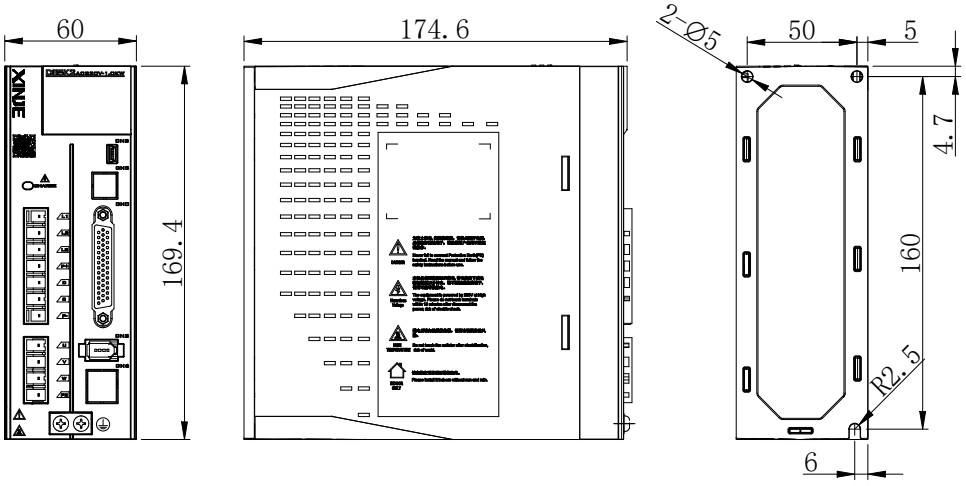
■ DS5K2-20P1-PTA, DS5K2-20P4-PTA Unit: mm



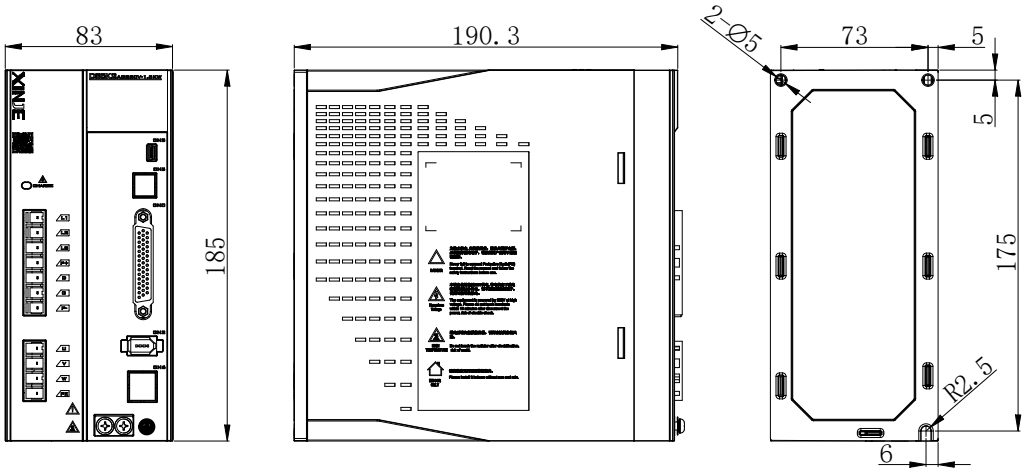
■ DS5K2-20P7-PTA Unit: mm



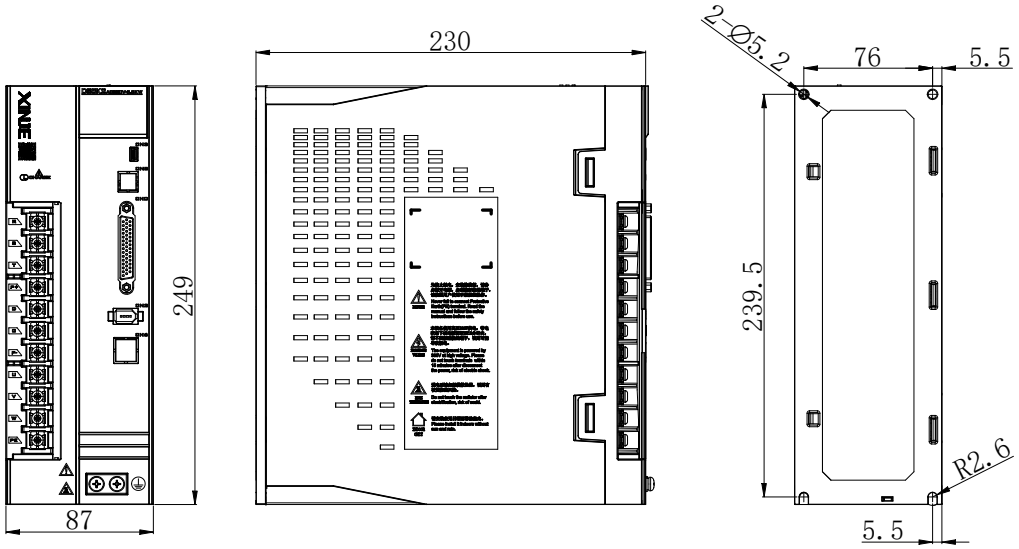
■ DS5K2-21P0-PTA, DS5K2-41P0-PTA, DS5K2-41P5-PTA Unit: mm



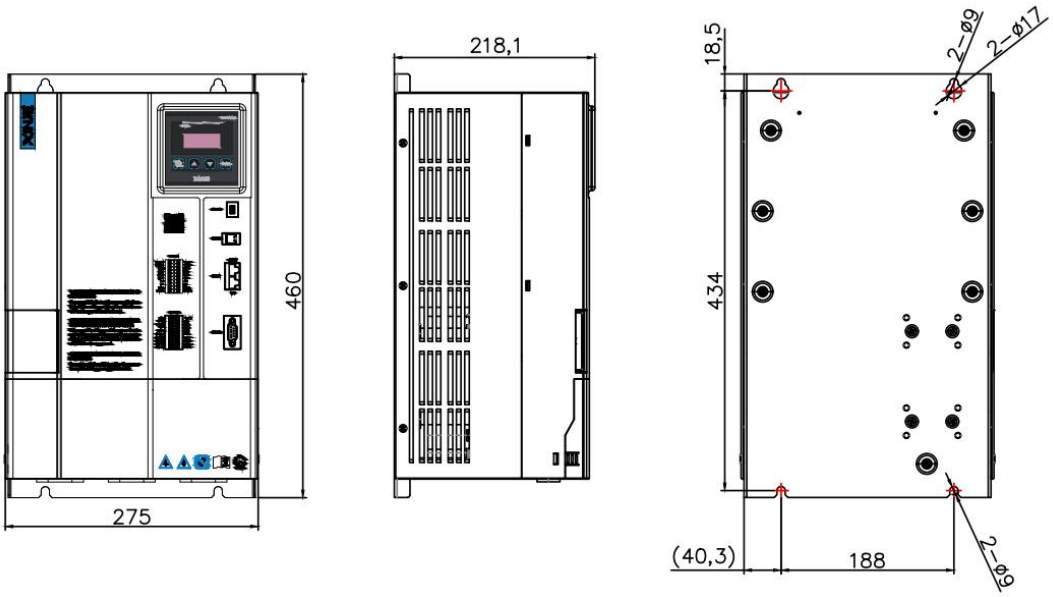
■ DS5K2-21P5-PTA, DS5K2-22P3-PTA, DS5K2-22P6-PTA, DS5K2-42P3-PTA, DS5K2-43P0-PTA Unit: mm



■ DS5K2-45P5-PTA, DS5K2-47P5-PTA Unit: mm

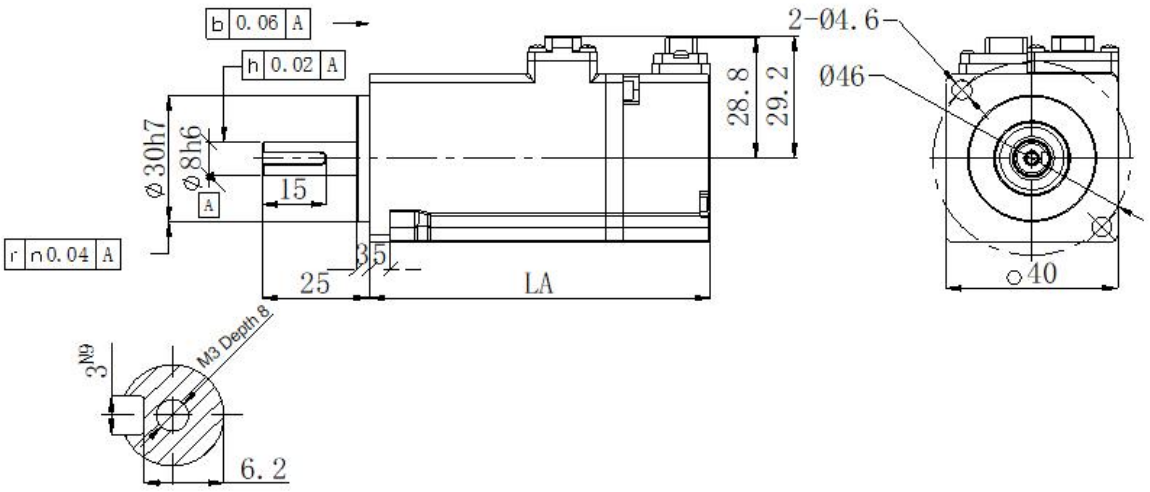


■ DS5K2-422P0-PTA, DS5K2-432P0-PTA Unit: mm



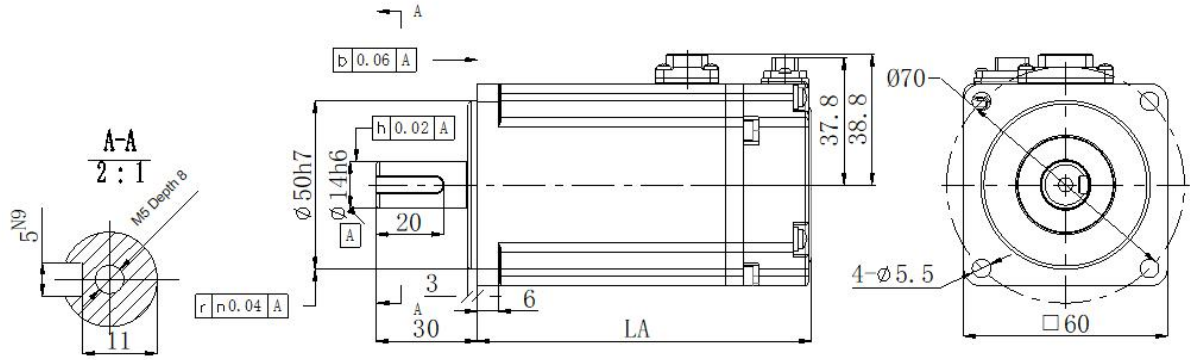
2.5 External Dimensions of the Servo Motor

■ Installation dimensions for 40-watt base motor Unit: mm



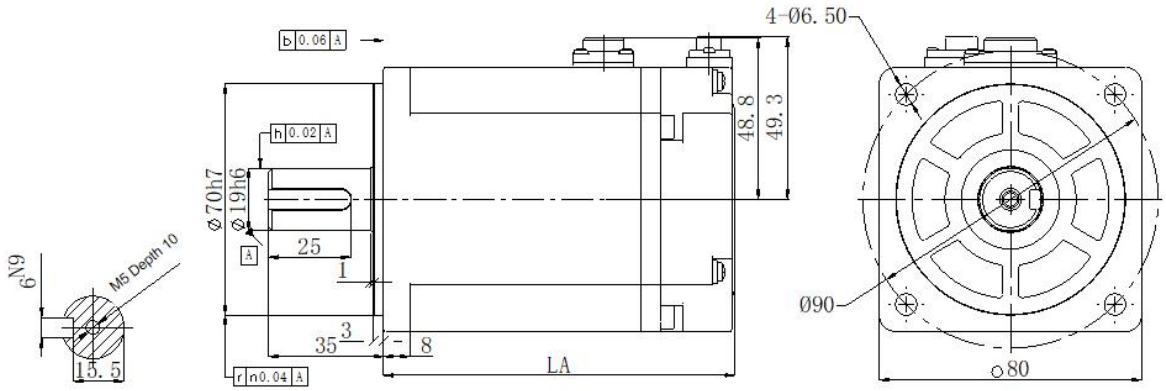
Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6H-40CN30B□3-20A5-S	60.8	93.4	8	High Inertia
MS6H-40CN30B□3-20P1-S	77.4	110		
MS6H-40TH30B□3-20A5-S	62.8	95.4		
MS6H-40TH30B□3-20P1-S	79.4	112		

■ Installation dimensions for 60-watt base motor Unit: mm



Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6H-60CN30B□3-20P2	76.4	99.15	14	High Inertia
MS6H-60CN30B□3-20P2-S	66.7	93.5		
MS6S-60CN30B□3-20P4	98.4	121.15		Low inertia
MS6S-60CN30B□3-20P4-S	88.7	115.5		
MS6S-60TH30B□3-20P4	97.4	121.2		
MS6S-60TH30B□3-20P4-S	97.4	121.2		
MS6H-60CN30B□3-20P4	98.4	121.15		High Inertia
MS6H-60CN30B□3-20P4-S	80.2	106.95		
MS6H-60TH30B□3-20P4	98.4	121.15		
MS6H-60TH30B□3-20P4-S	80.2	106.95		

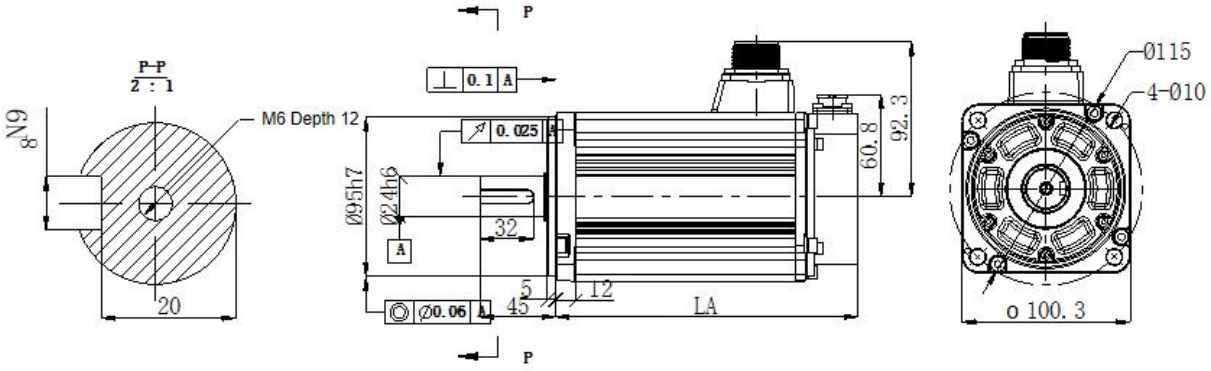
■ Installation dimensions for 80-watt base motor Unit: mm



Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6S-80CN30B□3-20P7	107.1	132.1	19	Low inertia
MS6S-80CN30B□3-20P7-S	95	126.9		

MS6S-80TH30B□3-20P7	107.1	132.1		
MS6S-80TH30B□3-20P7-S	106.1	138		
MS6H-80CN30B□3-20P7	107.1	132.1		High Inertia
MS6H-80CN30B□3-20P7-S	89.2	121.1		
MS6H-80TH30B□3-20P7	107.1	132.1		
MS6H-80TH30B□3-20P7-S	100.3	132.2		
MS6S-80CN30B□3-21P0	117.6	142.6		Low inertia
MS6S-80TH30B□3-21P0	117.6	142.6		
MS6H-80CN30B□3-21P0	134	159		High Inertia
MS6H-80CN30B□3-21P0-S	112.5	144.4		
MS6H-80TH30B□3-21P0	134	159		
MS6H-80TH30B□3-21P0-S	123.6	155.5		

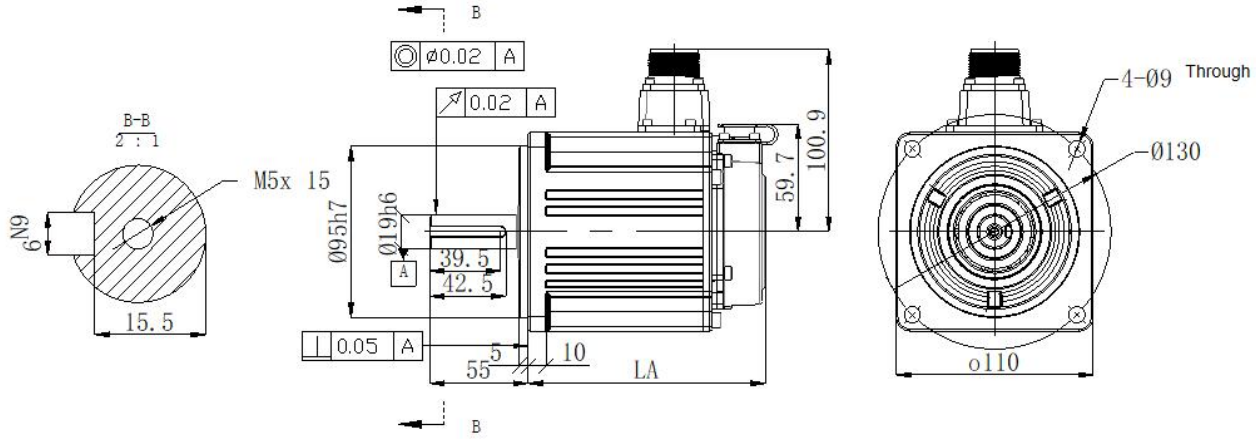
■ Installation dimensions for 100-unit base motor Unit: mm



Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6L-100CN30B□2-□1P5	180	205	24	Ultra-low inertia
MS6L-100TH30B□2-□1P5	193	218		

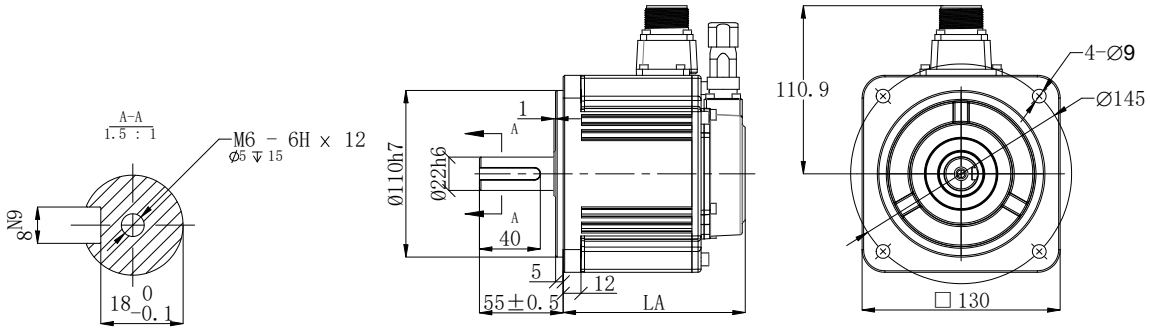
MS6L-100CN30B□2-42P5	228	253		
MS6L-100TH30B□2-42P5	241	266		

■ Installation dimensions for the 110-unit base motor Unit: mm



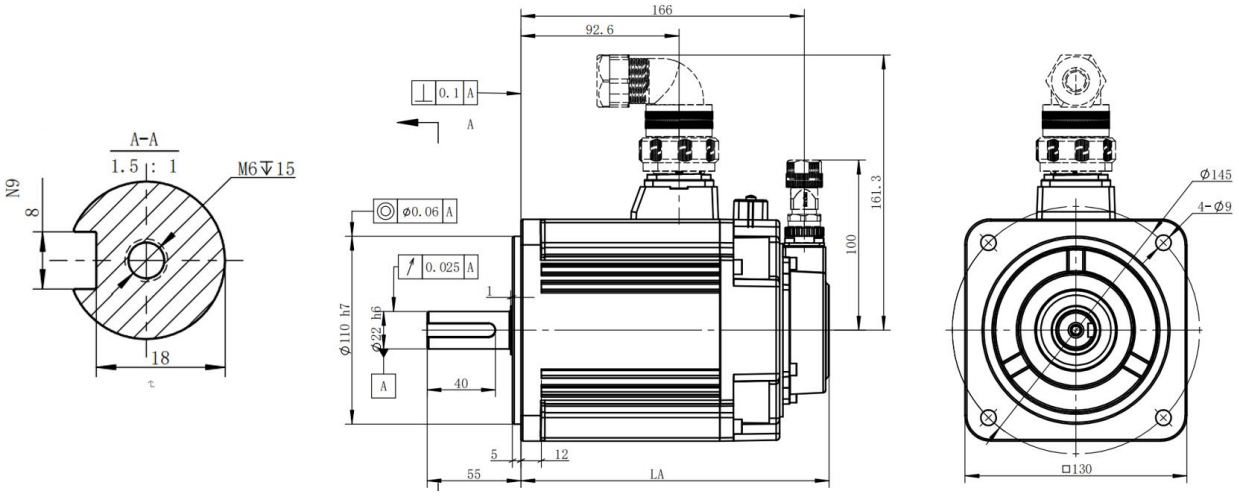
Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-110CN30B□2-□1P5	132.5	163.5	19	Central Inertia
MS6G-110TH30B□2-□1P5	149	180		
MS6G-110CN30B□2-21P8	132.5	163.5		
MS6G-110TH30B□2-21P8	149	180		

■ Installation dimensions for the 130-base motor Unit: mm

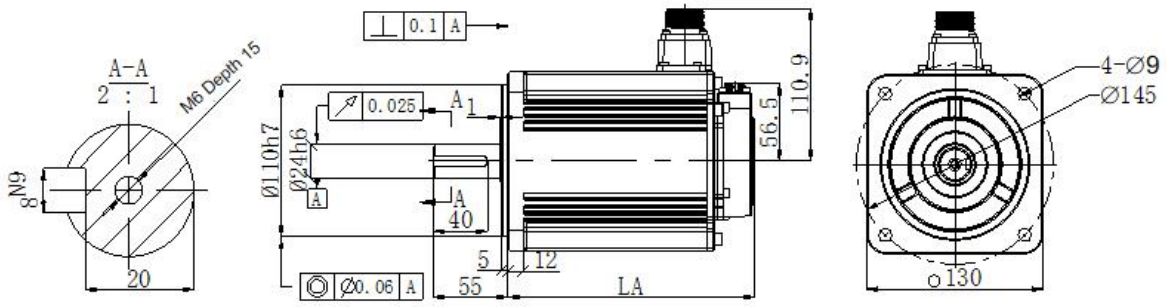


Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-130CN15B□2-□0P8	133.5	162.5	22	Central Inertia

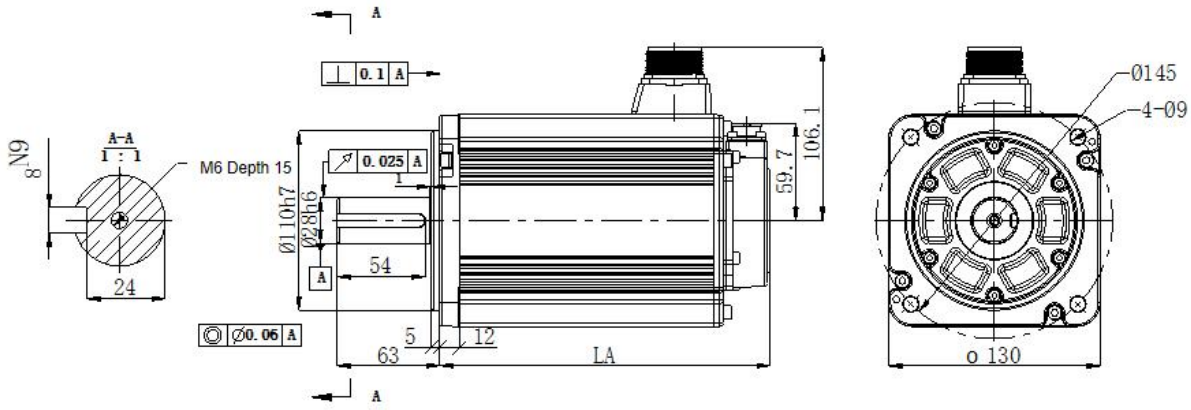
Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-130TH15B□2-□0P8	150	179		
MS6G-130CN25B□2-□1P0	119.5	148.5		
MS6G-130TH25B□2-□1P0	136	165		
MS6G-130CN20B□2-□1P5	133.5	162.5		
MS6G-130CN15B□2-□1P5	151.5	180.5		
MS6G-130TH20B□2-□1P5	150	179		
MS6G-130TH15B□2-□1P5	168	197		
MS6G-130CN15E□2-□2P3	181.5	210.5		
MS6G-130TH15E□2-□2P3	198	227		



Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-130CN25B□2-22P6	148.5	180.5	22	Central Inertia
MS6G-130TH25B□2-22P6	165	197		



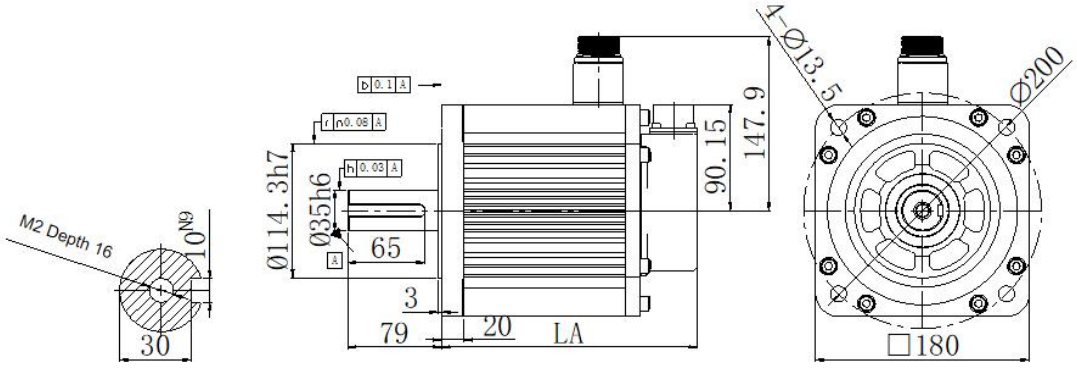
Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-130CN15B□2-□2P3	181.5	210.5	24	Central Inertia
MS6G-130TH15B□2-□2P3	198	227		



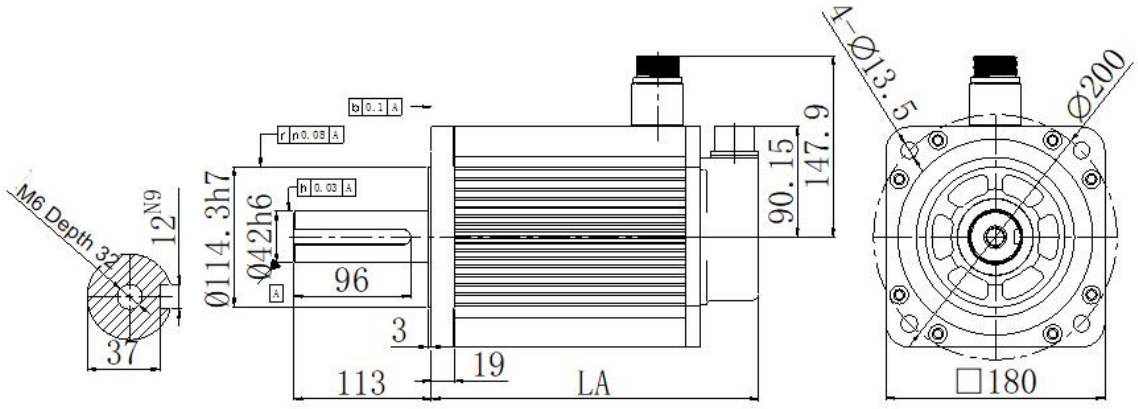
Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6S-130CN30B□2-43P0	202.8	231.8	28	Low inertia
MS6S-130TH30B□2-43P0	219.3	248.3		
MS6S-130CN30B□2-45P0	257.8	298.5		

Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6S-130TH30B□2-45P0	274.3	315		
MS6S-130CN30B□2-47P0	321.8	362.5		
MS6S-130TH30B□2-47P0	338.3	379		

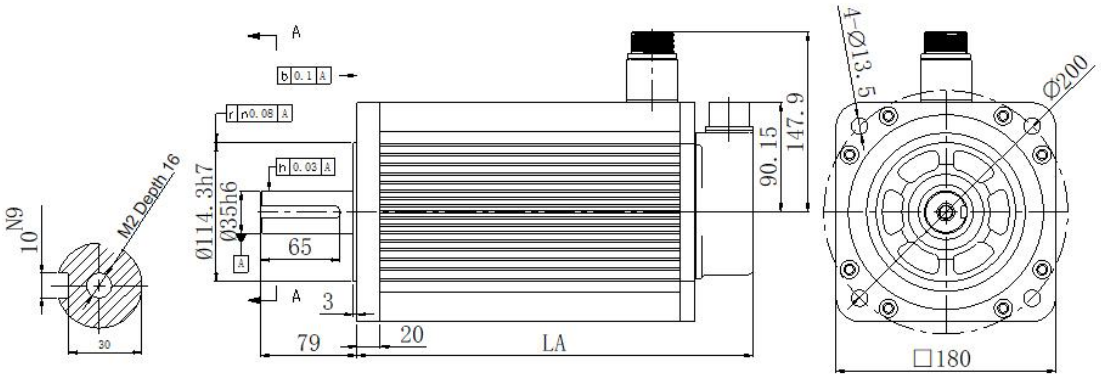
■ Installation dimensions for the 180-axis motor Unit: mm



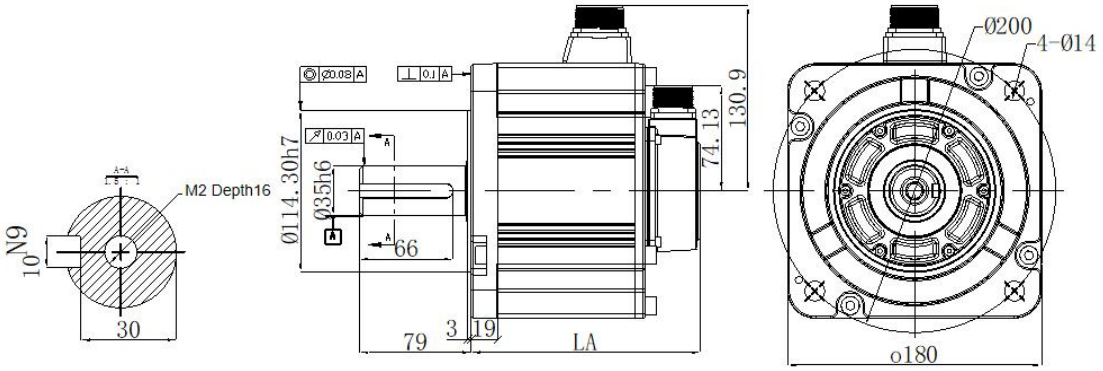
Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6H-180CN15B□2-43P0	215	255	35	High Inertia
MS6H-180CN15B□2-44P4	247	287		



Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6H-180CN15B□2-45P5	269	309	42	High Inertia
MS6H-180CN15B□2-47P5	325	365		

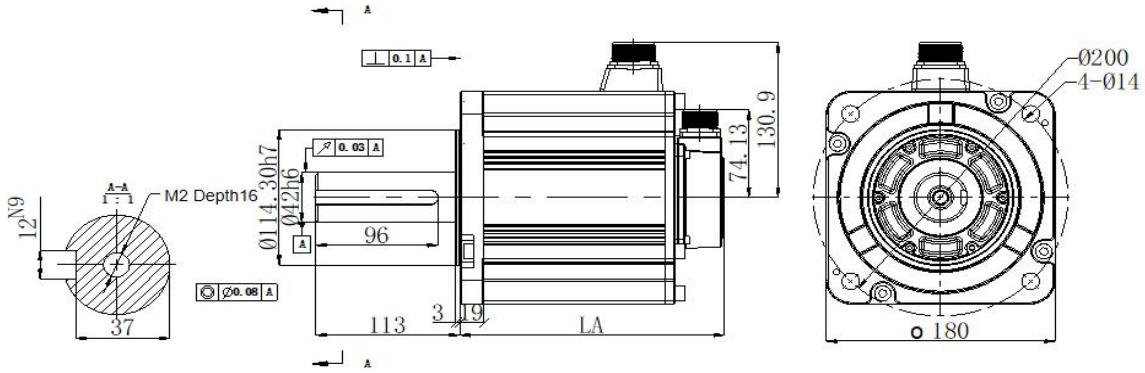


Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6H-180CN15E□2-45P5	269	309	35	High Inertia
MS6H-180CN15E□2-47P5	325	365		



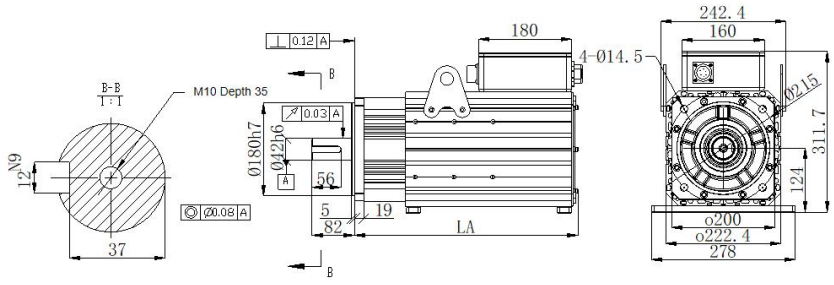
Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-180CN15B□2-43P0	162	206.5	35	Central Inertia

Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-180CN15B□2-44P4	185	229.5		
MS6G-180TH15B□2-43P0	176.5	221		
MS6G-180TH15B□2-44P4	199.5	244		

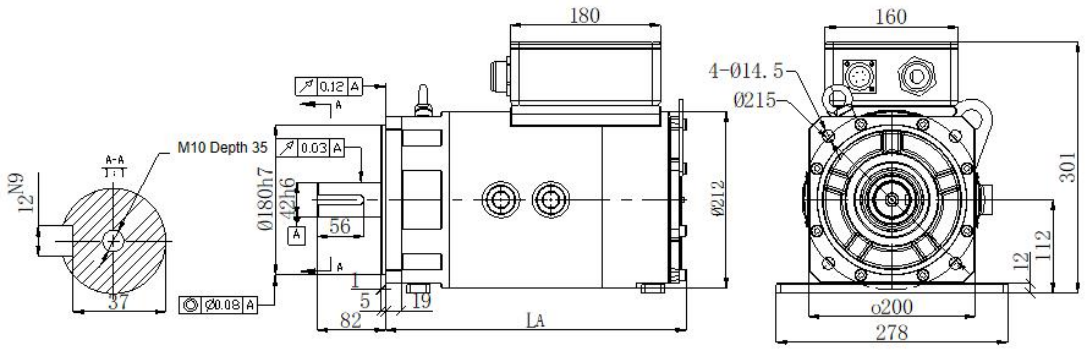


Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-180CN15B□2-45P5	208	252.5	42	Central Inertia
MS6G-180CN15B□2-47P5	256	300.5		
MS6G-180TH15B□2-45P5	222.5	267		
MS6G-180TH15B□2-47P5	270.5	315		

■ Installation dimensions for 200-unit base motor Unit: mm

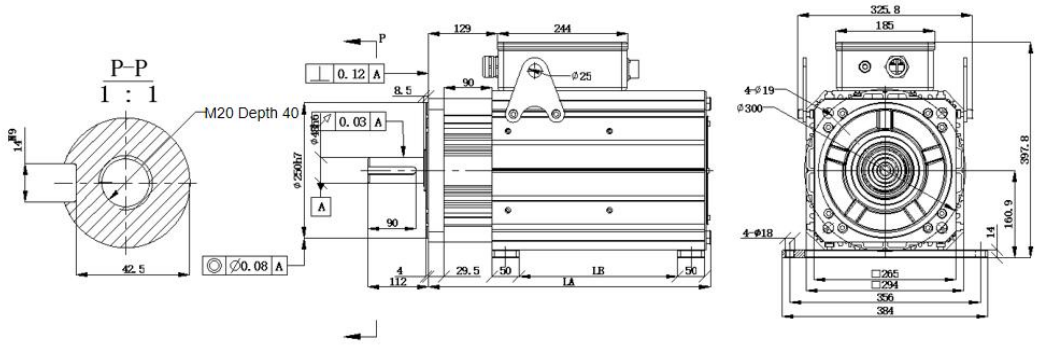


Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-200TH17B□2-413P0-F	433	512	42	Central Inertia
MS6G-200TH17B□2-417P0-F	468	545.5		
MS6G-200TH17B□2-421P0-F	503	580.7		
MS6G-200TH17B2-427P0-F	536.4	615.7		



Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-200TH17B2-413P0-Y	361	/	42	Central Inertia
MS6G-200TH17B2-417P0-Y	396	/		
MS6G-200TH17B2-421P0-Y	431	/		
MS6G-200TH17B2-427P0-Y	166	/		

■ Installation dimensions of the 265 motor base unit: Unit: mm



Motor Model	LA±1		Diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-265TH17B2-430P0-F	527.5	/	48	Central Inertia
MS6G-265TH17B2-448P0-F	577.5	/		

3. Cabling of the servo system

The recommended wiring materials for each interface of the servo driver are listed in the table below:

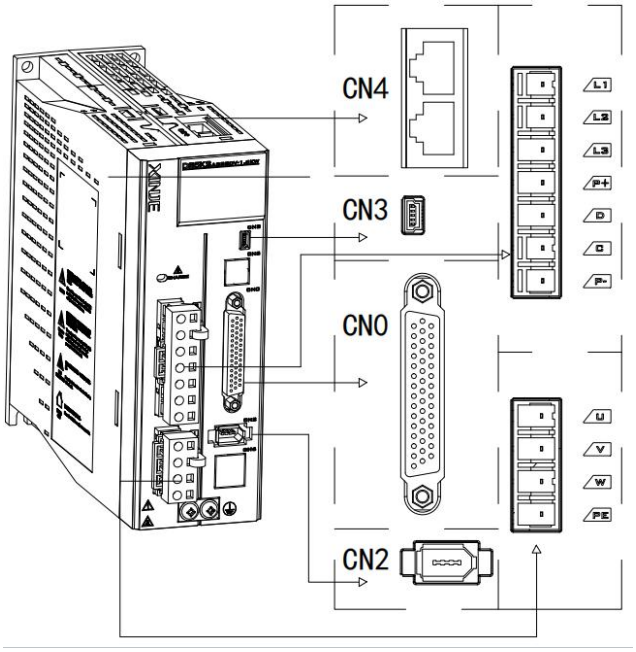
Drive Model	Power Cable – Wire Diameter mm²	UVW Power Cable – Cross-sectional Area (mm²)	Encoder wire – Wire diameter (mm²)	Ground ⏚ Wire – Wire Diameter (mm²)
100W	2.0	0.3	0.2 (7 cores)	0.3
200 ~ 750W	2.0	0.5	0.2 (7 cores)	0.5
1 ~ 2.6kW	2.0	1.5	0.2 (7 cores)	1.5
3kW	2.0	2.0	0.2 (7 cores)	2.0
5.5~7.5kW	6.0	6.0	0.2 (7 cores)	6.0
22kW	10.0	10.0	0.2 (8 cores)	10.0
32kW	16.0	16.0	0.2 (8 cores)	16.0



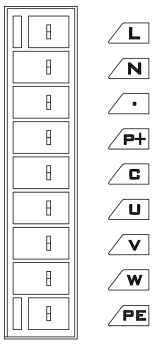
- Do not run power and signal cables through the same conduit or bundle them together. During wiring, maintain a distance of at least 30 cm between power and signal cables.
- For signal lines and encoder (PG) feedback lines, use multi-strand twisted pairs and multi-core twisted-pair shielded cables.
- Regarding wiring length, the maximum length for command input lines is 3 m, while that for PG feedback lines is 20 m.
- Even if the panel displays OFF after disconnecting the drive power supply, high voltage may still remain in the servo unit's internal capacitors. Avoid touching the power terminals for at least 10 minutes.
- Avoid frequent power cycling of the drive unit. When repeated on/off cycles are required, ensure the switching frequency exceeds 2 cycles per minute. The servo driver contains large internal capacitors, causing significant charging current (0.2 seconds) to flow through its internal circuit during startup. Frequent power cycling may degrade the performance of key components in the drive's main circuitry and shorten its service life.

3.1 Introduction to Terminal Blocks

3.1.1 Terminal Layout of the Servo Driver



3.1.2 Main Circuit Terminals and Description



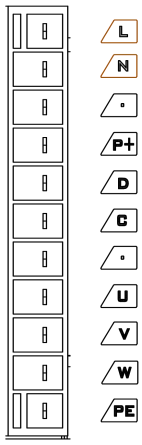
■ DS5K2-20P1-PTA, DS5K2-20P4-PTA

In top-down order, the functions of the main circuit terminals are as follows:

Terminal	Function	Explain
L、N	Main circuit power input terminal	Single-phase AC 200–240 V, 50/60 Hz
●	Air Pin	-
P+、C	Use an external braking resistor	Connect the braking resistor to terminals P+ and C. P0-25 = Power value; P0-26 = Resistance value
U、V、W	Motor Connection Terminal	Connected to the motor
PE	Motor Grounding Terminal	Connect to the motor's grounding terminal for grounding.

■ DS5K2-20P7-PTA

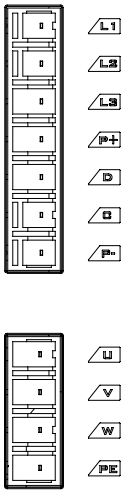
In top-down order, the functions of the main circuit terminals are as follows:



Terminal	Function	Explain
L、N	Main circuit power input terminal	Single-phase AC 200–240 V, 50/60 Hz
●	Air Pin	-
P+、D、C	Use the built-in braking resistor	Short-circuit the P+ and D terminals; open the connection between P+ and C.
	Use an external braking resistor	Connect the braking resistor to terminals P+ and C, then disconnect the shorting wire between P+ and D. P0-25 = Power value; P0-26 = Resistance value
U、V、W	Motor Connection Terminal	Connected to the motor
PE	Motor Grounding Terminal	Connect to the motor's grounding terminal for grounding.

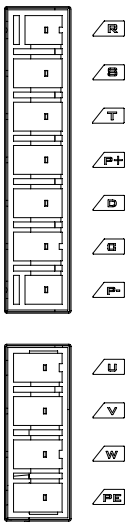
■ DS5K2-21P0-PTA, DS5K2-21P5-PTA, DS5K2-22P3-PTA, DS5K2-22P6-PTA

In top-down order, the functions of the main circuit terminals are as follows:



Terminal	Function	Explain
L1、L2、L3	Main circuit power input terminal	Three-phase (L1·L2·L3) AC, 200–240 V, 50/60 Hz Or single-phase (L1·L3) AC 200–240 V, 50/60 Hz
P+、D、C	Use the built-in braking resistor	Short-circuit the P+ and D terminals; disconnect P+ from C.
	Use an external braking resistor	Connect the braking resistor to terminals P+ and C, then disconnect the shorting wire between P+ and D. Set P0-25 = power value, P0-26 = resistance value
P+、P-	Busbar Terminal	The real-time voltage of the busbar can be measured. Note: This is hazardous.
U、V、W	Motor Connection Terminal	Connected to the motor
PE	Motor Grounding Terminal	Connect to the motor's grounding terminal for grounding.

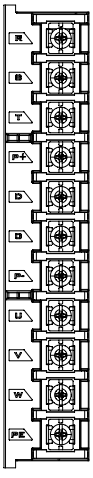
■ DS5K2-41P0-PTA, DS5K2-41P5-PTA, DS5K2-42P3-PTA, DS5K2-43P0-PTA



In top-down order, the functions of the main circuit terminals are as follows:

Terminal	Function	Explain
R、S、T	Main circuit power input terminal	Three-phase AC, 380–440 V, 50/60 Hz
P+、D、C	Use the built-in braking resistor	Short-circuit the P+ and D terminals; disconnect P+ from C.
	Use an external braking resistor	Connect the braking resistor to terminals P+ and C, then disconnect the shorting wire between P+ and D. Set P0-25 = power value, P0-26 = resistance value
P+、P-	Busbar Terminal	The real-time voltage of the busbar can be measured. Note: This is hazardous.
U、V、W	Motor Connection Terminal	Connected to the motor
PE	Motor Grounding Terminal	Connect to the motor's grounding terminal for grounding.

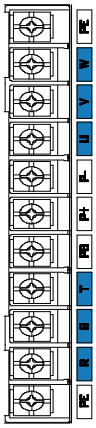
■ DS5K2-45P5-PTA, DS5K2-47P5-PTA



In top-down order, the functions of the main circuit terminals are as follows:

Terminal	Function	Explain
R、S、T	Main circuit power input terminal	Three-phase AC, 380–440 V, 50/60 Hz
P+、D、C	Use the built-in braking resistor	Short-circuit the P+ and D terminals; disconnect P+ from C. (This model does not have a built-in braking resistor and is not supported.)
	Use an external braking resistor	Connect the braking resistor to terminals P+ and C. Set P0-25 = power value, P0-26 = resistance value
P+、P-	Busbar Terminal	The real-time voltage of the busbar can be measured. Note: This is hazardous.
U、V、W	Motor Connection Terminal	Connected to the motor
PE	Motor Grounding Terminal	Connect to the motor's grounding terminal for grounding.

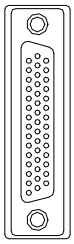
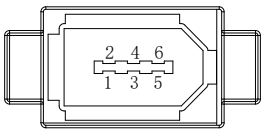
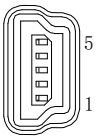
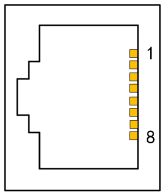
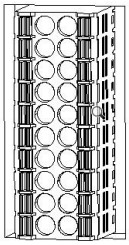
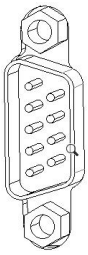
■ DS5K2-422P0/432P0-PTA



In top-down order, the functions of the main circuit terminals are as follows:

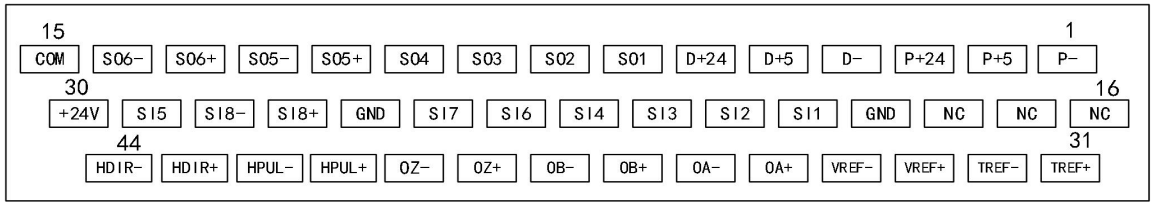
Terminal	Function	Explain
PE	Drive Ground Terminal	Ground the drive. Ensure proper grounding before powering on
R、S、T	Main circuit power input terminal	Three-phase AC, 380–440 V, 50/60 Hz
PB、P+	Use an external braking resistor	When using an external braking resistor, connect it to the P+ and PB terminals.
P+、P-	Busbar Terminal	The real-time voltage of the busbar can be measured. Note: This is hazardous.
U、V、W	Motor Connection Terminal	Connected to the motor
PE	earth terminal	Perform grounding. Ensure proper grounding before powering on.

3.1.3 Description of CN0 to CN4 Terminals

Type	CN0-Control Terminal	CN2 Encoder Connection Terminal	CN3-232 Communication Terminal	CN4-485 Communication Terminal
7.5 kW and below				
22 kW and above				

3.1.3.1 Description of CN0 Control Terminal

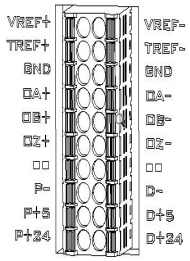
■ CN0 Terminal Specifications (7.5 kW and below)



Number	Name	Explain	Number	Name	Explain
1	P-	impulse -	23	SI4	input terminal
2	P+5	Pulse +5V	24	SI6	input terminal
3	P+24	Pulse + 24V	25	SI7	input terminal
4	D-	direction -	26	GND	Driven by long-term goals...
5	D+5	Direction +5V	27	SI8+	High-speed Input Terminal
6	D+24	Direction +24V	28	SI8-	High-speed Input Terminal
7	SO1	leading-out terminal	29	SI5	High-speed Input Terminal
8	SO2	leading-out terminal	30	+24V	Input Port Common Terminal
9	SO3	leading-out terminal	31	T-REF+	External torque analog signal with differential input +
10	SO4	leading-out terminal	32	T-REF-	External torque analog differential input-
11	SO5+	leading-out terminal	33	V-REF+	External rotational speed analog differential input +
12	SO5-	leading-out terminal	34	V-REF-	External rotational speed analog differential input-
13	SO6+	leading-out terminal	35	OA+	Encoder frequency-divided output OA+
14	SO6-	leading-out terminal	36	OA-	Encoder frequency-divided output OA-
15	COM	Output Common Port	37	OB+	Encoder frequency-divided output OB+
16	NC	Keep	38	OB-	Encoder frequency-divided output OB-
17	NC	Keep	39	OZ+	Encoder frequency-divided output OZ+
18	NC	Keep	40	OZ-	Encoder frequency-divided output OZ-
19	GND	Analog Input Source	41	HPUL+	Long-range drive with high-speed pulses +
20	SI1	input terminal	42	HPUL-	Long-range drive high-speed pulse −
21	SI2	input terminal	43	HDIR+	Long-line drive in high-speed direction +
22	SI3	input terminal	44	HDIR-	Long-line drive high-speed direction-

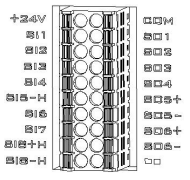
■ CN0 Terminal Specifications (22 kW and above)

From top to bottom and left to right, the functions of Terminal CN0 (top) are as follows:



Terminal	Explain	Terminal	Explain
V-REF+	External rotational speed analog differential input +	V-REF-	External rotational speed analog differential input-
T-REF+	External torque analog signal with differential input +	T-REF-	External torque analog differential input-
GND	Analog Input Source	GND	Analog Input Source
OA+	Encoder frequency-divided output OA+	OA-	Encoder frequency-divided output OA-
OB+	Encoder frequency-divided output OB+	OB-	Encoder frequency-divided output OB-
OZ+	Encoder frequency-divided output OZ+	OZ-	Encoder frequency-divided output OZ-
NC	Keep	NC	Keep
P-	impulse -	D-	direction -
P+5	Pulse +5V	D+5	Direction +5V
P+24	Pulse + 24V	D+24	Direction +24V

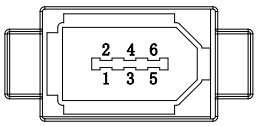
From top to bottom and left to right, the functions of Terminal CN0 (bottom) are as follows:



Terminal	Explain	Terminal	Explain
+24V	Input Port Common Terminal	COM	Common terminal of the output end
SI1	input terminal	SO1	leading-out terminal
SI2	input terminal	SO2	leading-out terminal
SI3	input terminal	SO3	leading-out terminal
SI3	input terminal	SO4	leading-out terminal
SI5	Input Terminal (High Speed)	SO5+	leading-out terminal +
SI6	input terminal	SO5-	leading-out terminal -
SI7	input terminal	SO6+	leading-out terminal +
SI8+H	Input Terminal (High Speed) +	SO6-	leading-out terminal -
SI8-H	Input Terminal (High Speed) -	NC	Keep

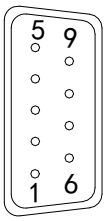
3.1.3.2 Description of CN2 Encoder Connection Terminals

The terminal arrangement on the encoder socket side of the CN2 driver body is as follows (for models up to 7.5 kW):



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

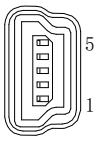
The terminal arrangement on the encoder socket side of the CN2 driver body is as follows (for models 22 kW and above):



NO.	Definition	NO.	Definition
1	temperature -	6	GND
2	temperature +	7	GND
3	485-B	8	5V
4	485-A	9	5V
5	PE		

3.1.3.3 Description of CN3 Communication Terminals

■ RS-232 Communication



Drive Body Port CN3

Pin Number	Name	Explain
1	TXD	RS232 Sender
2	RXD	RS232 Receiver
3	GND	RS232 Signal Ground

Use the dedicated cable communication provided by XINJE Company.

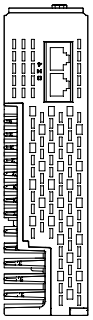
Default RS232 communication parameters: baud rate 115200 bps; 8-bit data bits; 1 stop bit; parity check.
RS232 communication operates in full-duplex mode: the TXD pin (pin number 1) on driver 232's communication port must connect to the RX pin of the USB-to-Serial converter, while the RXD pin (pin number 2) should connect to the TX pin.
The internal hardware supports a maximum frequency of 250 kHz and does not support hot swapping.

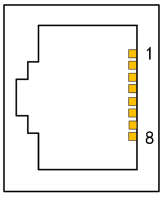
The Modbus station number is set as follows:

Parameter Number	Function	Factory Settings	Set Range	Revise	Come into force
P7-10	Modbus Station Number Configuration	1	1 ~ 255	servo OFF	immediately

3.1.3.4 Description of CN4 Communication Terminals

■ RS-485 Communication





On the drive body side – CN4 port

NO.	Definition
1	CAN_H
2	CAN_L
3	CAN GND
4	485-A
5	485-B
6	485GND
Other	Reserve

Default communication parameters for RS485 port: baud rate 19200 bps, 8-bit data, 1-stopbit, parity check.

The Modbus station number can be freely specified and is set by P7-00; the CAN bus station number is set by P7-30.

Parameter Number	Function	Factory Settings	Set Range	Revise	Come into force
P7-00	Modbus Station Number Configuration	1	0 ~ 255	servo OFF	immediately
P7-30	CAN Bus Communication Station Number	1	1~64	servo OFF	Power On Again

- Supports the standard Modbus RTU protocol and functions as a Modbus RTU slave device.
- The RS232 and RS485 communication ports can be used simultaneously.
- Only the 22/32 power range supports CAN communication.

3.2 Classification and Functions of Signal Terminals

3.2.1 Low-Speed Pulse Command Input

Command Structure	Selectable	Meaning	P- incoming signal	D- incoming signal	Refer to the chapter
P0-10 xxx□	0	CW/CCW dual-pulse sequence mode	CW	CCW	5.3.2.4
	1	AB Phase Mode (not supported in External Pulse Speed Mode)	A phase	B phase	
	2	Pulse + Direction Mode	impulse	direction	
1. For the collector-open-circuit type (24 V voltage), the positive input signal is P+ (pin 3)/D+ (pin 6); 2. For the differential method (5 V voltage), the positive input signal is P+ (pin 2)/D+ (pin 5).					

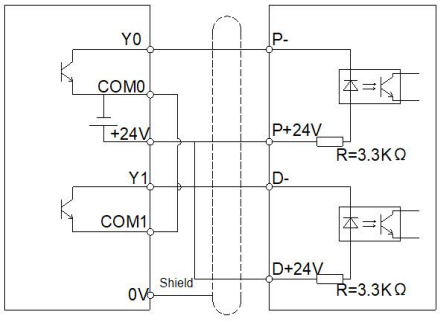
■ Pulse Input Specifications

Pulse Specifications		Maximum Input Frequency	Voltage Specification
P- P+5V D- D+5V	5V differential input	500kHz	Typical 5V (range: 3.3 V to 5 V)
P-P+24V D-D+24V	24V Collector Input	200kHz	Standard DC24V (range: 18V to 28V)

The interface circuits for P+D, CW, CCW, and AB phases are shown in the wiring diagram below:

Collector open-circuit type (24 V voltage)

PLC, CNC systems, micro-controllers, and servo drivers

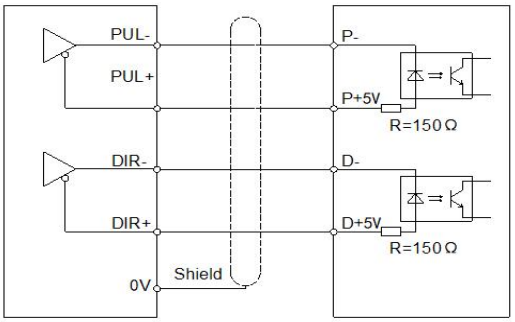


When the upper device uses a collector-open-output configuration, follow this connection method and ensure that P+5V and D+5V are left open.

- The power supply voltage ranges from 18 V to 25 V for P-/P+24V and D-/D+24V configurations. Voltages below 18 V may result in pulse or directional abnormalities.
- To prevent interference, use a twisted-pair shielded cable.

Differential Method (5V voltage)

PLC, CNC systems, micro-controllers, and servo drivers



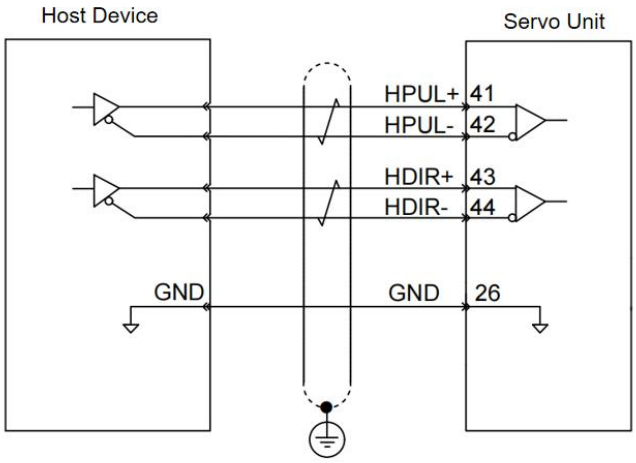
When the upper device outputs a 5V differential signal, use the diagrammed connection method and ensure that P+24V and D+24V are left open.

- To enhance anti-interference performance, use twisted-pair shielded cables and keep command signal lines within 3 meters. The shielding layer should be connected to the controller's 0V terminal, and ensure proper grounding of the servo unit.
- The P-/P+24V and D-/D+24V power supply ranges are 18V to 25V, while the P-/P+5V and D-/D+5V ranges are 3.3V to 5V; voltages below 18V or 3.3V may cause pulse or directional anomalies.
- The servo pulse input port is turned on at 10 mA.
- If the controller is a XINJE PLC, its pulse output port has a rated current of 50 mA. Based on this specification, theoretically one pulse channel can support up to five servos; however, it is recommended not to exceed three.

3.2.2 High-Speed Pulse Command Input

The high-speed pulse command input supports systems with a 5 V differential input; the output circuits for high-speed command pulses and symbols on the host device side can only be delivered to the servo driver via a differential driver.

The high-speed pulse command input port is soldered onto port CN0, comprising pins 41 (High-Speed Pulse +), 42 (High-Speed Pulse －), 43 (High-Speed Pulse Direction +), and 44 (High-Speed Pulse Direction －); see Section 3.1.3.1 for details on the CN0 control terminals.



Ensure that the 5V ground of the upper device is connected to the driver's high-speed pulse GND (long line drive ground on pin 26), and use a twisted shielded cable to connect it to a clean external ground terminal to reduce noise interference.

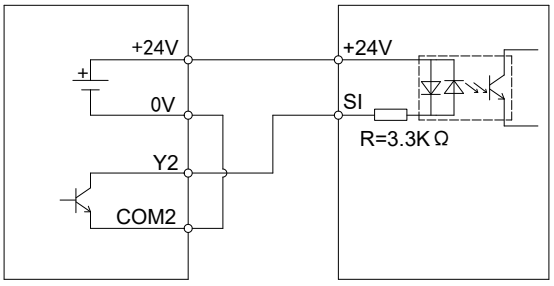
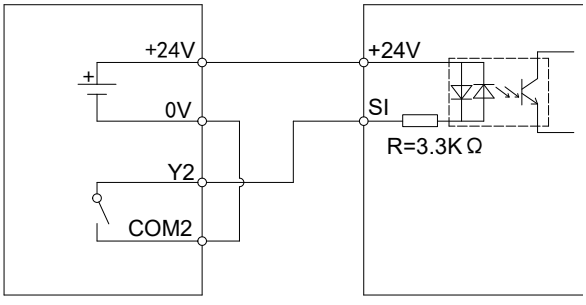
3.2.3 SI Input Signals

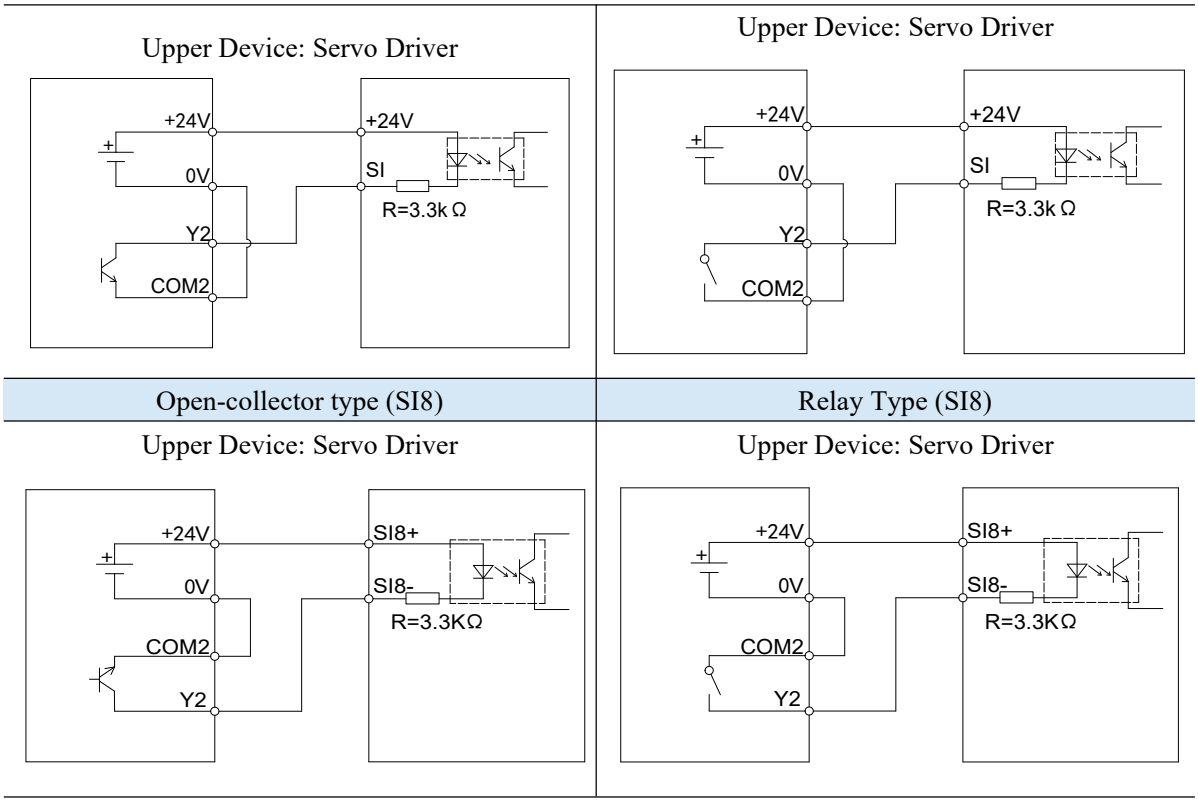
Connect using a relay or a transistor circuit with an open collector. When using a relay, select one designed for low current. Failure to use a low-current relay may result in poor contact.

Classify	Input terminal	Function
on-off input	SI1 ~ SI8	Multi-functional Input Signal Terminal

Factory allocation of input terminals

Terminal	SI1	SI2	SI3	SI4	SI5~SI8
Function	S-ON/ enable	ALM-RST/Alarm Reset	P-OT/Prohibited forward rotation	N-OT/Reversal Prohibited	Un absorbed

Open-collector type (SI1−SI4, SI6−SI7)	Relay type (SI1−SI4, SI6−SI7)
Upper Device: Servo Driver	Upper Device: Servo Driver
	
Collector open-circuit type (SI5)	Relay Type (SI5)



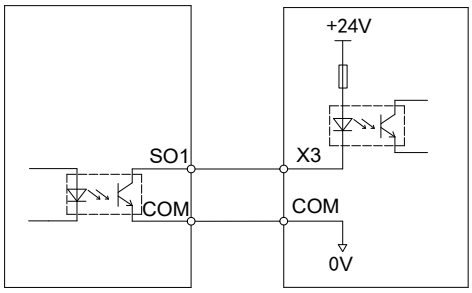
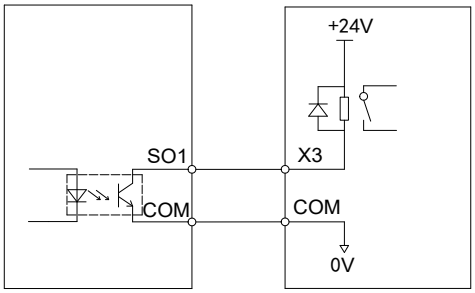
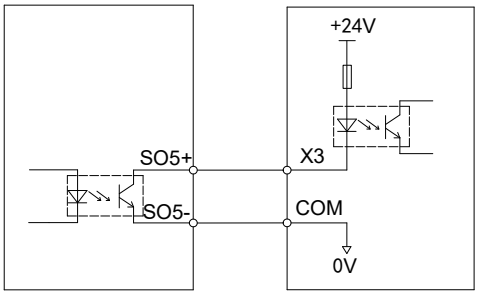
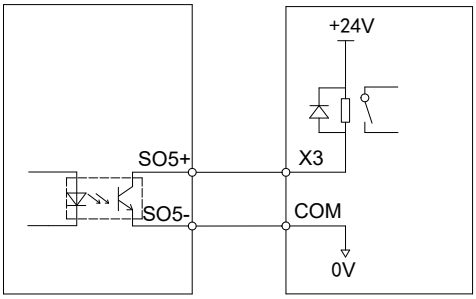
- Six-channel low-speed SI inputs (SI1－SI6, SI7), with a response time of ≤2 ms; supports both NPN and PNP connection configurations.
- SI5 and SI8 are high-speed SI inputs with a response time of ≤ 2 μs.
- The high-speed SI5 supports only NPN configuration, while the high-speed SI8 supports both NPN and PNP configurations and operates at 24 V DC; a minimum voltage of 18 V is recommended, with a maximum recommended voltage not exceeding 28 V.

3.2.4 SO Output Signal

Classify	Leading-out terminal	Function
Optocoupler Output	SO1 ~ SO6	Multi-functional output terminal

Factory allocation of output terminals

Terminal	SO1	SO2	SO3~SO6
Function	COIN/Positioning Complete	ALM/ report to the police	unabsorbed

Optocoupler type (SO1−SO4)	Relay type (SO1−SO4)
Servo Driver Upper Device Servo Driver Upper Device 	Servo Driver Upper Device Servo Driver Upper Device 
Optocoupler type (SO5, SO6)	**Relay type (SO5, SO6)**
Servo Driver Upper Device Servo Driver Upper Device 	Servo Driver Upper Device Servo Driver Upper Device 

- SO5 and SO6 are labeled with + or-; SO5− and SO6− can be connected together using a common COM port.
- Maximum load voltage: DC 30 V (maximum)
- Maximum Load Current:
  - For currents up to 400 W: SO1 should be set to 500 mA (maximum), and SO2−SO6 to 50 mA (maximum). Due to the high current required for brake engagement, control the brake motor via SO1 terminal with brake parameter P5-44 set to n.0001.
  - For outputs of 750 W or higher: SO1−SO6 should carry up to 50 mA. Due to the high current required for brake engagement, use an intermediate relay when controlling the brake motor via SO channels.
- SO1−SO4 supports only NPN configuration; SO5/SO6 support both NPN and PNP configurations with low-speed SO output.

3.2.5 Simulation Input Circuit

The torque analog input port and speed analog input port are soldered onto terminal CN0 as follows: Pin

31 (external torque analog differential input +), Pin 32 (external torque analog differential input-), Pin 33 (external speed analog differential input +), and Pin 34 (external speed analog differential input-); see Section 3.1.3.1 for details on the CN0 control terminals.

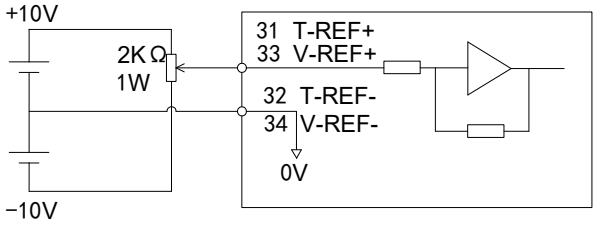
- The allowable operating voltage for the input signal is ±10 V, not exceeding ±10.5 V.
- The input impedance is as follows:

  Speed command input: approximately 72 kΩ

  Torque command input: approximately 72 kΩ

  - The command corresponding to the analog input voltage value is configured via the P3 parameter group; see sections 5.5.3 Torque Control (External Analog Signals) and 5.4.4 Speed Control (External Analog Signals) for details.

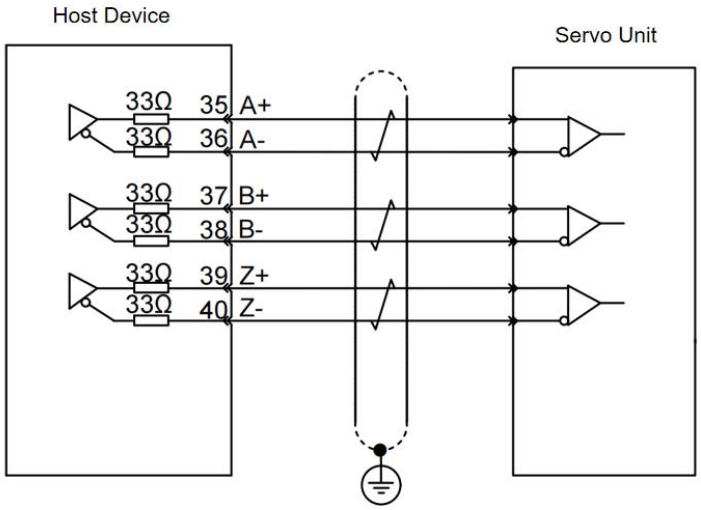
Upper Device: Servo Driver



- For analog signals, always use twisted-pair shielded cables and connect them to a clean external ground terminal to minimize noise interference.
- When using analog voltage signals, the analog signal ground (pin 32 T-REF/ and pin 34 V-REF-) must be shorted to both the external reference ground and the internal analog reference ground (pin 19 GND); this should not be done for differential analog signals.

3.2.6 Encoder Feedback Output Signal

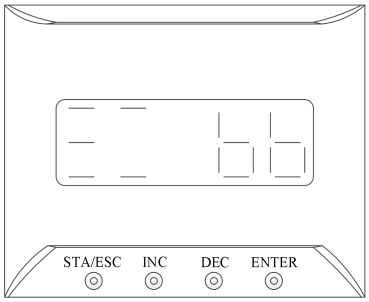
The encoder's frequency-divided output circuit generates a differential signal via a differential driver, providing closed-loop feedback for the host device's position control system. On the host side, use either a differential or optocoupler receiver circuit for signal acquisition, with a maximum output current of 20 mA.



4. Using the Operation Panel

4.1 Basic Operations

4.1.1 Instructions for the Operation Panel



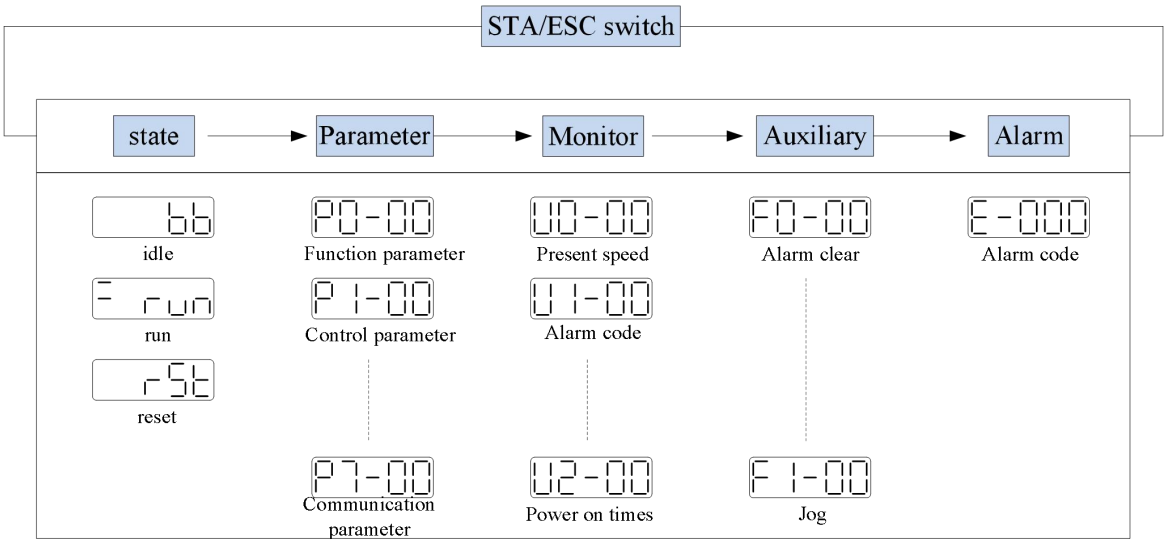
Button Name	Operation Declaration
STA/ESC	Short press: Switch states or return to the previous state.
INC	Short press: Display data in ascending order; Long press: Show data in ascending order.
DEC	Short press: Show data in descending order; Long press: Show data decreasing sequentially.
ENTER	Short press: Shift; Long press: Set and view parameters.

After power-on, the rear panel will perform a self-check: all display digits and five decimal points will light up simultaneously for 1 second.

4.1.2 Key Operations

By switching the basic modes of the panel controller, you can display operating status, set parameters, activate auxiliary functions, and check alarm status. Pressing the STA/ESC keys will sequentially change between modes in the order shown below.

State: bb indicates the servo system is idle; run indicates the servo system is operating; rst indicates the servo system requires a power cycle.



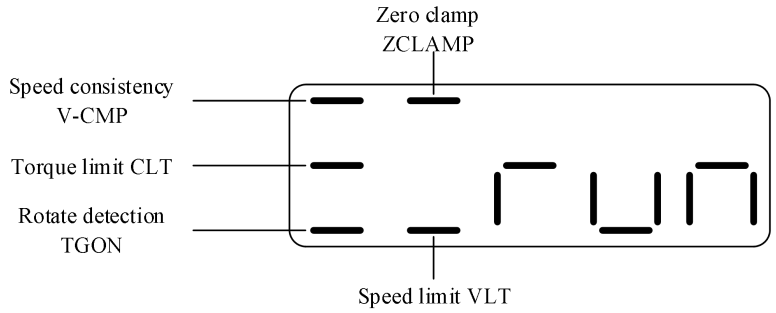
- Parameter setting Px-xx: The first x represents the group number, while the subsequent two x's indicate the parameter sequence numbers within that group.
- Monitoring status Ux-xx: The first 'x' represents the group number, while the subsequent two 'x's indicate the parameter sequence numbers within that group.
- Auxiliary Function Fx-xx: The first 'x' represents the group number, while the subsequent two 'x's indicate the parameter sequence number within that group.
- Alarm Status E-xxx: The first two x characters represent the major alarm category, while the last x character indicates the specific subtype within that category.

4.2 Description of the Operation Display Status

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

Parameter	Signal Name	Leave the factory setting	Suit pattern	Meaning	Revise	Come into force
P8-25	Panel Display Settings	0	All	0: Displays normally; upon power-on, shows 'bb' or 'run'. 1: When powered on, the panel displays the value of U0-00 and speed feedback in rpm. 2: When powered on, the panel displays the value of U0-07 and torque feedback in%	at any time	Power off and then power on again

■ When operating in speed or torque control mode

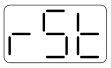
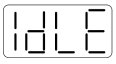


Number of digits displayed

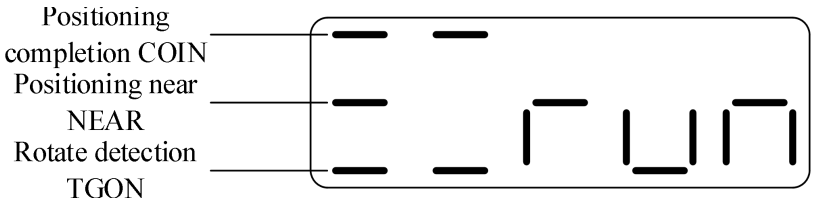
Bit Data	Display Content
P5-39 Same-speed detection (/V-CMP)	The light turns on when the motor's actual speed matches the commanded speed. Same-speed signal detection width: P5-04 (unit: rpm)
P5-42 Torque Limitation (/CLT)	The light turns on when the torque exceeds the set value. Internal forward torque limit: P3-28 Internal reverse torque limit: P3-29
P5-40 Rotation Detection (/TGON)	The light turns on when the motor speed exceeds the rotation detection speed. Rotation Detection Speed: P5-03 (Unit: rpm)
P5-31 Zero Clamping (/ZCLAMP)	The light turns on when the zero-clamping signal activates.
P5-43	When torque control is enabled, the light turns on if the speed exceeds the

Speed Limit (/VLT)	set value. Forward speed limit during torque control: P3-16; Reverse speed limit: P3-17.

Short Code Display Content

Short Code Display Content	Display Content
	In standby mode Servo off state (motor is not powered)
	in service Server-enabled state. (The motor is powered on)
	needs to be reset The server needs to be powered on again
	Prohibited forward drive state P-OT ON state. Refer to Section 5.2.4.
	Prohibit Inverse Drive State N-OT ON state. Refer to Section 5.2.4.
	Control Mode 2 is empty

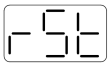
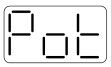
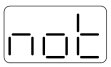
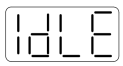
■ When in position control mode



Number of digits displayed

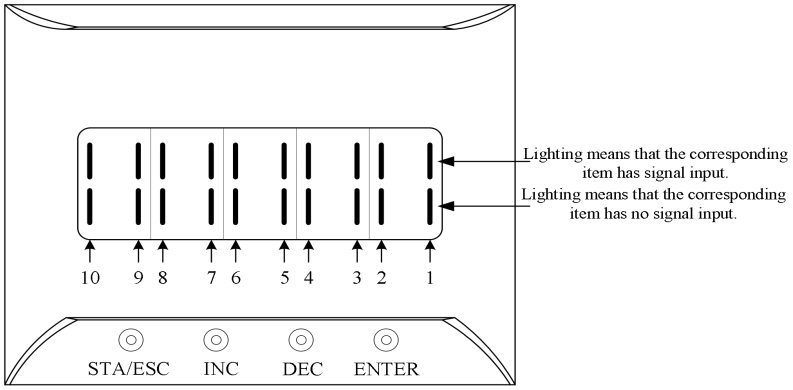
Bit Data	Display Content
P5-38 Location End (/COIN)	During position control, the light turns on when the set position matches the actual position. Positioning completion width: P5-00 (unit: command pulse)
P5-36 Near (/NEAR)	During position control, the light turns on when the set position matches the actual position. Near Signal Width: P5-06
P5-40 Rotation Detection (/TGON)	The light turns on when the motor speed exceeds the rotation detection speed. Rotation Detection Speed: P5-03 (Unit: rpm)

Short Code Display Content

Short Code Display Content	Display Content
	In standby mode Servo off state (motor is not powered)
	in service Server-enabled state. (The motor is powered on)
	needs to be reset The server needs to be powered on again.
	Prohibited forward drive state P-OT ON state. Refer to Section 5.2.4.
	Prohibit Inverse Drive State N-OT ON state. Refer to Section 5.2.4.
	Control Mode 2 is empty

4.3 Monitoring Parameters for Group U

■ State of the U0-21 input signal

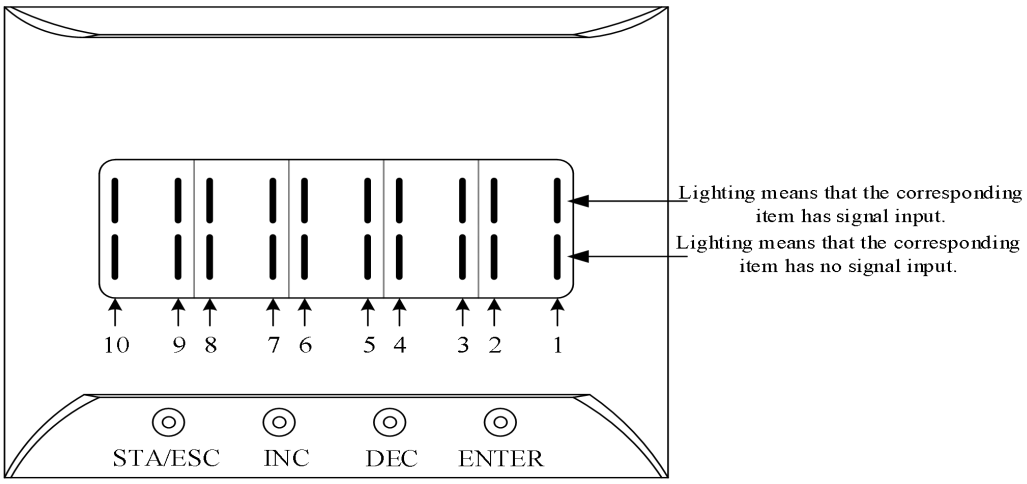


■ U0-21 Input Signal 1 Allocation

Block code	Explain	Block code	Explain
1	/S-ON Servo Enable Signal	2	/P/ – Proportional action command for the P/CON ratio
3	/P-OT prohibits forward drive	4	-N/OT: Reverse drive is prohibited
5	/ALM-RST Alert Clear	6	/P/ – External torque limit on the positive-side of the P/CL rotation
7	-N/CL Reversal Side External Torque Limit	8	/SPD-D Internal Speed Selection Settings
9	/SPD-A Internal Speed Selection Settings	10	/SPD-B Internal Speed Selection Settings

When reading the status via communication, the binary values correspond sequentially from right to left to the /S-ON and /P-CON positions: 0 indicates no input at that position, while 1 indicates input. For example, 0x0001 indicates input at /S-ON, and 0x0201 indicates inputs at both /S-ON and /SPD-B.

■ State of the U0-22 input signal

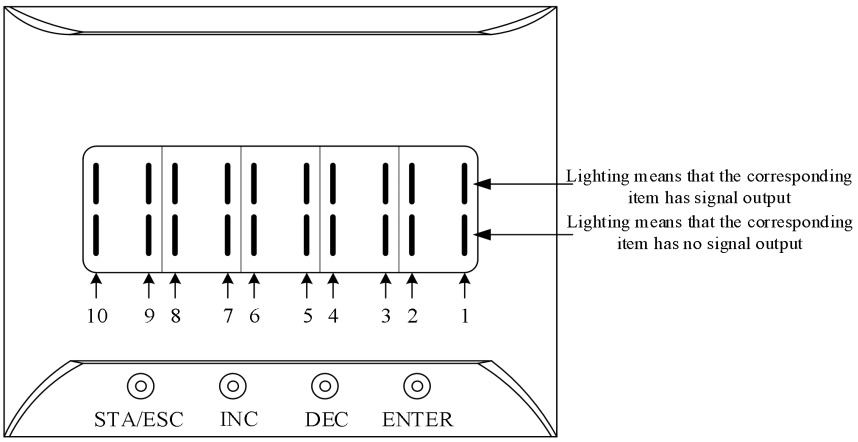


■ U0-22 Input Signal 2 Allocation

Block code	Explain	Block code	Explain
11	/C-SEL Control Method Selection	12	/ZCLAMP Zero Clamping
13	/INHIBIT: Pulse inhibition instruction	14	/G-SEL Gain Switching
15	/CLR Pulse Clear	16	/CHGSTP Step Change
17	Keep	18	Keep
19	Keep	20	Keep

When reading the status via communication, the binary values read from right to left correspond to the /C-SEL and /ZCLAMP positions: 0 indicates no input at that position, while 1 indicates input. For example, 0x0001 means input at /C-SEL, and 0x0009 indicates inputs at both /C-SEL and /G-SEL.

■ State of the U0-23 output signal

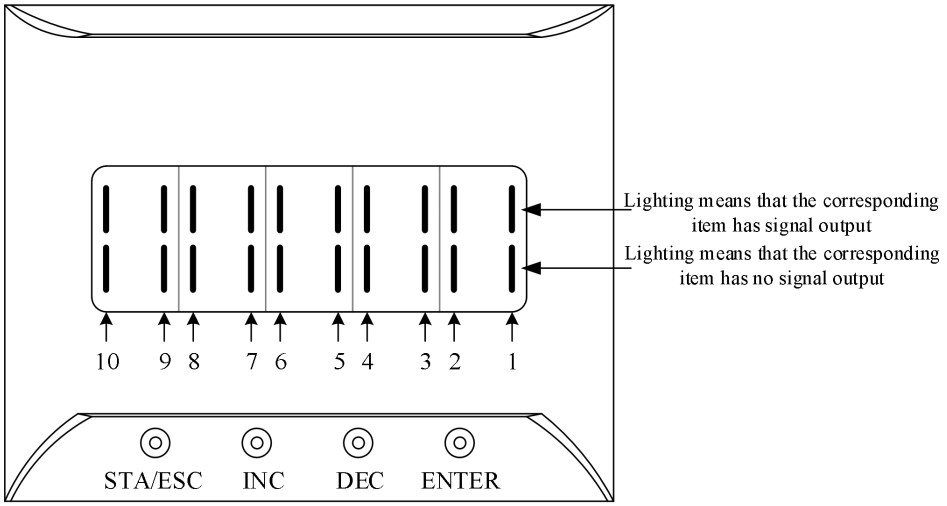


■ U0-23 Output Signal 1 Allocation

Block code	Explain	Block code	Explain
1	Keep Positioning Complete (/COIN_HD)	2	Location End (/COIN)
3	Same-speed detection (/V-CMP)	4	Rotation Detection (/TGON)
5	Ready (/S-RDY)	6	Torque Limitation (/CLT)
7	Speed Limit Detection (/VLT)	8	Brake Interlock (/BK)
9	Warning (/ WARN)	10	Output Near (/NEAR)

When reading the status via communication, the binary values obtained correspond sequentially from right to left to /COIN_HD and /COIN positions: 0 indicates no output at that position, while 1 indicates output. For example, 0x0001 means output from /COIN_HD; 0x0201 indicates outputs from both /COIN_HD and /NEAR.

■ State of the U0-24 output signal

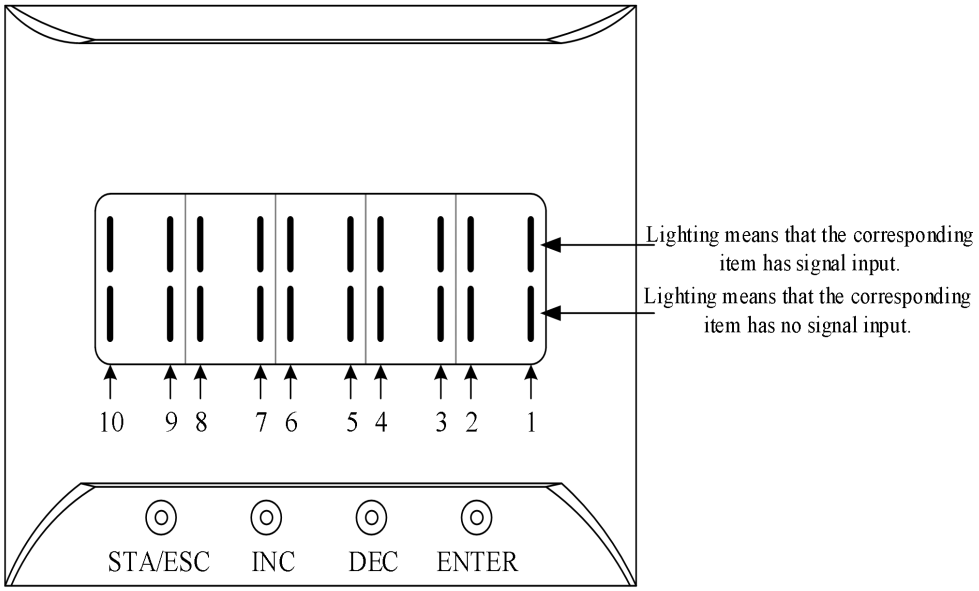


■ U0-24 Output Signal 2 Allocation

block code	Explain	block code	Explain
11	report to the police (/ALM)	12	Speed reached (/V-RDY)
13	Custom Output 1	14	Custom Output 2
15	/Z Xiang	16	/MRUN
17	Keep	18	Keep
19	Keep	20	Keep

When reading the status via communication, the binary values read from right to left correspond to /ALM and position: 0 indicates no input at that position, while 1 indicates input. For example, 0x0001 indicates output from /ALM, and 0x0011 indicates outputs from both /ALM and Z-phase.

■ U4-18 Input Signal Status Monitoring

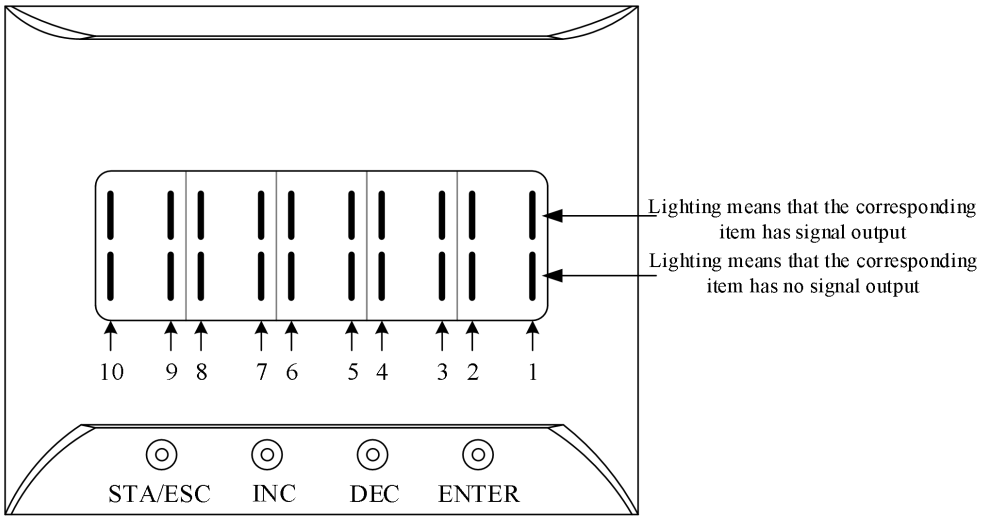


■ U4-18 Input Signal Status

block code	Explain	block code	Explain
1	SI1 Input State	2	SI2 Input State
3	SI3 Input Status	4	SI4 Input Status
5	SI5 Input State	6	SI6 Input Status
7	SI7 Input Status	8	SI8 Input Status
9	Keep	10	Keep

When reading the status via communication, the binary values obtained correspond sequentially from right to left to the SI1−SI8 input signals: 0 indicates no signal input at that SI pin, while 1 indicates a signal input. For example, 0x0001 means only SI1 has an input signal; 0x0002 indicates only SI2 has an input signal; and 0x0003 (equivalent to binary 0b0000 0011) signifies both SI1 and SI2 have input signals.

■ U4-19 Output Signal Status Monitoring

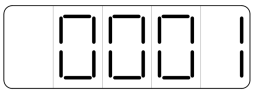
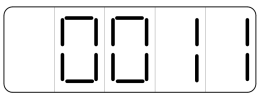
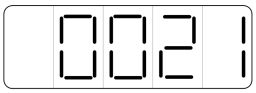


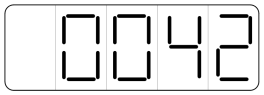
■ U4-19 Output Signal Status

block code	Explain	block code	Explain
1	SO1 Output Status	2	SO2 Output Status
3	SO3 Output Status	4	SO4 Output Status
5	SO5 Output Status	6	SO6 Output Status
7	Keep	8	Keep
9	Keep	10	Keep

When reading the status via communication, the binary values read correspond sequentially from right to left to the SO1−SO6 output signals: 0 indicates no signal output at that pin, while 1 indicates a signal output. For example, 0x0001 means only SO1 has an output signal; 0x0002 indicates only SO2 has an output signal; and 0x0003 (equivalent to binary 0b0000 0011) signifies both SO1 and SO2 have output signals.

■ U0-88 Motor Code Reading Status

U0-88 Display Status	meaning
	0001 − Encoder motor parameters read successfully, but P0-33 = 0; use the motor parameters stored in the encoder.
	0011 − Encoder motor parameters read successfully; P0-33 = 0. Use the motor parameters from the driver.
	0021 − Encoder motor parameters read successfully, but the value is 0; set P0-53 before use.

U0-88 Display Status	meaning
	0031 – Encoder motor parameters read successfully but damaged (CRC verification error); set to P0-53 before use.
	0042 – Failed to read encoder motor parameters; set P0-53 before use.

4.4 Auxiliary Function Parameters for Group F

4.4.1 Operation for Group F0

Function Code	Explain	Function Code	Explain
F0-00	Clear Alert	F0-08	Panel External Instructions After Calibration
F0-01	Return Parameters to Factory Settings	F0-09	Internal instructions within the panel are automatically configured during setup.
F0-02	Clear Position Deviation	F0-10	Panel Vibration Suppression 1
F0-04	Clear historical alarm records	F0-11	Panel Vibration Suppression 2
F0-07	Panel Inertia Identification	F0-12	Panel vibration suppression (fast FFT)

1. Clear Alarm (F0-00)

Set F0-00=1 to reset the alarm status. When an alarm occurs, first eliminate the cause before clearing it.

2. Parameters restored to factory settings (F0-01)

Under enable-off conditions, set F0-01 to 1 and press ENTER to confirm. The parameters will be restored to factory settings without requiring a power cycle.

3. Correct positional deviation (F0-02)

Set F0-02 to 1 to clear the deviation.

4. Clear historical alarm records (F0-04)

Set F0-04 to 1 to clear historical alarm records U1-14 through U1-53.

5. Panel Inertia Identification (F0-07)

Reference panel inertia identification: Follow procedure 6.3.4.

6. External Panel Command Self-Setting (F0-08)

Refer to Section 6.4.5 for automatic adjustment based on external commands.

7. Internal Command Self-Setting of the Panel (F0-09)

Refer to the internal instructions for self-calibration procedure 6.4.4.

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

Refer to Operation Step 6.7.3 for vibration suppression details.

9. Panel vibration suppression (F0-12)

Refer to Operation Step 6.7.6 for vibration suppression.

4.4.2 Operation for Group F1

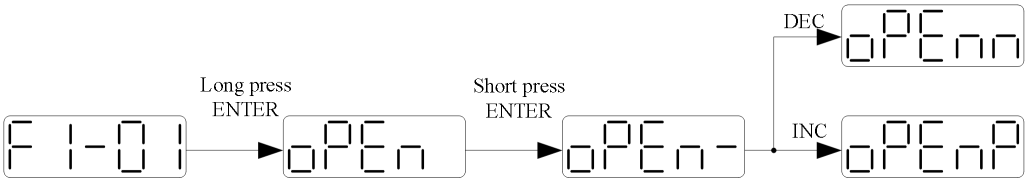
Function Code	Explain	Function Code	Explain
F1-00	Click	F1-04	Tref (Torque Analog Signal) Zero Adjustment
F1-01	pilot run	F1-05	Software Enablement
F1-02	Current Sampling Zeroing	F1-06	Absolute encoder position reset
F1-03	Vref (Speed Analog Signal) Zero Adjustment	-	-

1. Trial Operation (F1-01)

Before entering trial operation mode, confirm that the motor shaft is not connected to the machinery!

When connecting the servo driver to a non-original encoder cable or power cable, first enter test-run mode to verify proper connection of the encoder terminals or power terminals.

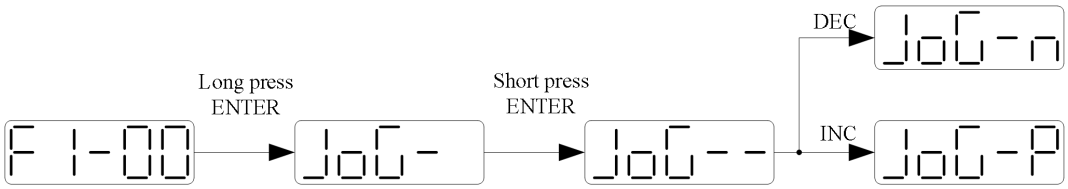
The trial run primarily checks the power lines and encoder feedback circuits to ensure proper connections. Follow the steps below to operate the motor normally in both forward and reverse directions. If the motor shaft exhibits vibration or an alarm occurs, immediately disconnect the power supply and recheck the wiring.



2. On-off operation (F1-00)

Before entering manual operation mode, verify that the trial run under motor idle conditions is functioning properly to confirm correct servo wiring.

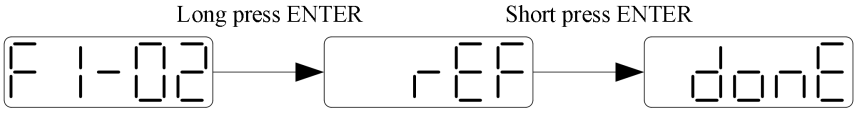
The dot movement mode requires the driver to be in BB idle state. It is internally controlled by speed mode, with P3-09 and P3-10 regulating acceleration and deceleration times.



Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-18	JOG Point Movement Speed	100	1rpm	0 ~ 1000	servo OFF	immediately

3. Current Sampling Zeroing (F1-02)

When the servo driver completes self-update, or when the motor operates unstably after an extended period, users are advised to perform automatic current detection offset adjustment.



Press Status/ESC to exit this feature.

4. Zero calibration of Vref (rotational speed analog signal) (F1-03)

Refer to Chapter 5.4.4.5.

5. Tref (Torque Analog Signal) Zero Adjustment (F1-04)

Refer to Chapter 5.5.4.3.

6. Force Enable (F1-05)

Parameter	Signal Name	Setting	Meaning	Revise	Come into force
P0-03	Enable Mode	0	Do not disable	servo OFF	immediately
		1 (Default)	I/O Enable/S-0N		
		2	Software Enablement (F1-05 or Communication)		
		3	Bus Enable (for models supporting the motion bus)		
Set P0-03 to 2. F1-05 = 0: Disables the enable function and restores to the BB idle state. F1-05 = 1: Forced enable; the servo is in RUN operating state.					

- The forced enable setting configured via F1-05 becomes invalid after power restoration.
- To ensure the function remains active upon power-on and continues to work after power-off, set P0-03 to 1 and P5-20 to n.0010.

7. Absolute encoder position reset (F1-06)

Refer to Section 5.6.5 for clearing the absolute encoder value position.

4.5 Fault Alarm Handling

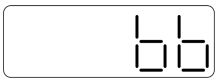
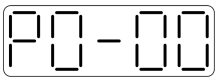
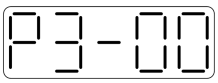
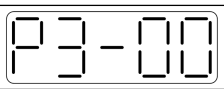
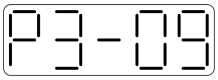
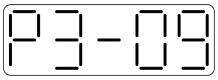
When a fault occurs, the system automatically enters an alarm state and displays the alarm number; in normal operation, this state is not visible. During an alarm state, writing 1 to F0-00 via the panel allows you to reset the fault.

If a servo alarm occurs due to the power supply being turned off, there is no need to clear the alarm.

When an alarm occurs, the cause should first be identified before the alarm is cleared.

4.6 Parameter Settings for Group P

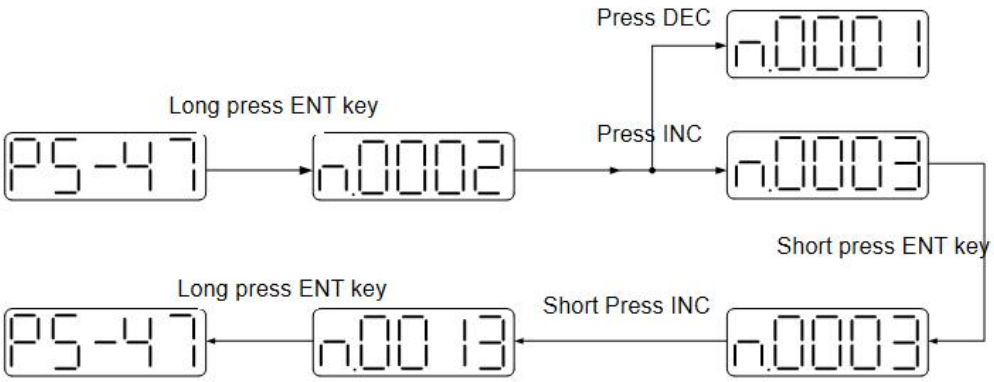
For example, describe the operational steps when changing the value of parameter P3-09 from 2000 to 3000.

step	panel display	The buttons you are using	concrete operations
1		STA/ESC INC DEC ENTER	No action required
2		STA/ESC INC DEC ENTER	Press the STA/ESC key to access parameter settings
3		STA/ESC INC DEC ENTER	Press the INC key once to increment by 1; set the parameter to 3 and display P3-00
4		STA/ESC INC DEC ENTER	Shortly press the ENTER key to make the last zero on the panel flash
5		STA/ESC INC DEC ENTER	Press INC to add to 9
6		STA/ESC INC DEC ENTER	Long-press the ENTER key to access P3-09 and modify values.
7		STA/ESC INC DEC ENTER	Use the INC, DEC, and ENTER keys to add, subtract, or shift. Press ENTER long-term to confirm changes.
8	Operation completed		

When a parameter setting exceeds the allowed range, the driver will not accept the value and display error E-021 (Parameter out of range). This issue typically occurs when the host computer writes parameters to the driver via communication.

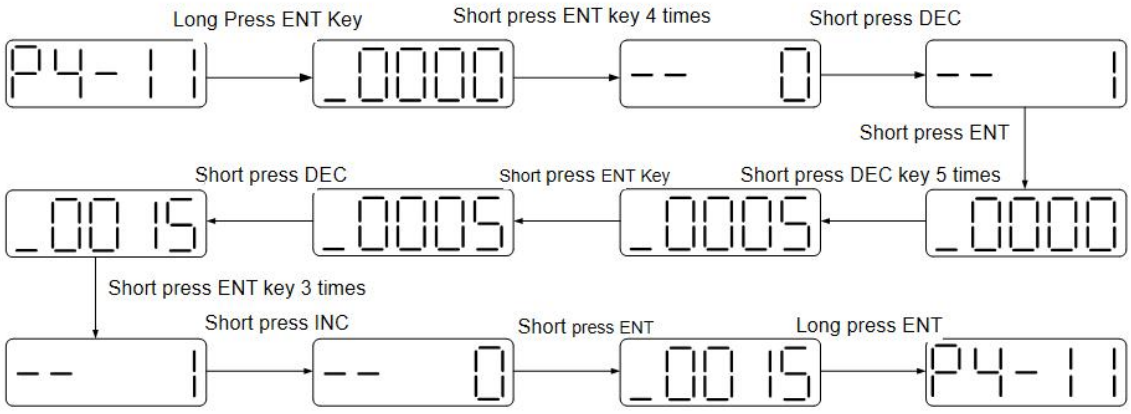
4.6.1 Example of setting parameters for the P-group related to input/output SI and SO

For example, the procedure involves changing the terminal of parameter P5-47 (alarm output terminal setting) from SO2 to SO3 control and modifying the normally open contact to a normally closed contact.



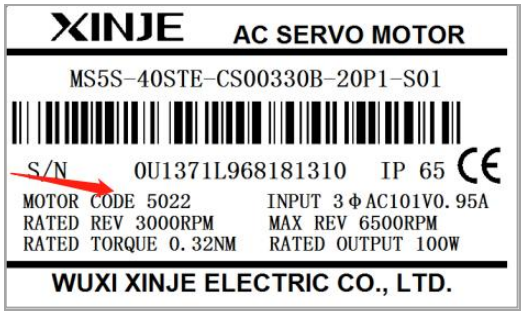
4.6.2 Example of Parameter Setting for Negative Value Group P

For example, set parameter P4-11 (high bit of internal position mode pulse count) to-15, specifying the operation procedure when the first pulse count is-150,000.



4.7 View Motor Code

A servo driver can be paired with motors of similar power ratings, with different models identified by the motor code on the nameplate. Before debugging the servo system, ensure that the motor code U3-70 matches the one indicated on the nameplate.



5. Operation of the Servo System

5.1 Selection and Switching of Control Modes

5.1.1 Selection of Control Mode

The servo unit can combine and switch between two control modes. The /C-SEL signal allows free switching between Mode 1 and Mode 2 to meet more complex control requirements.

User Parameters		Control Model	Refer to
P0-01 Sub-pattern 1	1	Torque Control (Internal Setting)	5.5.1
	2	Torque Control (External Analog Signal)	5.5.4
	3	Speed Control (Internal Set Speed)	5.4.2
	4	Speed Control (External Analog Signal)	5.4.4
	5	Position Control (Internal Position Command)	5.3.3
	6 (Default)	Position Control (External Pulse Command)	5.3.2
	7	Speed Control (Pulse Frequency Command)	5.4.3
P0-02 Sub-pattern 2	1	Torque Control (Internal Setting)	5.5.1
	2	Torque Control (External Analog Signal)	5.5.4
	3	Speed Control (Internal Set Speed)	5.4.2
	4	Speed Control (External Analog Signal)	5.4.4
	5	Position Control (Internal Position Command)	5.3.3
	6 (Default)	Position Control (External Pulse Command)	5.3.2
	7	Speed Control (Pulse Frequency Command)	5.4.3

Position control involves sending a pulse sequence command to the servo unit to move it to a specified location. The position command can be set by combining external pulse inputs, internal preset position commands, and speed limits. Position is controlled by the number of input pulses, while speed is controlled by the pulse frequency. This method is primarily used in applications requiring precise positioning control, such as robotic arms, grinding machines, engraving machines, and CNC machine tools.

Speed control refers to regulating the mechanical speed via speed commands. By receiving speed commands through digital signals, analog voltages, or communication links, the servo driver enables rapid and precise control of the mechanical speed.

Torque control refers to regulating a motor's output torque via a torque command, which can be specified using digital signals, analog voltages, or communication protocols. Since there is a linear relationship between servo motor current and torque, controlling the current directly enables torque regulation. This control method is primarily employed in applications requiring precise material tension control, such as winding/unwinding systems where the torque setpoint must remain stable regardless of variations in winding radius.

5.1.2 Control Mode Switching

Mode switching refers to the ability of the servo system to transition between Mode 1 and Mode 2 via an external input signal (C-CEL), when the servo is enabled in ON mode (as indicated by the "Run" status on the servo panel).

- relevant parameter

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-30	/C-SEL	n.0000	All	Control Mode Switching Signal	at any time	immediately
Parameter range: n.0000–001A, assigned to other input terminals via parameter P5-30. To switch the control mode from SI2 input signals, set P5-30 to n.0002/0012. For hardware wiring details, refer to Chapter 3.2.2.						

Parameter Setting Status	Signal/C-SEL Terminal Input Status	Signal/C-SEL Terminal Logic	Control Method
P5-30=n.0000	No external terminal input required	invalid	The control mode set for P0-01
P5-30=n.000□	The SI□ terminal has no signal input.		
P5-30=n.001□	The SI□ terminal has a signal input.		
P5-30=n.0010	No external input terminals required	valid	The control mode set for P0-02
P5-30=n.000□	The SI□ terminal has a signal input.		
P5-30=n.001□	The SI□ terminal has no signal input.		

5.2 Configuration of Basic Functions

5.2.1 Manual Operation

The spot-run test must be completed after power-on but before online debugging, aiming to ensure the servo system operates normally without abnormal vibrations or unusual noises. This test can be performed via parameters in Panel F or using our company's upper-level debugging software, XINJE Servo Tuner.

Point operation consists of two modes: point operation and trial operation. Point operation employs closed-loop control, while trial operation uses open-loop control. The standard debugging procedure is to first perform a trial operation before proceeding to point operation. Both modes require the servo to be disabled (i.e., the panel set to bb) for proper functionality.

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-18	JOG Point Movement Speed	100	1rpm	0 ~ 1000	servo bb	immediately

P3-18 is the speed setting for closed-loop point-start operation, effective only in point-start mode and invalid in other normal control modes.

1. Panel Click

- relevant parameter

Function Code	Meaning	Explain
F1-00	Click	Closed-loop pulse operation
F1-01	pilot run	Open-loop point movement operation

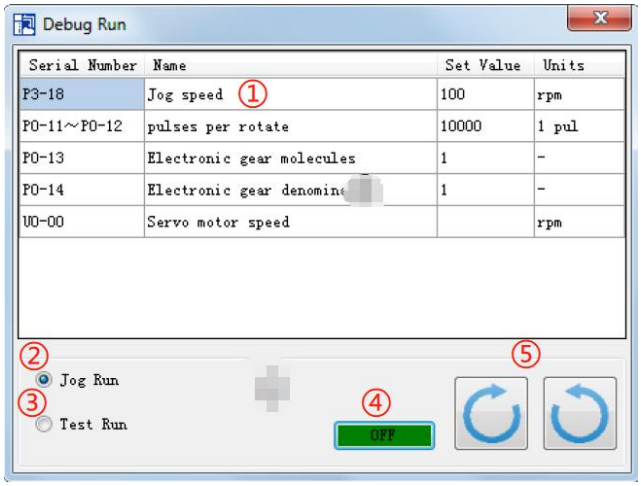
Panel Point-Click Operation Steps:

To operate the panel via manual selection, first run in open-loop mode (F1-01) without issues, then proceed to closed-loop operation (F1-00). Detailed operating procedures are described in Chapter 4.4.2.

2. XINJE Servo Tuner DIP Setting



Click [Run Test] in the menu bar to display the following screen:



The interface is primarily divided into five configuration modules.

① Point-speed P3-18: Sets the motor's operating speed in the [Point-speed] mode;

② Point-start mode: Closed-loop point-start operation;

③ Test operation mode: open-loop point-start operation;

④ Enable: Activation in push-button mode;

⑤ Forward/reverse: Causes the motor to rotate forward or backward.

Steps for operating the upper-level computer in manual mode:

Open the XINJE Servo Tuner software on the servo host computer, set the P3-18 point-speed value, select the [Test Run]/[Point Motion] button, click [Enable], and use the forward/reverse buttons on the interface to control the device's directional movement.

5.2.2 Servo Enable Settings

The servo enable signal indicates whether the servo motor is powered and operational; when disabled, the motor cannot operate. Enablement can be controlled via external terminal signals or computer communication.

- relevant parameter

Parameter	Meaning	Setting	Meaning	Revise	Come into force
P0-03	Enable Mode	0	Do not disable	servo bb	immediately
		1 (Default)	I/O Enable/S-ON		
		2	Software enablement (F1-05 or via host computer operation)		
		3	Bus Enable		

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-20	/S-ON	n.0001	All	Server Enable Signal	at any time	immediately

1. Force Enable

When P0-03=2, the forced enable of F1-05 becomes effective; it becomes ineffective upon power restoration.

The F1-05 can be set to value 1 via the panel or written a single word at hexadecimal address 0x2105 using Modbus RTU protocol communication.

2. Power on to enable

Parameter settings: P0-03 = 1 (default), P5-20 = n.0010

This configuration ensures the servo system remains enabled immediately upon power-up, without requiring external terminal control, and maintains this enabled state even after a fresh power cycle.

3. Enable external SI terminal control

When P0-03 is set to 1, the external terminal enable control becomes effective.

Parameter settings: P0-03 = 1 (default); P5-20 = n.000 □ / n.001 □.

□ Represents the SI terminal number; for example, P5-20 corresponds to n.0001 (default), enabling control at SI1 terminal.

Prerequisite	Parameter Setting Status	Signal/S-ON Terminal input mode	Signal /S-ON Terminal Logic	Server Status
P0-03=1	P5-20=n.000□	The SI□ terminal has no signal input.	invalid	The panel displays "bb"; the servo is disabled.
	P5-20=n.001□	The SI□ terminal has a signal input.		
	P5-20=n.000□	The SI□ terminal has a signal input.	valid	Panel shows "Run", servo enabled
	P5-20=n.001□	The SI□ terminal has no signal input.		

4. Bus Enable

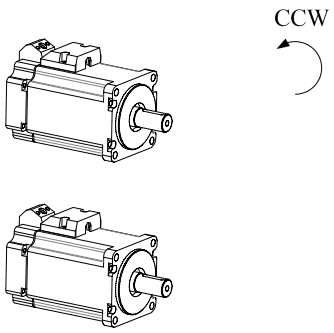
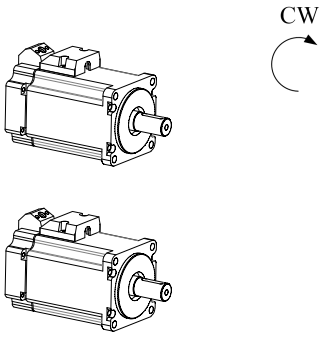
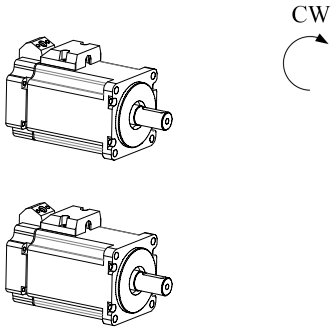
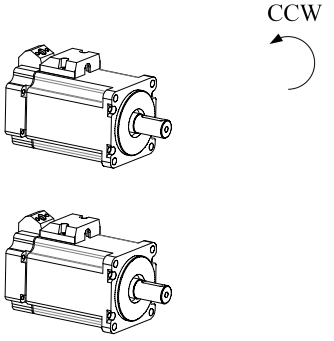
When P0-03 equals 3, this setting enables the host computer on the XNet bus (specific to the DS5E series). The XNet bus is a proprietary bus developed by XINJE; servos must be connected via this bus in conjunction with XINJE's PLCs supporting it. For detailed instructions, refer to the X-NET Bus User Manual on XINJE's official website.

5.2.3 Switching Rotation Direction

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-05	Rotation Direction Definition 0: Normal Mode 1: Anti-pattern	0	-	0~1	servo bb	Power On Again

Users can change the rotation direction of the servo motor using parameter P0-05. The motor's "forward rotation" is defined as "counterclockwise," and "reverse rotation" as "clockwise" (both measurements are taken from the perspective of the motor shaft).

Pattern	Corotation	Reversal	P0-05 Settings
Standard Setting CCW is forward rotation			P0-05=0
Reverse Mode CW means forward rotation			P0-05=1

5.2.4 Setting of Stop Method

Servo shutdown methods are categorized into inertial shutdown, deceleration shutdown, and dynamic braking (DB) shutdown. The following Explains each method in detail.

Downtime Method	Free Stop	Stop and shut down	DB halt
Downtime Principle	The servo drive is not enabled, and the servo motor remains unpowered; it freely decelerates to	The servo driver applies reverse braking torque, causing the motor to	The servo motor operates in short-circuit

	zero, with the deceleration time influenced by mechanical inertia and equipment friction.	decelerate rapidly to zero.	braking mode.
Downtime Characteristics	Advantages: Smooth deceleration with minimal mechanical impact Disadvantages: The deceleration process is relatively slow.	Advantages: Short deceleration time Disadvantages: Subject to mechanical impact	Advantages: Short deceleration time Disadvantages: Subject to mechanical impact

Based on the specific scenarios, servo shutdowns are categorized into three types: servo OFF shutdown, alarm-induced shutdown, and out-of-range shutdown.



The DS5K2 series comes standard with dynamic braking (DB) functionality.

1. Parking modes with servo OFF and alarm activation

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-30	Stop timeout time	20000	1ms	0 ~ 65535	servo bb	immediately
P0-27	Server Gateway enables shutdown mode	0	-	0 ~ 5	servo bb	immediately
P0-29	Alarm Stop Method	2	-	0 ~ 5	servo bb	immediately

Parameter	Value	Meaning
P0-27	0	Free run stops; it resumes free operation after stopping.
	1	Free run has stopped; maintain the DB state after stopping.
	2	The deceleration brake stops; after stopping, it remains in free-running mode.
	3	The deceleration brake has stopped; maintain DB status after stopping.
	4	The DB stops and remains running freely after stopping.
	5	The DB stops; its state is maintained after stopping.
P0-29	Enable Property Alarm for the Envoy	
	0	Free run stops; it resumes free operation after stopping.
	1	Free run has stopped; maintain the DB state after stopping.
	2/4	The DB stops and remains running freely after stopping.
	3/5	The DB stops; its state is maintained after stopping.
	Do not enable attribute alerts	
	0	Free run stops; it resumes free operation after stopping.
	1	Free run has stopped; maintain the DB state after stopping.
	2	The deceleration brake stops; after stopping, it remains in free-running

Parameter	Value	Meaning
		mode.
	3	The deceleration brake has stopped; maintain DB status after stopping.
	4	The DB stops and remains running freely after stopping.
	5	The DB stops; its state is maintained after stopping.

Explain ：

1）Server Service Enable shutdown mode (P0-27)

- When P0-27 = 0, if the servo mode is turned off, the motor will stop automatically without any alarm.
- When P0-27=1, if the servo mode is turned off, the motor will stop freely and remain in DB state after stopping.
- When P0-27 = 2, if the servo is turned off, the motor will initiate deceleration-based stopping until its speed falls below 50 rpm, after which it enters free-stop mode; simultaneously, the servo system records the duration of the deceleration phase. If the recorded time exceeds P0-30 before the motor speed drops below 50 rpm during this process, alarm E-262 will be triggered.
- When P0-27 = 3, if the servo is turned off, the motor will initiate deceleration-based stopping until its speed drops below 50 rpm, after which it enters free stopping mode; the servo simultaneously records the duration of the deceleration phase. If the recorded time exceeds P0-30 before the motor speed falls below 50 rpm, alarm E-262 will be triggered; the system will maintain DB status after cessation.
- When P0-27 = 4, if the servo mode is activated, the motor DB stops and remains in free-running mode after stopping.
- When P0-27 = 5, if the servo mode is activated, the motor DB will stop and maintain its stopped state.

2）Servo Alarm Parking Method (P0-29)

① Enable Property Alarm

- When P0-29 = 0, the motor will stop automatically upon triggering a servo alarm.
- When P0-29 = 1, if a servo alarm occurs, the motor will stop automatically and remain in DB mode after stopping.
- When P0-29 = 2, if a servo alarm occurs, the motor DB will stop and remain in free-running mode after stopping.
- When P0-29 = 3, if a servo alarm occurs, the motor DB will stop and maintain its DB state after stopping.
- When P0-29 = 4, if a servo alarm occurs, the motor DB will stop and remain in free-running mode after stopping.
- When P0-29 = 5, if a servo alarm occurs, the motor DB will stop and maintain its current state after stopping.

② Do not enable the attribute alarm

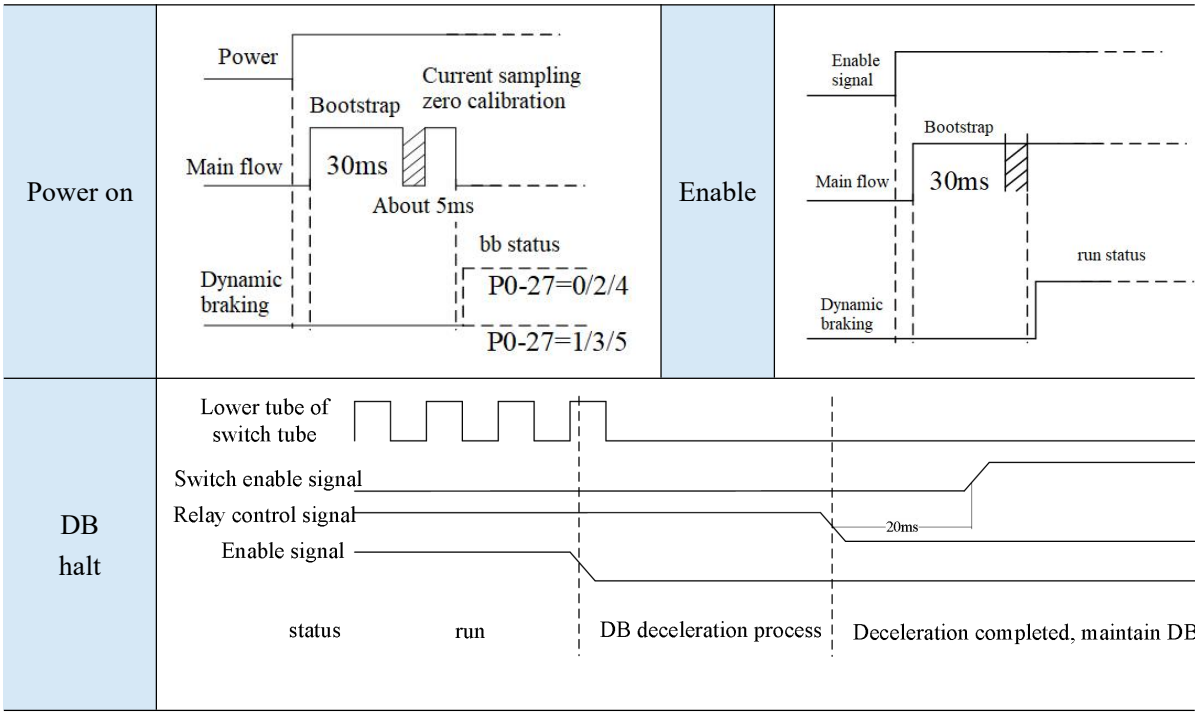
- When P0-29 = 0, the motor will stop automatically upon triggering a servo alarm.
- When P0-29 = 1, if a servo alarm occurs, the motor will stop automatically and remain in DB mode after stopping.
- When P0-29 = 2, if a servo alarm occurs, the motor will initiate deceleration-based stopping until its

speed falls below 50 rpm, after which it transitions to free stop; simultaneously, the servo system records the duration of the deceleration phase. If the recorded time exceeds P0-30 during deceleration, the servo will proceed directly to free stop. Since the servo remains in an alarm state at this point, the E-262 alarm will not be triggered regardless of P0-29's value. After stopping, the motor continues operating freely.

- When P0-29 = 3, if a servo alarm occurs, the motor will initiate deceleration-based braking until its speed drops below 50 rpm, after which it switches to free braking; simultaneously, the servo system records the duration of the deceleration phase. If the recorded time exceeds P0-30 during deceleration, the servo will proceed directly to free braking. Since the servo remains in an alarm state at this point, the E-262 alarm will not be triggered regardless of P0-29's value. After stopping, the system maintains the DB status.
- When P0-29 = 4, if a servo alarm occurs, the motor DB will stop and remain in free-running mode after stopping.
- When P0-29 = 5, if a servo alarm occurs, the motor DB will stop and maintain its current state after stopping.

3) The SO terminals of the servo drive are assigned for brake engagement; the values set on P0-27/P0-29 are invalid, and the system will stop in reduced-speed mode.

Dynamic Braking (DB) sequence diagram (low level indicates active):



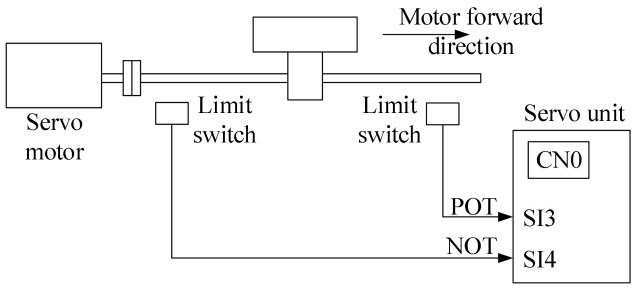
2. Parking method when exceeding the allowed distance

The overtravel prevention function of a servo unit is a safety feature that automatically stops the servo motor upon receiving a signal from a limit switch when the mechanical moving part exceeds the designed safe movement range.

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-28	Server Overload Stop Mode	2	-	0 ~ 3	servo bb	immediately
P0-30	Stop timeout time	20000	1ms	0 ~ 65535	servo bb	immediately
P5-22	Prohibited forward rotation /P-OT	n.0003	-	0~0xffff	at any time	immediately
P5-23	Reverse is prohibited /N-OT	n.0004	-	0~0xffff	at any time	immediately

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



For rotational applications such as conical rollers and conveyors, an overtravel prevention function is not required; therefore, no wiring for the overtravel prevention input signal is necessary.

Parameter Setting Status	Signal/POT, Terminal Input Status	Overlimit Signal (/POT, /NOT) Terminal Logic
P5-22/P5-23=n.0000	No external terminal input required	invalid
P5-22/P5-23=n.000□	The SI□ terminal has no signal input.	
P5-22/P5-23=n.001□	The SI□ terminal has a signal input.	
P5-22/P5-23=n.0010	No external input terminals required	valid
P5-22/P5-23=n.000□	The SI□ terminal has a signal input.	
P5-22/P5-23=n.001□	The SI□ terminal has no signal input.	

The internal parameter settings for forward limit signal/POT and reverse limit signal/NOT cannot be configured on the same terminal input simultaneously.

Operation Direction	Meet the limit	Running state
corotation	Normal limit is valid	Set POT to the servo overtravel stop mode according to

		P0-28.
	Anti-limit effective	Call E-261
reversal	Normal limit is valid	Call E-261
	Anti-limit effective	Note: Set the servo overtravel stop mode for parking according to P0-28.

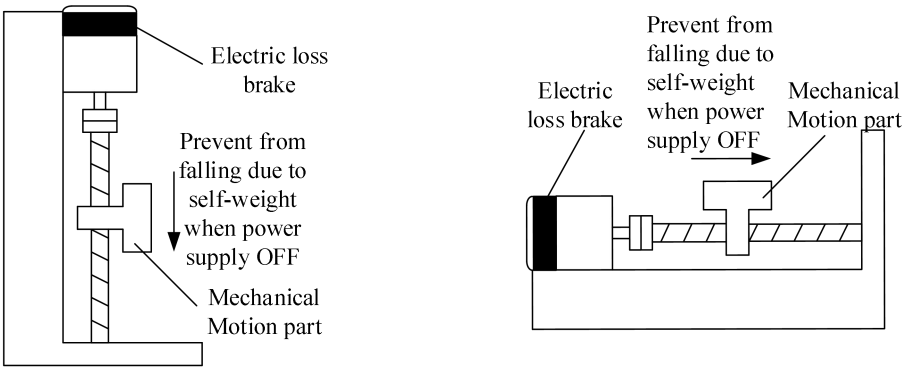
Parameter	Value	Meaning
P0-28 n.xxx□	0	Stop the deceleration at position 1; after stopping, the torque in the overtravel direction is zero. Receive the command.
	1	Stop automatically; the torque in the overtravel direction is zero after stopping; receive the command
	2	The stop mechanism 2 has ceased operation; no commands are received in the overtravel direction after stopping.
	3	Report an Incident (E-260)
P0-28 n.xx□x	0	Do not disable the over-limit alarm E-261
	1	Overlimit Alarm Shielding E-261



- When P0-28 = 0/2, the motor begins decelerating and stopping upon receiving an overtravel stop signal; simultaneously, the timeout duration during overtravel processing also comes into effect.
- During position control, using an out-of-range signal to stop the motor may generate position deviation pulses. To eliminate these pulses, a clear signal (CLR) must be input. If the servo unit continues to receive these pulses, they will accumulate until the servo unit triggers an alarm.
- During torque control, the SO terminal of the servo drive is assigned for brake engagement and cannot be activated via the overtravel signal terminals P5-22 or P5-23.
- The servo drive's SO terminal is equipped with a brake engagement function, and P0-28 is automatically set to 2.

5.2.5 Power Failure Brake (Brake Lock)

When a servo motor controls a vertical load, the purpose of using a "servo motor with power-off brake" is to prevent the movable parts from shifting under their own weight or external forces when the system's power supply is turned off.



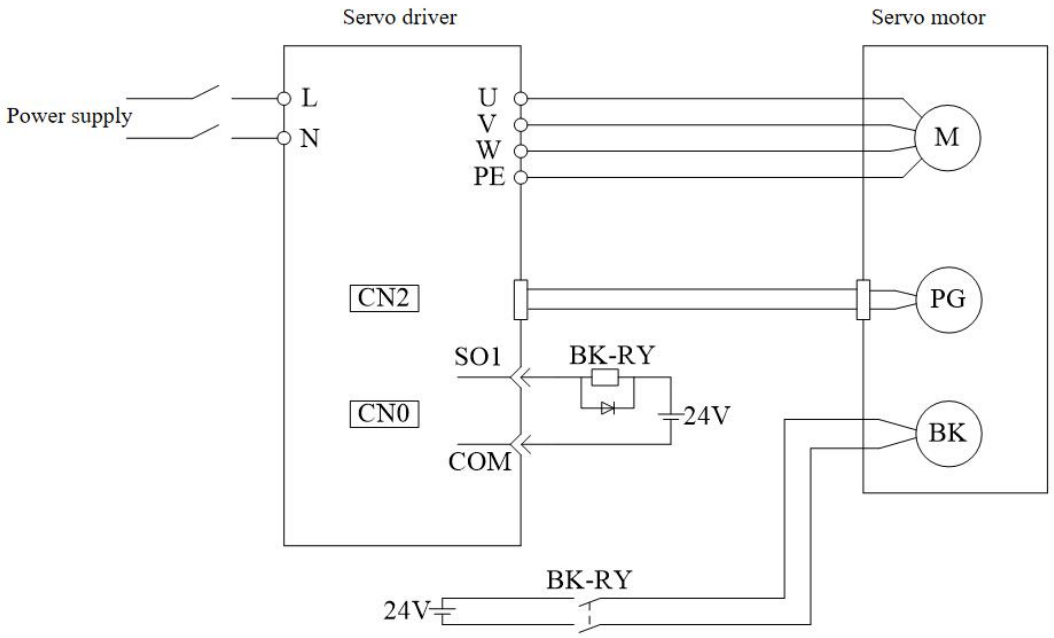
The brake integrated into the servo motor is a fixed, dedicated type without excitation operation. It cannot be used for dynamic braking and should only be employed when keeping the servo motor stationary.

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-44	Brake Interlock /BK	n.0000	-	0~ffff	servo bb	immediately
P5-07	Servo-off delay time	500	1ms	-500~9999	servo bb	immediately
P5-08	Brake Command Output Speed	30	rpm	20 ~ 10000	servo bb	immediately
P5-09	Brake Command Wait Time	500	ms	0 ~ 65535	servo bb	immediately

1. Hardware Connection

The sequential output signals "/BK" and "Brake Power Supply" from the servo unit form the ON/OFF circuit for the brake. A typical connection configuration is illustrated below.



- The excitation voltage of the power-off brake is 24 V.
- If the brake current exceeds 400 mA, use a relay to divert the current and prevent terminal burnout. For DS5K2 series servos rated above 400 W requiring SO control of the brake motor, employ an intermediate relay for connection.

2. Software Parameter Settings

For servo motors with brake functionality, configure one SO terminal of the servo driver as the brake output/BK function and specify its valid logic by setting parameter P5-44.

Parameter Setting Status	Servo Drive Status	Signal/BK Terminal Output Logic	Servo Motor Status
P5-44=n.000□	servo bb	invalid	The brake power supply has been disconnected, and the motor is in a locked position.
	servo run	valid	The brake power supply is activated, and the motor is in a rotatable position.
P5-44=n.001□	servo run	invalid	The brake power supply has been disconnected, and the motor is in a locked position.
	servo bb	valid	The brake power supply is activated, and the motor is in a rotatable position.

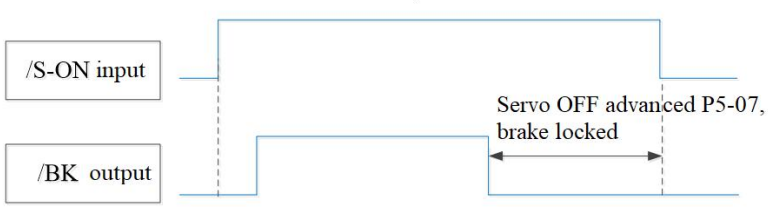
- When the SO terminal is used to control the brake, and the servo is enabled (ON), the brake power supply is activated, allowing the motor to rotate.
- If the motor fails to rotate during new device debugging, verify whether the brake is released.

3. Timing of servo-driven brake engagement control

1) Normal braking sequence under normal conditions

Due to the delay in brake activation, the mechanism may experience slight movement under gravitational forces. Adjust the time setting using parameter P5-07 to ensure the brake lever opens delayed or closes prematurely.

When using a servo motor with a brake, the control parameters for the brake output signal "/BK" and the ON/OFF operation timing of the servo SON signal are specified as shown below: the servo motor enters the powered-on enabled state before the output/BK signal activates the brake release; it only exits the powered-on state after the output/BK signal engages the brake lock.



This parameter specifies the duration during which rotation detection TGON is invalid when the motor is stationary.

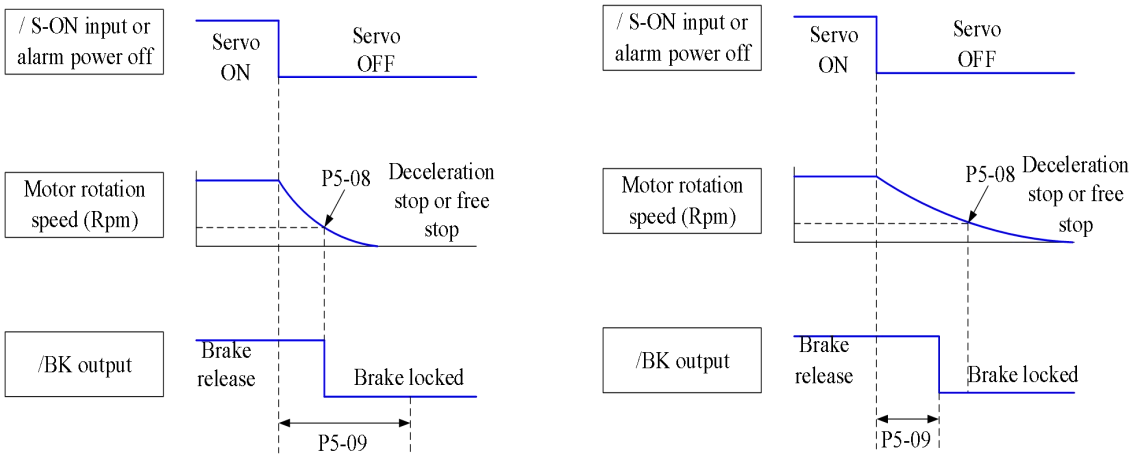
2) Time sequence for applying the brake in abnormal conditions

Upon occurrence of an alarm or power outage, the motor rapidly transitions to an unpowered state. During the period when the brake activates due to gravity or inertia, the mechanism may shift position. To prevent this,
The BK signal for motor rotation transitions from ON to OFF under the following conditions (either condition applies):

① After the servo is turned off, when the motor speed falls below the set value of P5-08;

② After the servo is turned off, if the time exceeds the setting value of P5-09.

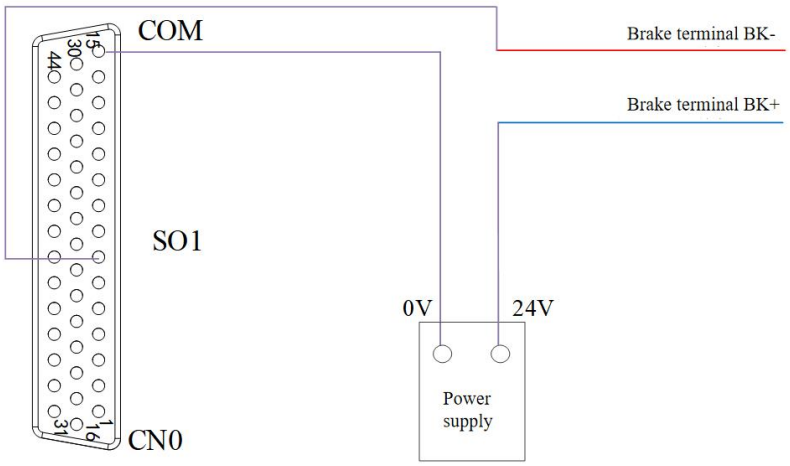
The timeline diagram is as follows:



Since the servo motor's brake is designed for position holding, it must be activated at the appropriate moment when the motor stops. Adjust these user parameters while monitoring the mechanical operation.

4. Brake Connection Method

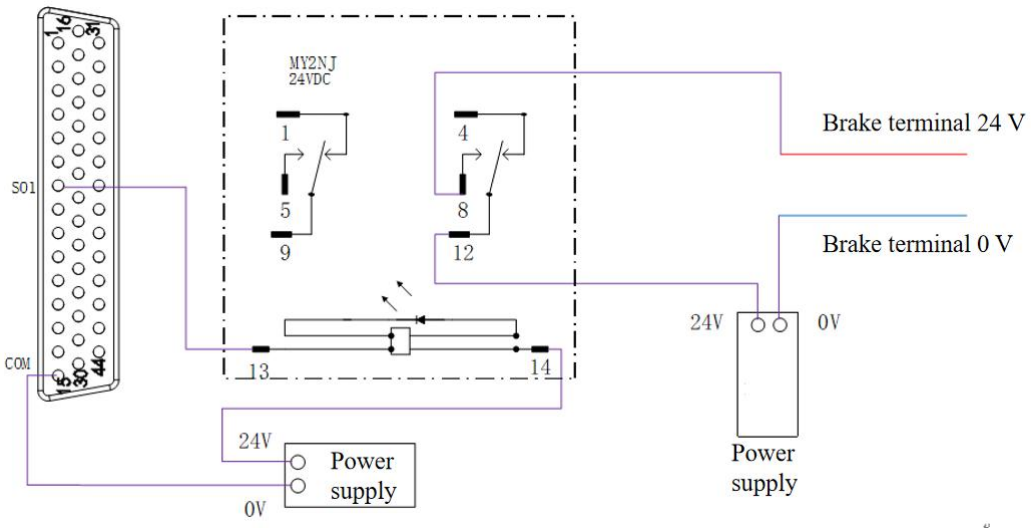
1) When the drive power is 400 W or lower, it can be directly connected via the SO terminal, as shown in the figure below:



And set parameter P5-44 to 0001

For motors rated 400 W or below controlled by the SO brake mechanism, use terminal SO1 for control and set the brake parameter P5-44 to n.0001 to prevent terminal burnout due to excessive current or brake failure caused by inability to open.

2) When the drive power is 750 W or higher, a intermediate relay must be used for connection; the wiring is as follows:



And set parameter P5-44 to 0001

For brake currents of 750 W or higher exceeding 400 mA, use a relay adapter to prevent terminal burnout due to excessive current or brake failure caused by inability to open the circuit.



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

5. If the brake lever slightly drops after a power outage, follow these solutions:

① Adjust P5-07 appropriately; it can be set to-500.

② Set P0-69.2 to 1 and use the busbar as the signal source for the drop-out condition.

6. Brake Protection Detection Function

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P9-39	Enable brake protection detection 0: Disabled 1: Enable	0	-	0~1	at any time	immediately
P9-40	Gravity Load Detection Value	0	%	0~300	at any time	immediately
P9-41	Gravity load identification enables functionality. 0: Not recognized 1: Identification	0	-	0~1	at any time	immediately
P9-42	Abnormal opening of the brake mechanism during rotation displacement	200	0.01 turn	25~65535	at any time	immediately

① Gravity load identification (in non-torque mode)

Setting P9-41 to 1 enables automatic gravity load detection. When the servo enable input is zero and the rotational speed is below 10 rpm, continuous detection occurs during the first 100－200 ms. Upon successful identification, the result is stored in the P9-40 gravity load detection parameter, and P9-41 returns to 0.

② Abnormal brake closure detection (in non-torque mode)

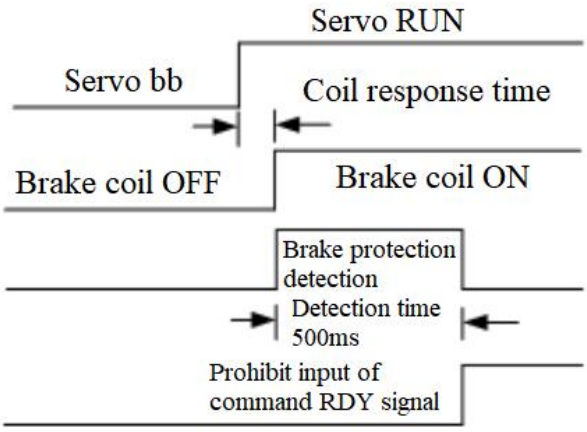
For applications employing brake motors under gravity loads, the input command must be zero within 700 ms after servo activation and the brake open signal is triggered, with the rotational speed below 10 rpm. Between 100 ms and 500 ms after activation and signal output, verify whether the motor torque falls below 70% of the set gravity load threshold; if not, trigger alarm E-166 indicating potential failure to open the brake.

The abnormal brake closure detection is performed only once after each activation and when the brake open signal is output; it will not be repeated during operation while enabled.

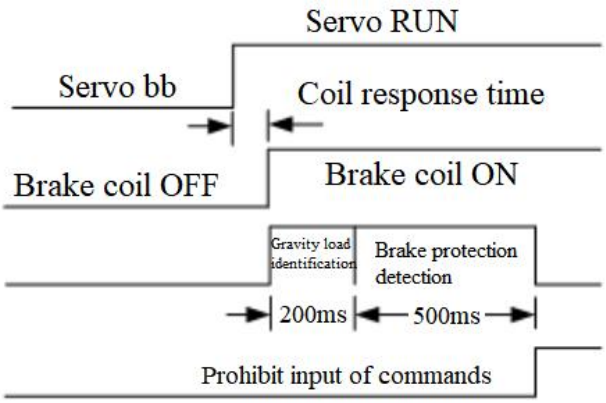
If the Automatic Gravity Identification function P9-41 is enabled, this brake abnormal disengagement detection procedure will be executed within 500 ms after the completion of the automatic gravity identification process.

If commands need to be entered immediately after servo enable, set P5-70 to 1 (this terminal will only conduct when enabled), assign the P5-41 (S-RDY) terminal, and wait until P5-41 is enabled before entering commands.

Sequence diagram for detecting abnormal brake release:



Auto Gravity Recognition Off



Auto Gravity Recognition On

③ Detection of abnormal brake release

When the brake is engaged, verify whether it is properly closed. If the motor rotates 2 revolutions after the brake engages, an alarm E-167 will be triggered.

5.3 Position Control

5.3.1 General Position Modes

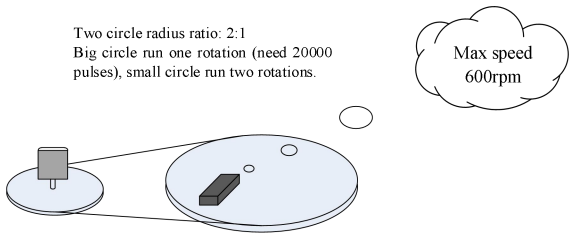
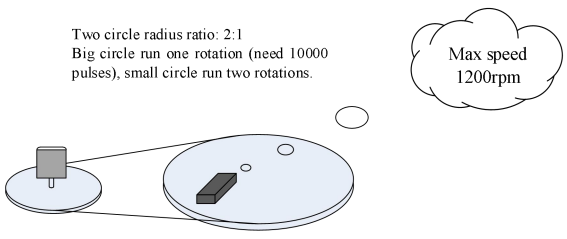
5.3.1.1 Electronic Gear Ratio

1. Overview

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

(1) Determine the number of command pulses required for the motor to complete one full rotation, ensuring it reaches the desired speed.

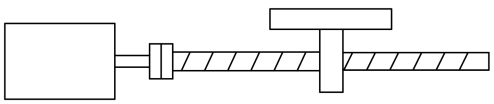
The following example uses a 19-bit encoder motor, with the PLC host sending pulses at a frequency of 200 kHz:

Set the number of pulses per revolution to 10000 The electronic gear ratio is set to 524288:10000	Set the number of pulses per revolution to 5000 The electronic gear ratio is set to 524288:5000
	

(2) During precise positioning, specify the physical unit length corresponding to each instruction pulse for ease of calculation.

As shown in the figure below, if a specified unit pulse corresponds to a workpiece movement of 1 μm, then the number of command pulses required for one full rotation of the load axis is 6 mm / 1 μm = 6000.

For a reduction ratio of 1:1, you can directly set P0−11 = 6000 and P0−12 = 0; the upper computer will then issue 6000 pulses to move the workpiece by 6 mm (refer to steps 1−6 for the detailed calculation method).



Encoder: 524288 (19 bits); Screw pitch: 6 mm

Do not change the electronic gear ratio.	Change the electronic gear ratio
Without modification, the electronic gear ratio motor rotates one full cycle generating 524,288 pulses (when P0-11 = 0 and P0-12 = 0). To rotate the motor one full revolution causing the workpiece to move 6 mm, 524,288 pulses are required; for a 10-mm movement, this amounts to 10/6 × 524,288 = 873,813.333 pulses. Since decimal values are truncated during pulse transmission, errors may occur.	By adjusting the electronic gear ratio, the motor requires 6,000 pulses to complete one full rotation. To rotate the motor one full revolution and move the workpiece by 6 mm, 6000 pulses are required; to move it by 10 mm, 10/6 × 6000 = 10000 pulses are needed. Since no decimal values are generated during pulse delivery, no errors occur.

- relevant parameter

Parameter	Meaning	Leave the factory setting	Unit	Set Range	Revise	Come into force
P0-11	Number of pulses per revolution * 1	0	pul	0 ~ 9999	servo OFF	immediately
P0-12	Pulse count per revolution × 10,000	1	pul	0 ~ 9999	servo OFF	immediately
P0-13	Electronic Gear Ratio (Molecular)	1	-	0 ~ 65535	Servo OFF (Mode 5) Anytime (Mode 6)	immediately
P0-14	Electronic Gear Ratio (Denominator)	1	-	0 ~ 65535	servo OFF	immediately
P0-92	Second group of electronic gear ratios (molecules): low position *1	1	-	1 ~ 9999	Servo OFF (Mode 5) Anytime (Mode 6)	immediately
P0-93	Second group of electronic gear ratios (molecules): high position * 10,000	0	-	0 ~ 65535	Servo OFF (Mode 5) Anytime (Mode 6)	immediately
P0-94	Second group of electronic gear ratios (denominator) lower position *1	1	-	1 ~ 9999	servo OFF	immediately
P0-95	Second group of electronic gear ratios	0	-	0 ~	servo OFF	immediately

Parameter	Meaning	Leave the factory setting	Unit	Set Range	Revise	Come into force
	(denominator): high value * 10,000			65535		

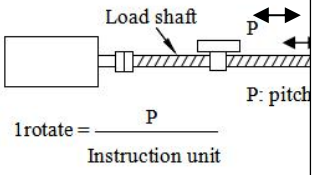
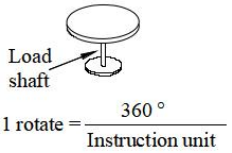
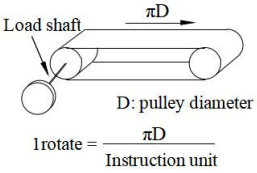
- The parameters P0-11 to P0-14 all pertain to the electronic gear ratio: P0-11 and P0-12 form one set, while P0-13 and P0-14 form another. However, the priority of the per-turn pulse count values for P0-11 and P0-12 takes precedence over those for the electronic gear ratios P0-13 and P0-14. The electronic gear ratios P0-13 and P0-14 only become active when both P0-11 and P0-12 are set to 0.
- When P0-11, P0-12, P0-13, and P0-14 are all set to 0, P0-92, P0-93, P0-94, and P0-95 will take effect.
- In BB mode, both the numerator and denominator of the electronic gear ratio can be modified arbitrarily. In Run mode, only the numerator of the gear ratio may be changed, and such modifications are permitted only in external pulse position mode with real-time updates; other control modes do not allow modifications when enabled.

2. Calculation of pulse count per revolution and electronic gear ratio

Step	Content	Explain	
1	Confirm Mechanical Specifications	Confirm the reduction ratio n:m (number of revolutions of the load shaft per m revolution of the servo motor), ball screw pitch, pulley diameter, etc.	
2	Confirm encoder pulse count	Confirm the encoder resolution of the servo motor used	
3	Decision Instruction Unit	Each pulse sent to the command decision controller corresponds to the actual distance or angle traveled during operation.	
4	Number of instructions required to rotate the load shaft one full revolution	Based on the decision instruction unit, calculate the number of instructions N required for the load axis to rotate one full revolution.	
5	Calculate the number of pulses M for one revolution of the computer shaft	The number of command pulses required for the motor shaft to rotate one full revolution is M = N/(m/n).	
6	Set the number of pulses per revolution (P0-11/P0-12) or the electronic gear ratio (P0-13/P0-14)/(P0-92~95)	P0-11=M%10000 P0-12=M/10000	Priority ↓
		$\frac{P0-13}{P0-14}=\frac{\text{Encoder resolution}}{M}=\frac{\text{Encoder resolution}\times m}{N\times n}$	

- In Step 6, the activation priority of pulse count per revolution depends on whether it exceeds the electronic gear ratio: when pulse counts P0-11 to P0-12 are all zero, only P0-13 to P0-14 will be activated; in special cases where the calculated pulse count per revolution is a decimal value, using the electronic gear ratio becomes necessary.
- When P0-13 and P0-14 exceed the set range, simplify the numerator and denominator of the electronic gear ratio. If the simplified values still fall outside the parameter range, use the second gear ratio range (P0-92 to P0-95); this range only activates when P0-11 to P0-14 equals zero.
- The servo motor encoders compatible with the DS5K2 series offer resolutions of 524,288 (19-bit) and 8,388,608 (23-bit).
- The instruction unit does not directly represent machining accuracy. Refining the instruction unit based on mechanical precision can enhance the servo system's positioning accuracy. For example, when using a lead screw, mechanical precision can reach 0.01 mm; thus, an instruction unit equivalent to 0.01 mm is more precise than one equivalent to 0.1 mm.

3. Example of Electronic Gear Configuration

Step	Name	Ball screw	Cone	Belt + Pulley
				
1	Confirm Mechanical Specifications	Ball screw pitch: 6 mm Mechanical gear ratio: 1:1	Full rotation: 360 degrees Reduction Ratio: 1:3	Pulley diameter: 100 mm Reduction Ratio: 1:2
2	Confirm encoder pulse count	Encoder Resolution: 524288	Encoder Resolution: 524288	Encoder Resolution: 524288
3	Decision Instruction Unit	1 Instruction Unit: 0.001 mm	1 Instruction Unit: 0.1 degree	1 Instruction Unit: 0.02 mm
4	Number of instructions required to rotate the load shaft one full revolution	6mm/0.001mm=6000	360/0.1=3600	314mm/0.02mm=15700
5	Calculate the number of pulses M for one revolution of the computer shaft	M =6000/(1/1)=6000	M=3600/(3/1)=1200	M=15700/(2/1)=7850
6	Set the number of pulses per cycle to P0-11/P0-12	P0-11=6000 P0-12=0	P0-11=1200 P0-12=0	P0-11=7850 P0-12=0
	Set the electronic gear ratio (P0-13/P0-14)/(P0-92	P0-13=524288 P0-14=6000 After the appointment	P0-13=524288 P0-14=1200 After the appointment	P0-13=524288 P0-14=7850 After the appointment

	~95)	P0-13=32768 P0-14=375	P0-13=32768 P0-14=75	P0-13=262144 P0-14=3925 Convert to the second gear ratio P0-92=2144 P0-93=26 P0-94=3925 P0-95=0

5.3.1.2 Positioning Completion Signals (/COIN, /COIN_HD)

This signal indicates that the servo motor has completed positioning during position control and is used by the command controller to confirm positioning completion.

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-00	Positioning completion width	11	Command Unit	1 ~ 65535	at any time	immediately
P5-01	Location Detection Mode Completed	0	-	0 ~ 3	at any time	immediately
P5-02	Positioning completion retention time	0	ms	0 ~ 65535	at any time	immediately

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-37	/COIN-HD	n.0000	5|6	Complete Positioning	at any time	immediately
P5-38	/COIN	n.0001	5|6	Positioning completed	at any time	immediately
For details on hardware wiring, refer to Chapter 3.2.2. To obtain the SO_2 output signal, set P5-37 and P5-38 to n.0002/0012.						



Each SO terminal can only be used for one signal function.

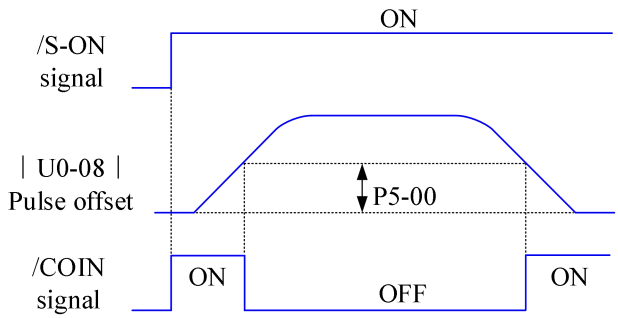
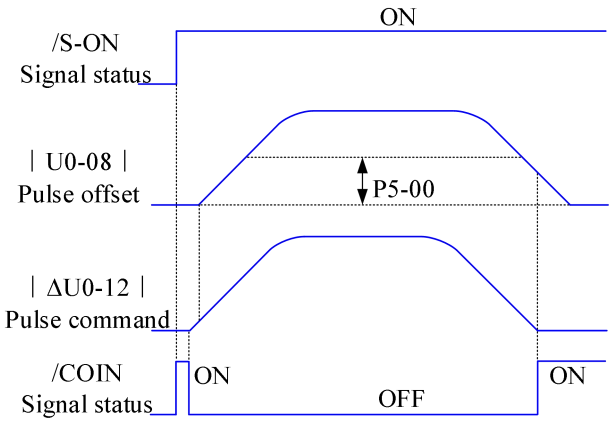
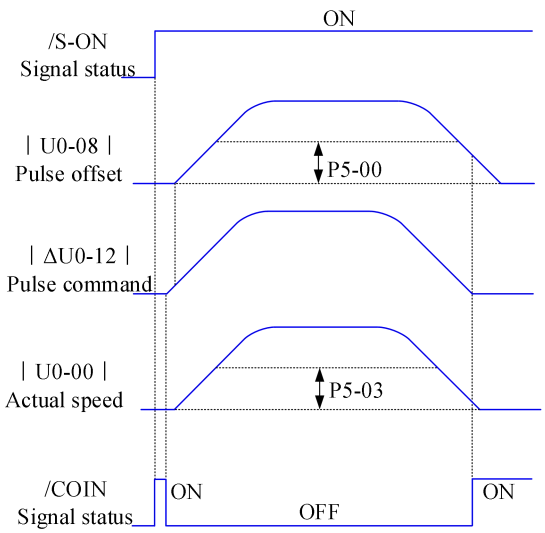
1. Conditions for completing signal output positioning

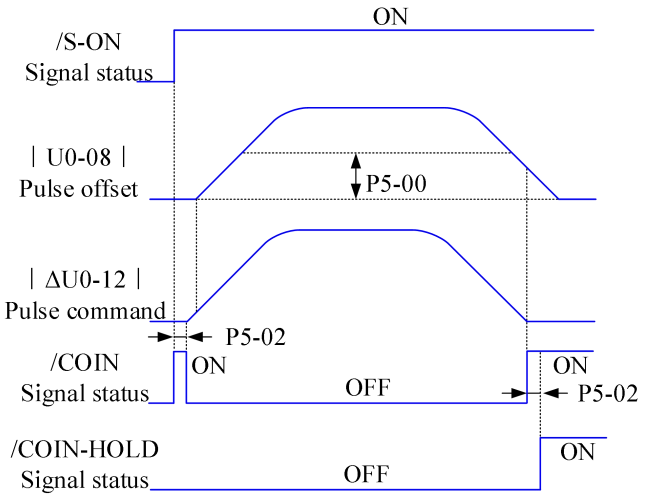
1) COIN-HD Signal Output Conditions

When positioning is completed and detection mode P5-01 is set to 3, the Positioning Completion Hold/COIN-HD signal may be output; the COIN-HD signal is then issued after the /COIN signal remains active for the duration specified by P5-02.

2) COIN Signal Output Conditions

According to the positioning completion detection mode set in P5-01, the Positioning Completion/COIN signal is output. The following outlines the prerequisites for this output and its schematic diagram.

Settings for P5-01	Content	Diagrammatic sketch
0	If the absolute deviation value remains below P5-00, the COIN signal is output.	
1	Upon completion of the instruction, if the deviation is below P5-00, the COIN signal is output.	
2	When the instruction ends and the motor speed is below the rotation detection speed (P5-03), while the absolute deviation value is less than P5-00, the COIN signal is output.	

Settings for P5-01	Content	Diagrammatic sketch
3	The instruction ends; if the absolute deviation value is below P5-00, the COIN signal is output. If COIN remains active for P5-02 seconds, the COIN-HOLD signal is output.	

2. Description of the completed positioning width

1) The positioning width P5-00 varies proportionally with changes in the electronic gear ratio, with a factory default value of 11 command units.
The following table provides an example:

Number of command pulses required for the motor to complete one full rotation	Positioning completed width P5-00
10000 (Default)	11 (Default)
20000	22
5000	6
3000	4
2000	3

The positioning width P5-00 varies proportionally with the number of command pulses required for one full rotation of the motor.

The output of the positioning completion signal depends on its width: the smaller the width, the slower the signal output, but this does not affect the motor's actual operating state.

2) The positioning completion width can also be set independently; changing it does not affect the number of command pulses required for one full motor rotation.

5.3.1.3 Near Position Signal (/NEAR)

The servo motor detects signals near the positioning completion signal to enable the device to prepare for the next action in advance.

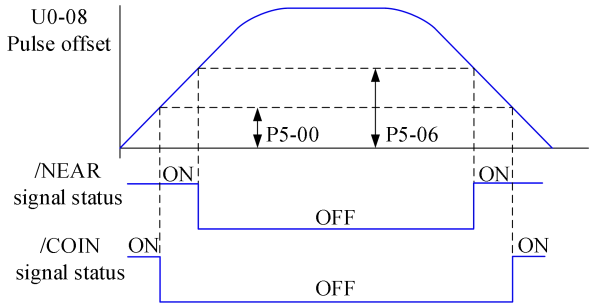
- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-06	Approach Signal Output Width	50	Command Unit	0 ~ 65535	at any time	immediately

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-46	/NEAR	n.0000	5|6	Close Positioning	at any time	immediately
For details on hardware wiring, refer to Chapter 3.2.2. To accurately locate the SO_2 output signal, set P5-46 to n.0002/0012.						

1. Positioning close to signal output conditions

When the pulse deviation value U0-08 of the servo driver is below the set value P5-06, a near-positioning signal (/NEAR) is output.



2. Description of the signal output approach

1) The approach signal output width P5-06 varies proportionally with changes in the electronic gear ratio, with a factory default value of 50 command units.

The following table provides an example:

Number of command pulses required for the motor to complete one full rotation	Approach signal output width P5-06
10000 (Default)	50 (Default)
20000	100

The width of the signal output P5-06 varies proportionally with the number of command pulses required per full rotation of the motor.

The output of the positioning completion signal depends on its width: the smaller the width, the

5000	25
3000	15
2000	10

slower the signal output, but this does not affect the motor's actual operating state.

2) The approach signal output width can also be set independently; changing it does not affect the number of command pulses required for one full motor revolution.

3) Set this parameter to be wider than the completed positioning width.

5.3.1.4 Instruction Pulse Inhibition (/INHIBIT)

Position commands are inhibited, including both internal and external position commands. This function prevents the input of stop command pulses during position control. When the /INHIBIT signal is ON, pulse commands are no longer counted.

- relevant parameter

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-32	/INHIBIT	n.0000	All	Instruction Pulse Prevention	at any time	immediately
Parameter range: n.0000–001A, assigned to other input terminals via parameter P5-32. To disable the signal command pulse input from SI2, set P5-32 to n.0002/0012. For detailed hardware wiring, refer to Chapter 3.2.2.						

1. Explanation of the validity of the INHIBIT terminal

Parameter Setting Status	Signal/INHIBIT Terminal Input Status	Signal/INHIBIT Terminal Logic
P5-32=n.0000	No external terminal input required	invalid
P5-32=n.000□	The SI□ terminal has no signal input.	
P5-32=n.001□	The SI□ terminal has a signal input.	
P5-32=n.0010	No external input terminals required	valid
P5-32=n.000□	The SI□ terminal has a signal input.	
P5-32=n.001□	The SI□ terminal has no signal input.	

2. Effect of the INHIBIT terminal signal on the motor's operating status

control model	Motor Operating Status	
	/INHIBIT terminal logic is valid	/INHIBIT terminal logic is invalid
5-Internal Position Control	Pause the current section	The INHIBIT signal changes from ON to OFF, and the process resumes from the pause point.
6. External Position Pulse Control	Pause pulse instruction reception	The INHIBIT signal switches from ON to OFF; after transitioning from OFF, the system continues operation upon receiving pulse commands.

5.3.1.5 Deviation Removal (/CLR)

Position deviation = (Position command − Position feedback) (per encoder unit)

The position deviation clearance function refers to the ability of the driver to clear the position deviation to zero when the servo is OFF or when it receives the /CLR signal.

- relevant parameter

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-34	/CLR	n.0000	All	Pulse Deviation Elimination	at any time	immediately
Parameter range: n.0000–001A, assigned to other input terminals via parameter P5-34. To clear signal deviation from SI2, set P5-34 to n.0002/0012. For hardware wiring details, refer to Chapter 3.2.2.						

1. Validity of the CLR signal

Parameter Setting Status	Signal/CLR Terminal Input Status	Signal/CLR Terminal Logic
P5-34=n.0000	No external terminal input required	invalid
P5-34=n.000□	The SI□ terminal has no signal input.	
P5-34=n.001□	The SI□ terminal has a signal input.	
P5-34=n.0010	No external input terminals required	valid
P5-34=n.000□	The SI□ terminal has a signal input.	
P5-34=n.001□	The SI□ terminal has no signal input.	

2. Explanation of the /CLR Signal

Send a pulse to the servo motor and apply the CLR input signal; the servo will latch the current pulse count, update the encoder's position to the control position feedback, and clear all intermediate values in the position loop, speed loop, and current loop.
The /CLR signal uses edge triggering.

3. Additional remarks regarding the pulse position deviation clearance signal

Setting F0-02 to 1 also eliminates pulse position deviation.

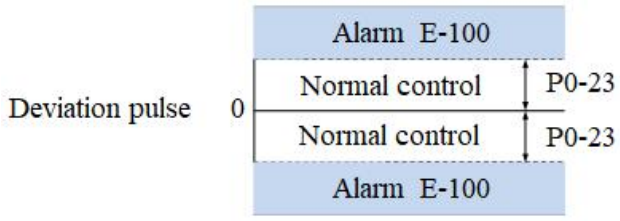
5.3.1.6 Position Pulse Deviation Setting

The pulse deviation value refers to the difference between the command pulse of an instruction controller (e.g., PLC) and the servo unit's feedback pulse under position mode, measured in 1 command unit, which is determined by the electronic gear ratio.
During position control, an alarm will be triggered if the deviation pulse exceeds a specified threshold value, which is defined as the deviation pulse limit.

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-23	Pulse Deviation Limit	2000	0.01 turn	0 ~ 65535	at any time	immediately

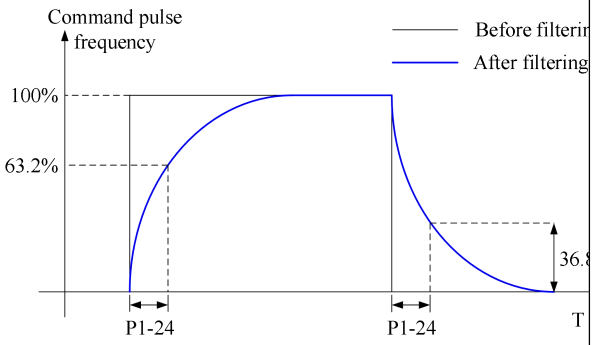
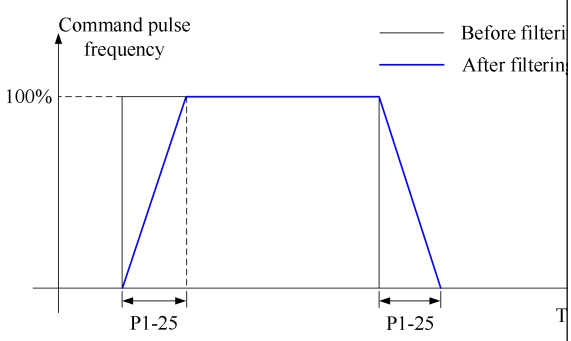
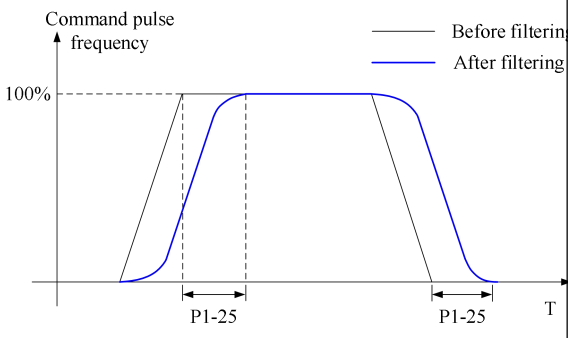
When the deviation pulse threshold is 0, the magnitude of the deviation pulse will not be detected.



5.3.1.7 Position Command Filter

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P1-24	Position instruction acceleration/deceleration filtering time	0	0.1ms	0 ~ 65535	immediately	The server has not started.
P1-25	Position Command Smoothing Filter Time	0	0.1ms	0 ~ 65535	immediately	The server has not started.

Position instruction acceleration/deceleration filtering	Position Command Smoothing Filter
	
	

5.3.1.8 Reference Origin

1. Identify the reference origin

This function identifies the physical zero point of the workbench as the coordinate origin for position control. Users can select either the forward rotation side or the reverse rotation side to determine the

reference point.

- Function Settings

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P4-00 n.xx(x	Origin Function	0	-	0 ~ 1	servo OFF	immediately



This function activates when P9-21=0 and is applicable to Location Modes 5 and 6. When this parameter is set to 0, the origin-seeking function is disabled; it becomes available only when set to n.001x.

- Signal Settings

Parameter	Signal Name	Factory Settings	Meaning	Revise
P5-28	/SPD-A	n.0000	Mode 3: Internal Speed Selection Signal Mode 5: Find origin in forward direction	The parameter range is 0000－001A, allocated to the input interface via parameters P5－28. Setting it to 0001 indicates signal input from terminal SI1.
P5-29	/SPD-B	n.0000	Mode 3: Internal Speed Selection Signal Mode 5: Reverse Direction to Find Origin	The parameter range is 0000－001A, assigned to the input interface via parameters P5－29. Setting it to 0001 indicates signal input from terminal SI1.

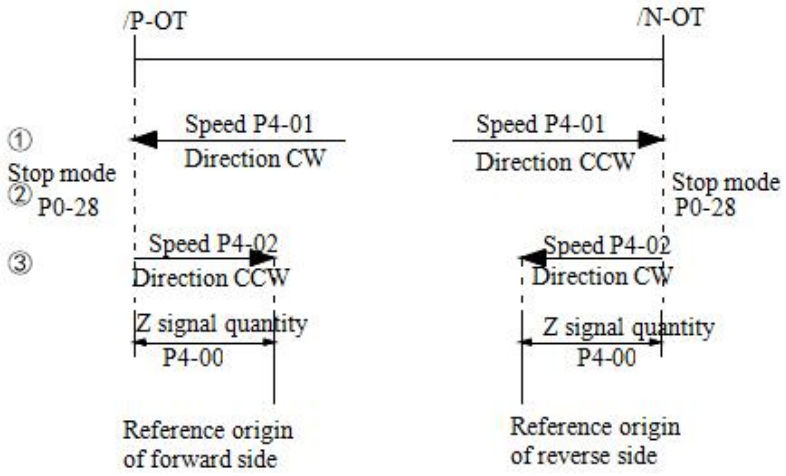
- Related Parameter Settings

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P4-00 n.xxx□	Z believes the number of signs	2	individual	0 ~ f	servo OFF	immediately
P4-00 n.(xxx	Return to the original state and complete the automatic calibration of the encoder zero position	0	-	0 ~ 1	servo OFF	immediately
P4-01	Speed of collision with the proximity switch	600	rpm	0 ~ 65535	servo OFF	immediately

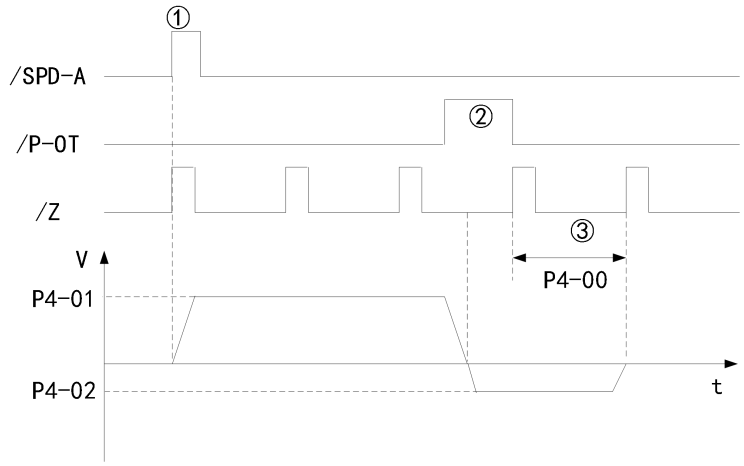
P4-02	Reduce the speed when approaching the proximity sensor	100	rpm	0 ~ 65535	servo OFF	immediately

Set P4-00.3=1 to enable the encoder zero-position calibration function upon completion of reset; after resetting, encoder positions U0-94 to U0-97 will be calibrated to 0.

- Find the reference origin schematic diagram



The sequence for locating the reference origin for forward and reverse rotation is shown below:



The steps are as follows:

1. Install a limit switch on either the forward or reverse rotation side; upon the rising edge of the /SPD-A signal, the motor rotates in the forward direction at the speed set by parameter P4-01 to locate the reference origin for forward rotation.
2. When the workbench strikes the limit switch, the motor stops according to the stop settings P-OT and N-OT specified in parameter P0-28;
3. Continue rotating in the direction opposite to that of the limit switch at the speed set by parameter P4-02; when the motor reaches the n-th position of the Z-axis signal from the optical encoder, use that position as the coordinate origin, where n is determined by parameter P4-00.

5.3.1.9 New Return to Origin Function

1. Function Description

The return-to-origin function operates in position control mode when the servo is enabled (ON). Upon activation, the servo motor searches for the origin to complete positioning; the identified origin serves as the reference point for subsequent position controls.

During the return-to-origin operation, all other position commands (including re-triggered return-to-origin signals) are masked. Once the return is complete, the servo driver can respond to other position commands.

Upon completion of returning to the origin, the servo driver sends a completion signal. The host computer can confirm that the return has been finished upon receiving this signal.

2. Parameter Settings

Parameter	Name	Set Range	Meaning	Set Time	Entry-into-force time	Factory default
P9-11.0	Number of Z phases	0~F	P9-11.0=0: Do not search for the Z-phase P9-11.0=1: Find one Z-phase P9-11.0=2: Find 2 Z-phase elements and so on	servo OFF	servo ON	0
P9-11.1	Return to Origin Trigger Method	0~2	P9-11.1=0: Prevent returning to the starting point P9-11.1 = 1: The process is triggered from the SI terminal (P5-28) and returns to its initial state. P9-11.1=2: In this original mode, the system starts from the initial state immediately after being powered on and enabled for the first time.	servo OFF	servo ON	0
P9-11.2	Return to Origin Mode	0~7	P9-11.2=0: Return to Origin Mode 0 P9-11.2=1: Return to Origin Mode 1 P9-11.2 = 2: Original Point Return Mode 2 and so on	servo OFF	servo ON	0
P9-11.3	Deceleration method when encountering an out-of-range signal	0、1	P9-11.3 = 0: Decelerate according to the acceleration/deceleration times specified in P9-14 P9-11.3 = 1: Reduce speed immediately	servo OFF	servo ON	0

P9-11.0 supports up to 15 Z-phase settings. Setting P9-11.1=0 disables the return-to-origin function; this parameter serves as the enable bit for the function. Return-to-origin modes 1, 3, 5, and 7 correspond to the opposite states of modes 0, 2, 4, and 6, respectively.

Parameter	Name	Set Range	Unit	Meaning	Setting time	Come into force time	Leave the factory Default
P9-12	Return to the original high-speed speed	0~3000	rpm	Travel at high speed back to the origin, identify deceleration points, and apply mechanical offset values	servo OFF	servo ON	200
P9-13	Return to the low-speed state at the origin	0~1000	rpm	Move at a low speed to the origin. The speed should be low enough to avoid mechanical impact when stopping.	servo OFF	servo ON	20
P9-14	Return to Origin Acceleration and Deceleration Time	0~1000	ms	The acceleration and deceleration time here refers to the duration required to reach 1000 rpm from 0 rpm.	servo OFF	servo ON	1000
P9-15	Maximum allowed time to return to the origin	0~12000	10ms	An alarm will be triggered if the total time required for the return-to-origin process exceeds the set parameter value. When P9-15=0, the timeout alarm for returning to origin is disabled.	servo OFF	servo ON	0
P9-16	Touch-to-restart speed threshold	0~1000	rpm	This parameter applies only to Origin Return Modes 6 and 7	servo OFF	servo ON	2

Parameter	Name	Set Range	Unit	Meaning	Setting time	Come into force time	Leave the factory Default
P9-17	Touch-based return-to-origin torque threshold	0~300 %	%	This parameter applies only to Origin Return Modes 6 and 7. The base value for the percentage is the rated torque.	servo OFF	servo ON	100%
P9-18	Touch-to-Return-to-Origin Time Threshold	10~1500	ms	This parameter applies only to Origin Return Modes 6 and 7	servo OFF	servo ON	500
P9-19	Low-bit value of quantitative pulse count	-9999~9999	-	Low-bit value of quantitative pulse count	servo OFF	servo ON	0
P9-20	High-value number of quantitative pulses	-9999~9999	-	High-value number of quantitative pulses	servo OFF	servo ON	0
P9-21	New and Old Return to Origin Function Selection	0、1	-	P9-21=0: Return to Origin Function P9-21=1: Return to Origin Function	servo OFF	again power on	0

Parameter	Name	Set Range	Unit	Meaning	Setting time	Come into force time	Leave the factory Default
P9-22	End filtering time for the new origin point	50~10000	ms	When returning to the origin is about to complete, this filtering time is required to wait until the motor has fully stopped before completely exiting the return-to-origin mode. Only after this filtering time will the return-to-origin completion signal be output.	servo OFF	servo ON	500
P4-00 n.(xxx	Return to the original state and complete the automatic calibration of the encoder zero position	0 ~ 1	-	After restoration is complete, set encoder positions U0-94 to U0-97 to 0.	servo OFF	immediately	0

The actual mechanical offset = P9-19 + P9-20 × 10000, where P9-19 and P9-20 must share the same sign (either both positive or both negative). This offset represents the servo's absolute position after returning to the origin.

Parameter n.xxxx	Name	Setting scope	Meaning	Set Time	Come into force time	leave the factory Default
P5-22	Positive Overtravel Signal POT	0~ffff	Forward limit signal in origin return mode	Operation Settings	immediately come into force	3
P5-23	Reverse Overlimit Signal NOT	0~ffff	Reverse limit signal in origin return mode	Operation Settings	immediately come into force	4

Parameter n.xxxx	Name	Setting scope	Meaning	Set Time	Come into force time	leave the factory Default
P5-54	Return to the origin to complete the signal	0~ffff	When the return-to-origin operation and state are fully completed, a return-to-origin completion signal is issued. Even if another mode is executed after returning to origin, this signal does not disappear. When returning to origin again, the return-to-origin completion signal disappears.	Operation Settings	immediately come into force	0
P5-64	Origin Switch Signal	0~ffff	The process of returning to the origin requires a switch signal for the origin.	Operation Settings	immediately come into force	0
P5-28	The SI terminal returns to its starting position.	0~ffff	When P9-11.1 equals 1, after assigning SI terminals to P5-28, the terminals can be used to trigger back to the original state.	Operation Settings	immediately come into force	0

3. Select New Origin Mode

Using the reset origin function, first set P9-21 to 1, then configure the travel switch (POT/NOT) and origin switch. If using mechanical offset settings (P9-19 or P9-20), adjust the offset within the travel range to prevent damage to machinery during origin restoration.

The Z-phase count (P9-11.0) and mechanical offset values (P9-19, P9-20) can operate simultaneously effectively. If both the Z-phase count (P9-11.0) and mechanical offsets (P9-19, P9-20) are non-zero, the servo first determines the Z-phase count (P9-11.0) before applying the mechanical offsets (P9-19, P9-20). If the Z-phase count (P9-11.0) is zero but the mechanical offsets (P9-19, P9-20) are non-zero, the servo applies the mechanical offsets without determining the Z-phase count. If the Z-phase count is non-zero but the mechanical offsets are zero, the servo determines the Z-phase (P9-11.0) without applying the mechanical offsets.

There are eight total origin-return modes, as follows:

(1) Positive reset: The deceleration point is determined by the origin switch, which may correspond to either the origin switch or the motor's Z signal (P9-11.2 = 0).

(2) Reverse reset: The deceleration point is determined by the origin switch, which may correspond to either the origin switch or the motor's Z signal (P9-11.2=1).
(3) Positive zero return: The deceleration point and origin are defined by the motor's Z signal (P9-11.2=2).
(4) Reverse reset: The deceleration point and origin are defined by the motor's Z signal (P9-11.2=3)
(5) Forward zero return: The deceleration point is the forward overtravel switch; the origin is either the forward overtravel switch or the motor's Z signal (P9-11.2=4).
(6) Reverse reset: The deceleration point is the reverse overtravel switch; the origin is either the reverse overtravel switch or the motor's Z signal (P9-11.2=5).
(7) Positive return to zero: The deceleration point is the mechanical limit position; the origin is either the mechanical limit position or the motor's Z signal (P9-11.2=6).
(8) Reverse reset: The deceleration point is the mechanical limit position; the origin is either the mechanical limit position or the motor's Z signal (P9-11.2=7).

Below is a detailed analysis of each origin-returning pattern:

(1) Origin Return Mode 0 − Positive return to zero; the deceleration point is determined by the origin switch, which may correspond to either the origin switch or the motor's Z signal (P9-11.2 = 0).

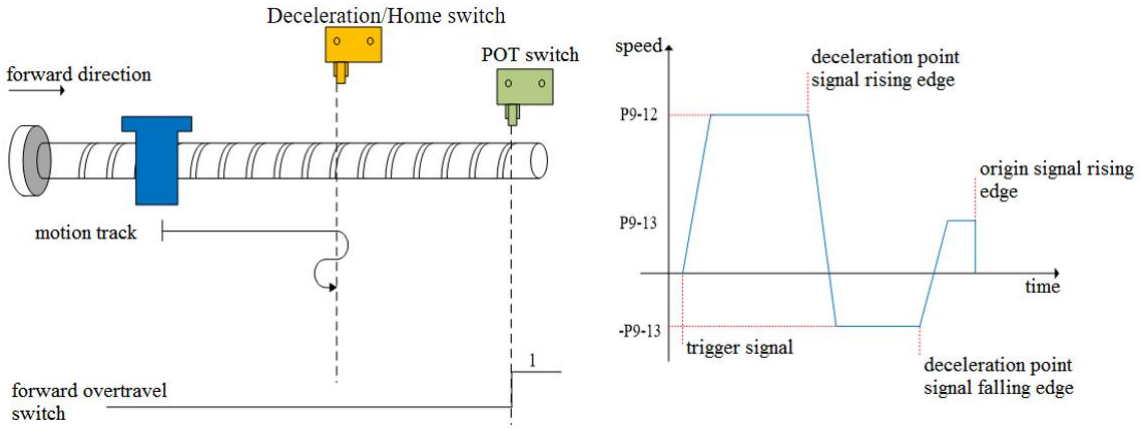
To use this mode, connect the POT, NOT, and origin switches.

1) When the motor starts moving, the origin switch (reduction point) signal is invalid (signal terminal assigned by P5-64:0 = invalid, 1 = valid); throughout the process, the forward overshoot switch (POT, P5-22) remains inactive.

The servo motor first searches forward at high speed for the deceleration point (origin) signal using the P9-12 setting (high-speed return to origin), continuing until it detects the rising edge of this signal. It then gradually decelerates according to the P9-14 setting (acceleration/deceleration time for return to origin) until reaching the value specified in P9-13 (low-speed return to origin). Subsequently, the motor searches backward at low speed for the deceleration point (origin) signal based on its falling edge as defined in P9-13; upon detecting this falling edge, it reverses direction and continues searching at low speed until encountering the rising edge of the deceleration point (origin) signal as set by P9-13. The subsequent return-to-origin operation involves four distinct scenarios:

① The number of Z phases (P9−11.0) is 0, and the mechanical offset values (P9−19, P9−20) are 0:

Continue the low-speed search for the deceleration point (origin) using P9-13 (original low-speed origin signal) during the rising edge detection process; stop immediately upon encountering the deceleration point (origin) signal's rising edge.

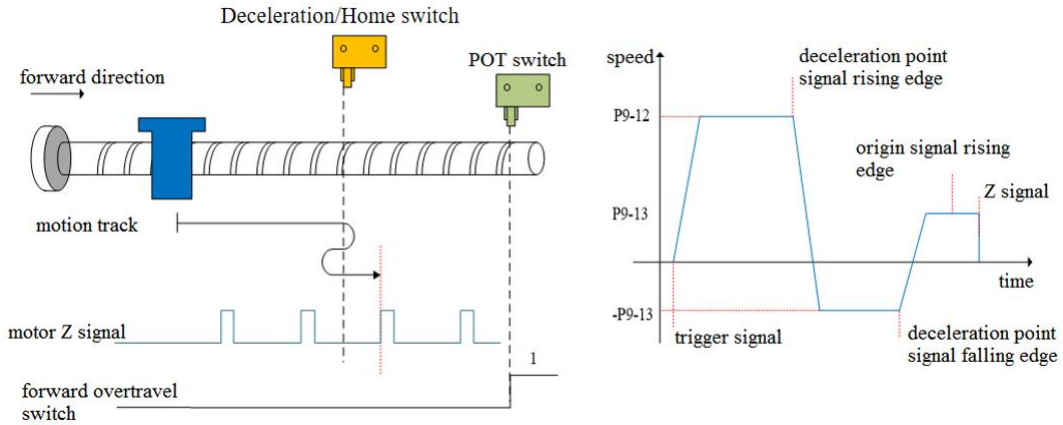


② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

While continuing the low-speed search for the deceleration point (origin) signal's rising edge using P9-13 (return-to-origin low-speed mode), the system immediately stops upon detecting the signal's rising edge. After the motor has completely ceased rotation, it advances a predetermined number of pulses (P9-19 and P9-20) at the speed set by P9-13 (return-to-origin low-speed mode), depending on the specified mechanical offset quantity and direction (positive or negative), before finally stopping the motor.

③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

Continue the low-speed search for the deceleration point (origin) using P9-13 (original low-speed speed) during the signal rising edge phase; upon detecting the deceleration point's rising edge, proceed accordingly, then stop immediately when the first Z signal is detected.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

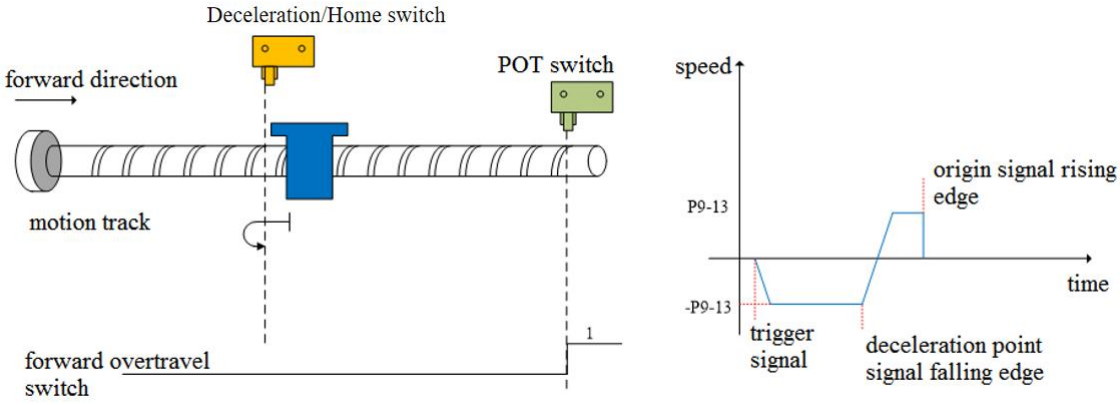
While continuing the low-speed search for the deceleration point (origin) signal's rising edge using P9-13 (return-to-origin low-speed speed), proceed until encountering the deceleration point; upon detecting the first Z-axis signal, stop immediately. After the motor has completely ceased rotation, drive it forward for a predetermined number of pulses (P9-19, P9-20) and in the specified direction (positive or negative) at the speed set by P9-13 (return-to-origin low-speed speed), then stop the motor.

2) When the motor starts operating, the origin switch (reduction point) signal remains active (signal terminal assigned by P5-64:0 = inactive, 1 = active); throughout this process, the forward overtravel switch (P5-22) is not triggered.

The servo motor directly uses the set value P9-13 (return-to-origin low-speed speed) to perform a low-speed reverse search for the deceleration point (origin) based on the falling edge of the signal; upon detecting this falling edge, it reverses direction (i.e., moves forward) and continues the low-speed search for the deceleration point (origin) using P9-13 (return-to-origin low-speed speed) according to the rising edge of the signal. The subsequent return-to-origin operation involves four distinct scenarios:

① The number of Z phases (P9−11.0) is 0, and the mechanical offset values (P9−19, P9−20) are 0:

During forward acceleration or constant-speed operation, the system shall immediately stop upon encountering the rising edge of a deceleration point (origin) signal.

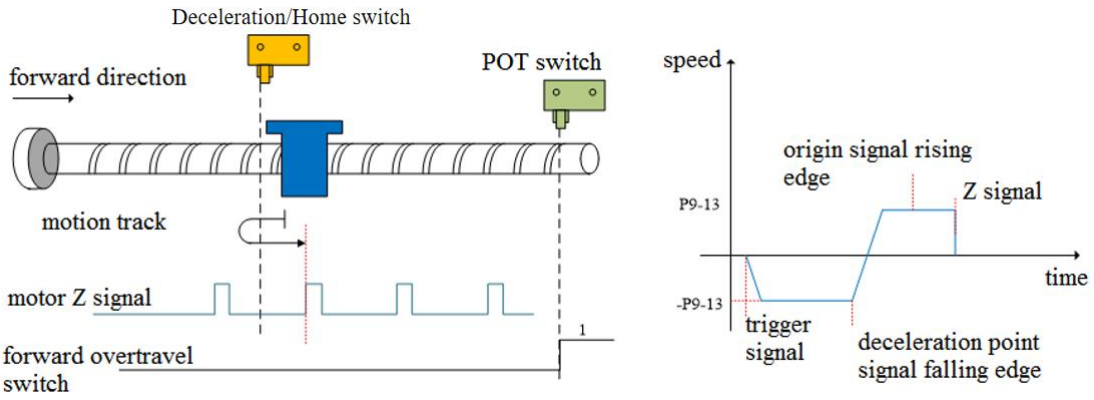


② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

During forward acceleration or constant-speed operation, the system shall immediately stop upon encountering the rising edge of the origin signal; once the motor has completely ceased rotation, it shall proceed at a speed set via P9-13 (low-speed return to origin) for a predetermined number of pulses and in the specified direction (positive or negative), covering a fixed distance before stopping definitively.

③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

During forward acceleration or constant-speed operation, continue running after encountering the rising edge of the origin signal, then stop immediately upon detecting the first Z signal.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

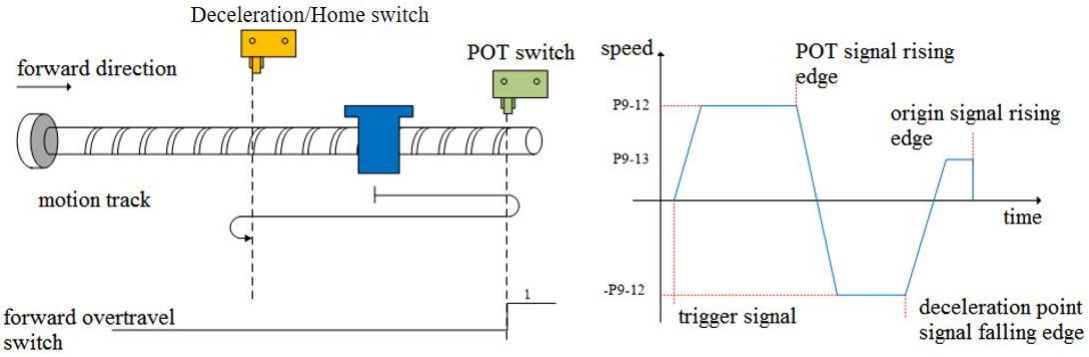
During forward acceleration or constant-speed operation, continue running upon encountering the rising edge of the origin signal; immediately stop when the first Z-axis signal is detected. After the motor has completely ceased rotation, proceed at the speed set by P9-13 (low-speed return to origin) for a predetermined number of pulses (P9-19, P9-20) in the specified direction (positive or negative), before stopping the motor.

3) When the motor starts moving, the origin switch (reduction point) signal is invalid (signal terminal assigned by P5-64:0 = invalid, 1 = valid); during operation, the forward overshoot switch (P5-22) becomes active.

The servo motor first performs a high-speed forward search for the deceleration point signal using the setting value P9-12 (high-speed return-to-origin speed). Upon encountering the forward limit switch (POT) (P5-22), the driver immediately initiates a high-speed reverse search for the deceleration point (origin) signal along its falling edge, based on the value set in P9-14 (acceleration/deceleration time for return to origin). Once the deceleration point (origin) signal's falling edge is detected, the motor decelerates and reverses direction according to the setting value P9-14 (acceleration/deceleration time for return to origin), thereby restoring forward motion. The servo motor then performs a low-speed forward search for the deceleration point (origin) signal using the setting value P9-13 (low-speed return-to-origin speed). The subsequent return-to-origin operation proceeds under four distinct scenarios:

① The number of Z phases (P9−11.0) is 0, and the mechanical offset values (P9−19, P9−20) are 0:

During forward acceleration or constant-speed operation, immediately stop the machine upon encountering the rising edge of the origin signal.

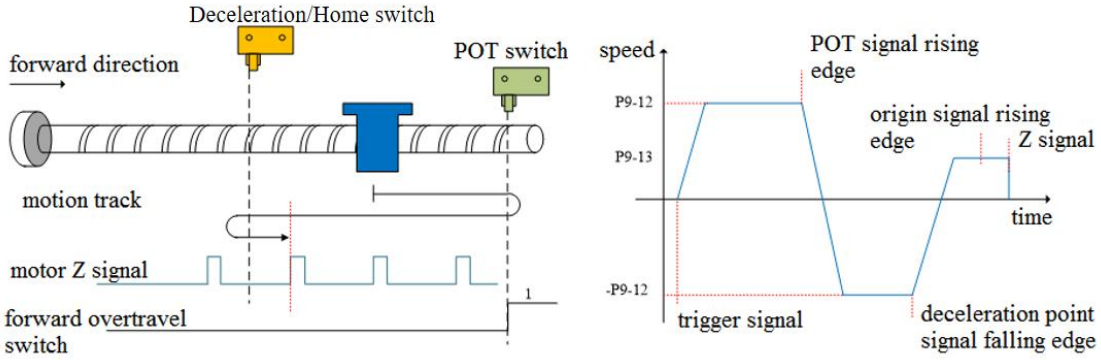


② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

During forward acceleration or constant-speed operation, the motor shall stop immediately upon encountering the rising edge of the deceleration point (origin) signal; once fully stationary, it shall execute a predetermined number of pulses with specified mechanical offset values and direction (positive or negative) at the speed set by P9-13 (returning to low-speed origin), covering a fixed distance as defined by pulses P9-19 and P9-20 before complete shutdown.

③ The number of Z phases is P9−11.0 = 1, and the mechanical offset values (P9−19, P9−20) are 0:

During forward acceleration or constant-speed operation, continue running after encountering the rising edge of the deceleration point (origin) signal, then stop immediately upon detecting the first Z signal.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

During forward acceleration or constant-speed operation, upon encountering the rising edge of a deceleration point (origin) signal, continue operation; then immediately stop when the first Z-axis signal is detected. After the motor has completely stopped, proceed at the speed set via P9-13 (low-speed return to origin) for a predetermined number of pulses in the specified direction (positive or negative), followed by a fixed distance travel based on the preset mechanical offset pulse count and direction before final motor shutdown.

(2) Origin Return Mode 1 – Reverse zero return, with the deceleration point being the origin switch; the origin is either the origin switch or the motor's Z signal (P9-11.2=1).

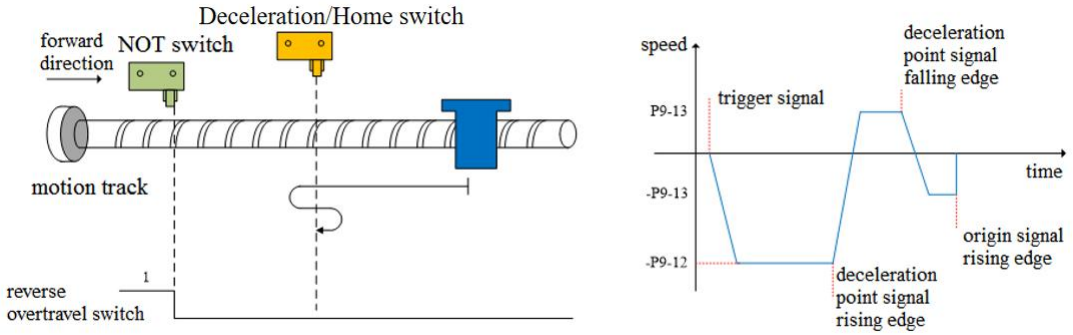
To use this mode, connect the POT, NOT, and origin switches.

1) When the motor starts operating, the origin switch (reduction point) signal is invalid, and the reverse overtravel switch (NOT) (P5-23) remains inactive throughout the entire process.

The servo motor first performs high-speed reverse search for the deceleration point signal using the setting value-P9-12 (high-speed return to origin), continuing until it encounters the rising edge of the deceleration point signal. It then gradually accelerates according to the setting P9-14 (acceleration/deceleration time for returning to origin) until reaching P9-13 (low-speed return to origin). Subsequently, the servo motor searches forward at low speed for the deceleration point (origin) signal based on its setting P9-13; upon detecting the falling edge of this signal, it reverses direction and continues searching low-speedly for the rising edge of the deceleration point signal using-P9-13. The subsequent return-to-origin operation involves four distinct scenarios:

① The number of Z phases (P9–11.0) is 0, and the mechanical offset values (P9–19, P9–20) are 0:

Continue the low-speed search for the deceleration point (origin) using-P9-13 (low-speed return to origin). During the operation along the rising edge of the deceleration point (origin) signal, stop immediately upon encountering its rising edge.

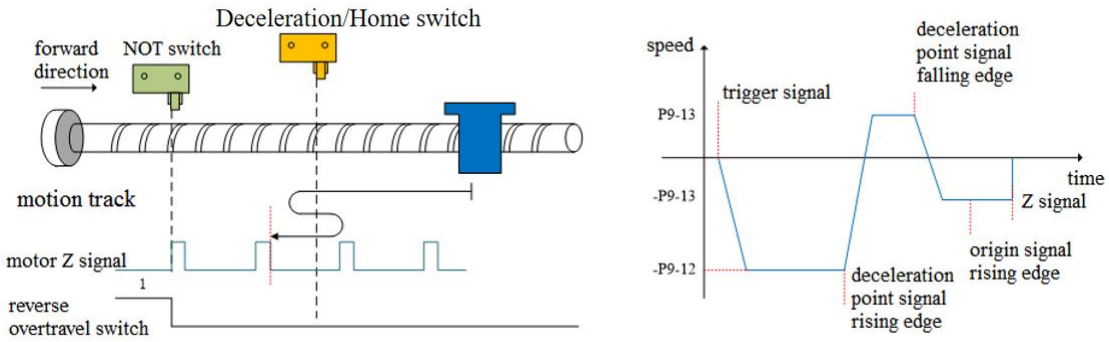


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

Continue the low-speed search for the deceleration point (origin) using command P9-13 (return to origin at low speed). During signal ascent, stop immediately upon detecting the deceleration point signal's rising edge; once the motor has fully ceased rotation, execute a predetermined number of pulses with the set mechanical offset value and direction (positive or negative), then drive the motor forward at the speed specified by P9-13 for fixed pulse durations (P9-19 and P9-20), followed by complete motor shutdown.

③ The number of Z phases (P9–11.0) is 1, and the mechanical offset values (P9–19, P9–20) are 0:

Continue the low-speed search for the deceleration point (origin) using the-P9-13 command (returning to the origin at low speed). During signal rising edge detection, proceed until reaching the deceleration point (origin), then stop immediately upon detecting the first Z signal.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

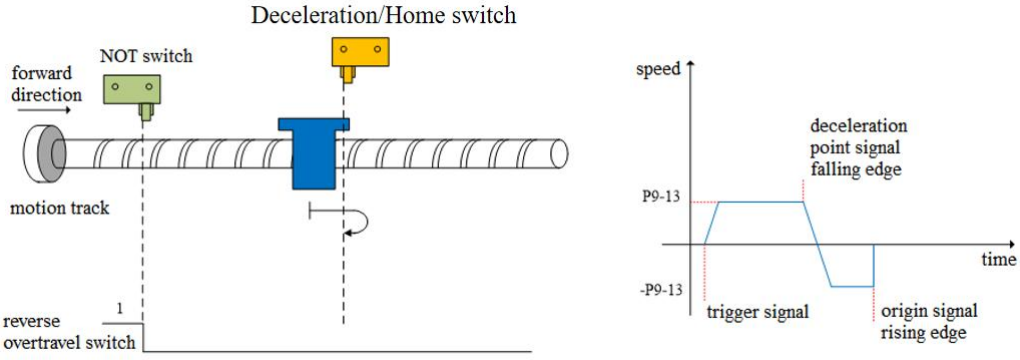
Continue the low-speed search for the deceleration point (origin) using command P9-13 (return to origin at low speed). During signal ascent, proceed until encountering the deceleration point; upon detection, stop immediately. After complete motor cessation, execute a predetermined number of pulses with the set mechanical offset value and direction (positive or negative), then drive the motor at the speed specified by P9-13 (return to origin at low speed) for a fixed distance (P9-19, P9-20), followed by motor shutdown.

2) When the motor starts operating, the origin switch (reduction point) signal remains active (signal terminal assigned by P5-64:0 = inactive, 1 = active); throughout this process, the reverse overtravel switch (NOT) (P5-23) is not triggered.

The servo motor directly uses the set value P9-13 (return-to-origin low-speed speed) to perform a low-speed forward search for the deceleration point (origin) upon detecting the falling edge of the return-to-origin signal; upon encountering this edge, it reverses direction (i.e., moves in the opposite direction) and continues the low-speed search for the deceleration point (origin) using-P9-13 (return-to-origin low-speed speed) until reaching the rising edge of the return-to-origin signal. The subsequent return-to-origin operation involves four distinct scenarios:

① The number of Z phases (P9–11.0) is 0, and the mechanical offset values (P9–19, P9–20) are 0:

During negative acceleration or constant-negative speed operation, immediately stop the machine upon encountering the rising edge of the origin signal.

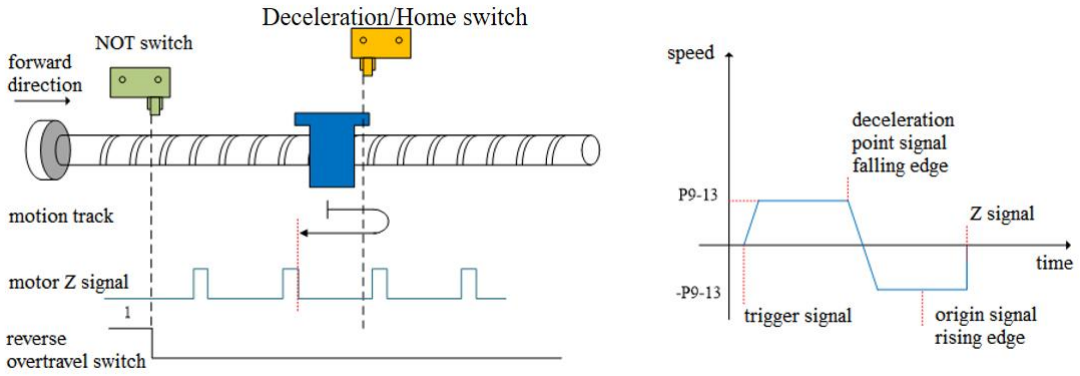


② The number of Z phases is P9−11.0 = 0, and the mechanical offsets (P9−19, P9−20) are not zero:

During negative acceleration or negative constant-speed operation, the system shall immediately stop upon encountering the rising edge of the origin signal; after the motor has completely ceased rotation, it shall proceed at a speed set via P9-13 (low-speed return to origin) for a predetermined number of pulses and in the specified direction (positive or negative), as indicated by P9-19 and P9-20, before finally stopping the motor.

③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

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



④ The number of Z phases is P9−11.0 = 1, and the mechanical offsets (P9−19, P9−20) are not zero:

During negative acceleration or negative constant-speed operation, continue running after encountering the rising edge of the deceleration point (origin) signal; immediately stop upon detecting the first Z-axis signal. Once the motor has completely ceased rotation, proceed at the speed set via P9-13 (low-speed return to origin) for a predetermined number of pulses in the specified direction (positive or negative), then halt the motor.

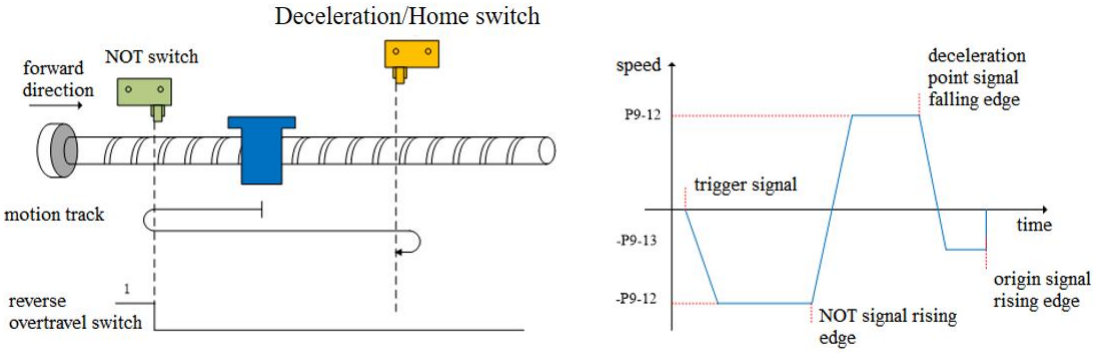
3) When the motor starts moving, the origin switch (reduction point) signal is invalid (signal terminal assigned by P5-64:0 = invalid, 1 = valid); during operation, the reverse overtravel switch becomes active (NOT) (P5-23).

The servo motor first searches for the deceleration point (origin) signal in reverse direction at high speed using the setting value-P9-12 (high-speed return to origin). Upon encountering the reverse overshoot switch (NOT), the driver decelerates and reverses direction (i.e., moves forward) based on the value set by P9-14 (acceleration/deceleration time for returning to origin), then immediately searches for the deceleration point (origin) signal in forward direction at high speed using P9-12. When the signal's falling edge is detected, the motor decelerates and reverses direction (i.e., moves backward) according to P9-14; subsequently, it searches for the deceleration point (origin) signal in reverse direction at low speed

using-P9-13. The subsequent return-to-origin operation proceeds under four distinct scenarios:

① The number of Z phases (P9−11.0) is 0, and the mechanical offset values (P9−19, P9−20) are 0:

During reverse acceleration or constant-speed reverse operation, the machine shall stop immediately upon encountering the rising edge of the origin signal.

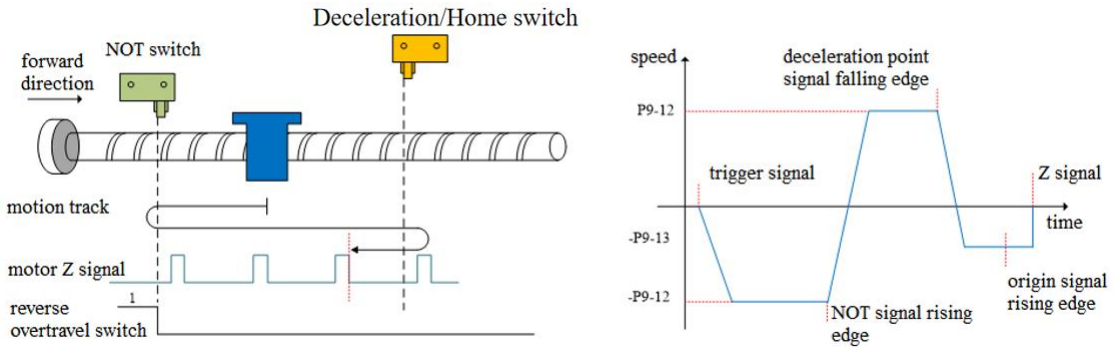


② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

During reverse acceleration or constant-speed reverse operation, the motor shall stop immediately upon encountering the rising edge of the deceleration point (origin) signal; once fully stationary, it shall proceed at the preset speed specified in P9-13 (low-speed return to origin) for a predetermined number of pulses and in the designated direction (positive or negative), followed by complete shutdown.

③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

During reverse acceleration or constant-speed reversal operation, continue running after encountering the rising edge of the origin signal, then stop immediately upon detecting the first Z signal.



④ The number of Z phases is P9−11.0 = 1, and the mechanical offsets (P9−19, P9−20) are not zero:

During reverse acceleration or constant-speed reverse operation, continue running after encountering the rising edge of the deceleration point (origin) signal; immediately stop upon detecting the first Z-axis signal. Once the motor has completely ceased rotation, drive it at the speed set via P9-13 (low-speed return to origin) for a predetermined number of pulses and in the specified direction (positive or negative),

then halt the motor.

(3) Origin Return Mode 2 – Forward zero return: the deceleration point and origin are defined by the motor's Z signal (P9-11.2=2).

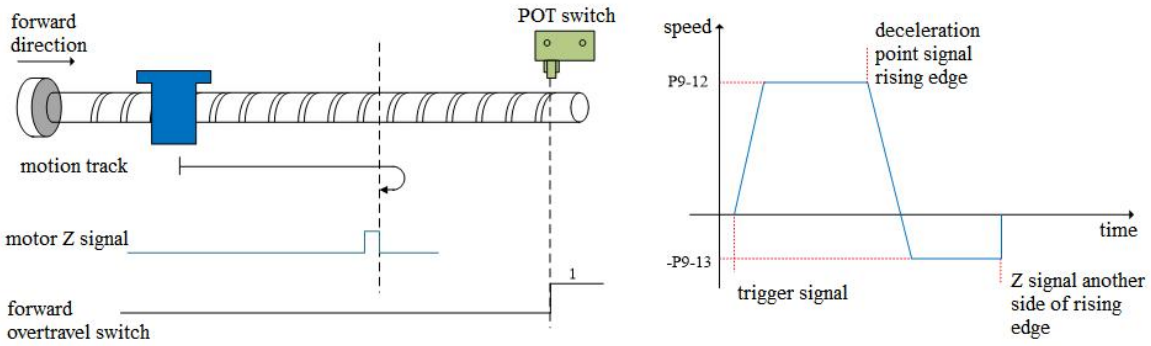
This mode does not determine the number of Z-phase motors. To use this mode, connect POT and NOT.

1) When the motor starts operating, the Z signal is either invalid or valid (signal terminal assigned by P5-64:0 = invalid, 1 = valid), and no forward travel switch (POT) is triggered throughout the entire process.

The servo motor first performs high-speed forward scanning of the Z signal using the P9-12 setting value (return-to-origin high-speed speed). Upon detecting the rising edge of the Z signal, it decelerates and reverses direction according to the P9-14 setting value (return-to-origin acceleration/deceleration time), then accelerates to the P9-13 setting value (return-to-origin low-speed speed) for reverse low-speed scanning of the Z signal. The subsequent return-to-origin operation proceeds in two distinct scenarios:

① The mechanical offset (P9-19, P9-20) is 0:

During reverse acceleration or constant-speed reverse operation, stop immediately upon encountering the rising edge on the opposite side of the motor's Z signal.



② The mechanical offset value (P9-19, P9-20) is not equal to 0:

During reverse acceleration or constant-speed reverse operation, the motor stops immediately upon encountering the rising edge on the opposite side of the Z signal. After complete motor cessation, the motor advances a predetermined number of pulses (P9-19 and P9-20) at the speed set in P9-13 (low-speed return to origin), following the specified mechanical offset quantity and direction (positive or negative), before stopping definitively.

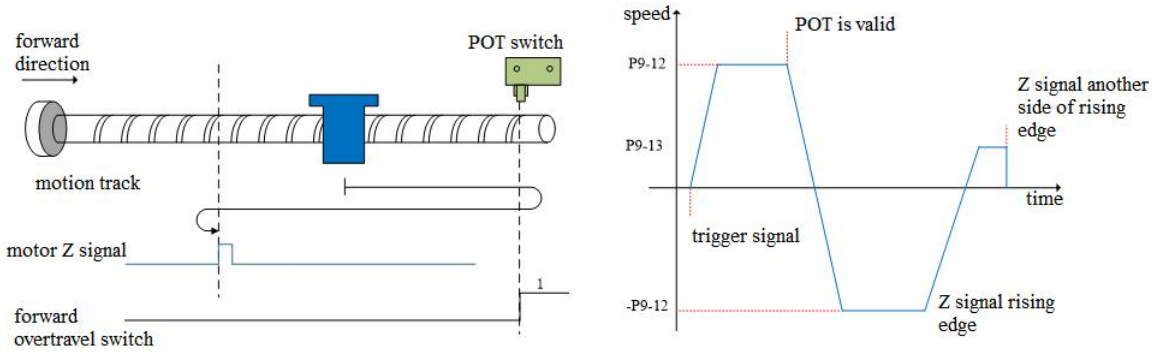
2) When the motor starts moving, the Z signal is either invalid or valid (signal terminal assigned by P5-64:0 = invalid, 1 = valid); during this process, the forward overshoot switch (POT, P5-22) is triggered.

The servo motor first performs a high-speed forward search for the Z signal using the P9-12 setting value (high-speed return-to-origin speed). Upon encountering the forward limit switch, the driver initiates a decelerated reverse search at-P9-12 (high-speed return-to-origin speed) based on the P9-14 setting value (acceleration/deceleration time for return to origin), continuing until it detects the rising edge of the Z

signal and gradually decelerates back toward forward motion according to P9-14. Subsequently, the servo motor conducts a low-speed forward search along the opposite rising edge of the Z signal using P9-13 (low-speed return-to-origin speed). The subsequent return-to-origin operation proceeds under two distinct scenarios:

① The mechanical offset (P9-19, P9-20) is 0:

During forward acceleration or constant-speed operation, the machine shall stop immediately upon encountering the rising edge of the Z signal on the opposite side.



② The mechanical offset value (P9-19, P9-20) is not equal to 0:

During forward acceleration or constant-speed operation, the motor stops immediately upon encountering the rising edge of the Z signal on the opposite side. After complete cessation, the motor advances a predetermined number of pulses at the set mechanical offset value and direction (positive or negative) at the speed specified in P9-13 (low-speed return to origin), then stops.

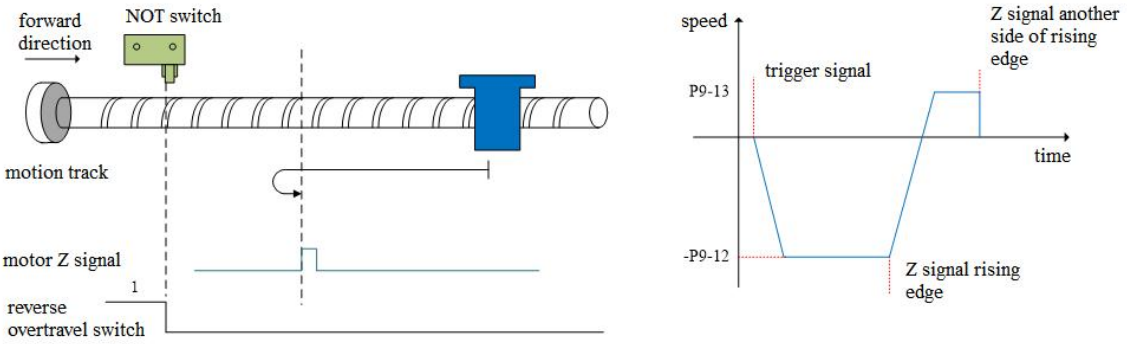
(4) Origin Return Mode 3 – Reverse zero return: The deceleration point and origin are defined by the motor's Z signal (P9-11.2=3).

This mode does not determine the number of Z-phase motors. To use this mode, connect POT and NOT.
1) When the motor starts operating, the Z signal must be either invalid or valid (signal terminal assigned by P5-64:0 = invalid, 1 = valid), and the reverse overtravel switch (NOT) must not be triggered throughout the entire process.

The servo motor first performs high-speed reverse scanning of the Z signal using the setting value-P9-12 (high-speed return to origin). Upon detecting the rising edge of the Z signal, it decelerates and reverses direction according to P9-14 (acceleration/deceleration time for origin return), then accelerates to P9-13 (low-speed return to origin) for forward low-speed scanning of the Z signal. The subsequent return-to-origin operation proceeds in two distinct scenarios:

① The mechanical offset (P9-19, P9-20) is 0:

During forward acceleration or constant-speed operation, the motor shall stop immediately upon encountering the rising edge on the opposite side of the Z signal.



② The mechanical offset value (P9-19, P9-20) is not equal to 0:

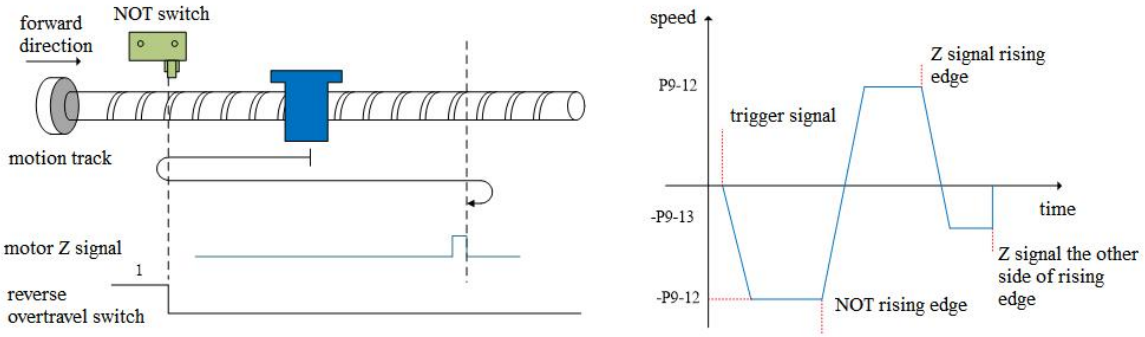
During forward acceleration or constant-speed operation, the motor stops immediately upon encountering the rising edge of the Z signal on the opposite side; after complete cessation, it advances a predetermined number of pulses (based on the set mechanical offset quantity and direction—positive or negative) at the speed specified in P9-13 (low-speed return to origin), then stops.

2) When the motor starts moving, the Z signal is either invalid or valid (signal terminal assigned by P5-64:0 = invalid, 1 = valid); during operation, this triggers the reverse overtravel switch (NOT).

The servo motor first performs a high-speed reverse search of the Z signal using the setting value-P9-12 (high-speed return to origin). Upon encountering the reverse overshoot switch, the driver decelerates in reverse mode according to P9-14 and then resumes high-speed forward search using P9-12 (high-speed return to origin) until reaching the rising edge of the Z signal; it subsequently decelerates gradually in reverse mode (i.e., restoring reverse direction) based on the setting value P9-14 (acceleration/deceleration time for return to origin), followed by low-speed reverse search along the opposite rising edge of the Z signal using-P9-13 (low-speed return to origin). The subsequent return-to-origin operation proceeds under two distinct scenarios:

① The mechanical offset (P9-19, P9-20) is 0:

During reverse acceleration or constant-speed reversal operation, the machine shall stop immediately upon encountering the rising edge of the Z signal on the opposite side.



② The mechanical offset value (P9-19, P9-20) is not equal to 0:

During reverse acceleration or constant-speed reverse operation, the motor stops immediately upon encountering the rising edge on the opposite side of the Z signal. After complete motor cessation, the motor advances a predetermined number of pulses (P9-19 and P9-20) at the speed set in P9-13 (low-speed return to origin), following the specified mechanical offset quantity and direction (positive or negative), before stopping definitively.

(5) Origin Return Mode 4 – Forward zero return, where the deceleration point and origin are defined by the forward travel switch POT (P5-22) (P9-11.2 = 4).

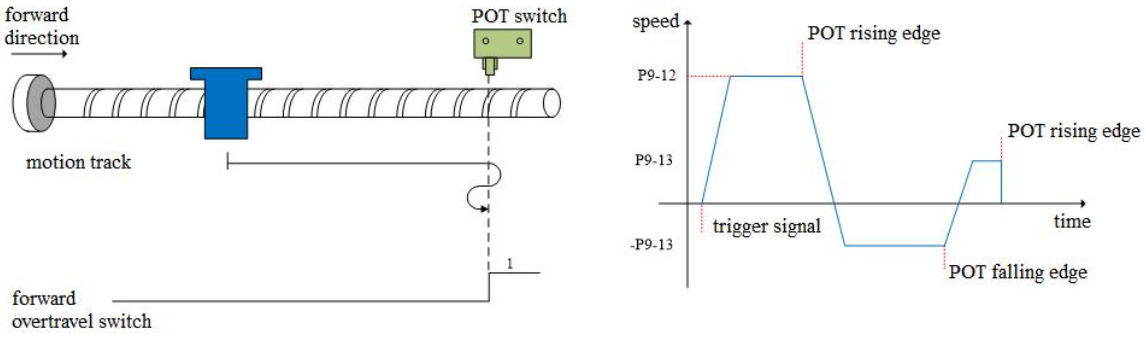
To use this mode, connect NOT and POT.

1) The forward travel switch (POT) is inactive when the motor starts moving.

The servo motor first performs a high-speed forward search for the forward limit switch using the P9-12 setting value (high-speed return to origin). Upon detecting the rising edge of the forward limit switch signal, it gradually decelerates and reverses direction according to the P9-14 setting (acceleration/deceleration time for returning to origin). Then, the servo motor conducts a low-speed reverse search for the forward limit switch signal using the P9-13 setting value (low-speed return to origin). After identifying the falling edge of the forward limit switch signal, the subsequent return-to-origin operation proceeds in one of four scenarios:

① The number of Z phases (P9–11.0) is 0, and the mechanical offset values (P9–19, P9–20) are 0:

Reverse the deceleration (i.e., return to forward mode), and use P9-13 (returning to low-speed starting point) to detect the rising edge of the forward overshoot switch signal at low speed. During forward acceleration or constant-speed operation, immediately stop the machine upon encountering the rising edge of the forward overshoot switch signal.



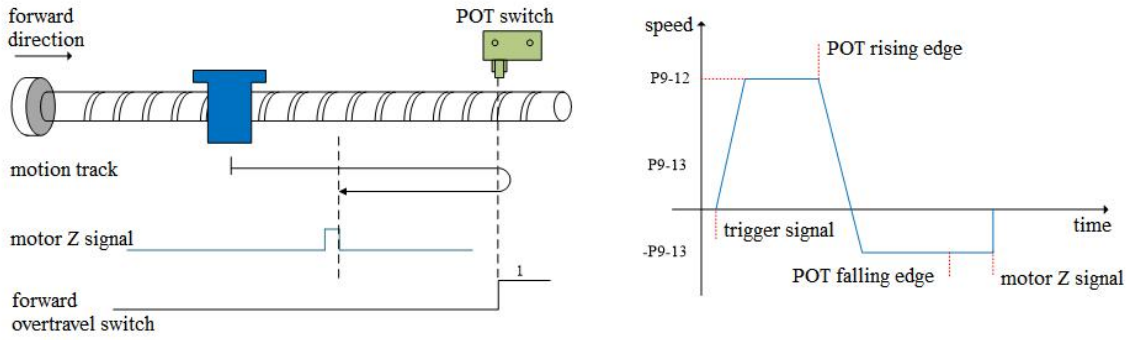
② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

Reverse the deceleration (i.e., return to forward motion), and using P9-13 (returning to low-speed speed at origin), search for the rising edge of the forward overshoot switch signal at low speed. During forward acceleration or constant-speed operation, immediately stop the motor upon encountering the rising edge

of the forward overshoot switch signal; after the motor has completely stopped, proceed with a fixed number of pulses based on the preset mechanical offset value and direction (only negative direction is allowed, meaning movement must occur between the origin switch and NOT), then drive the motor at the speed set by P9-13 (returning to low-speed speed at origin) for a predetermined distance before stopping the motor.

③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

Continue low-speed reverse operation set to-P9-13 (returning to origin at low speed), then stop immediately upon encountering the rising edge of the first Z signal.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

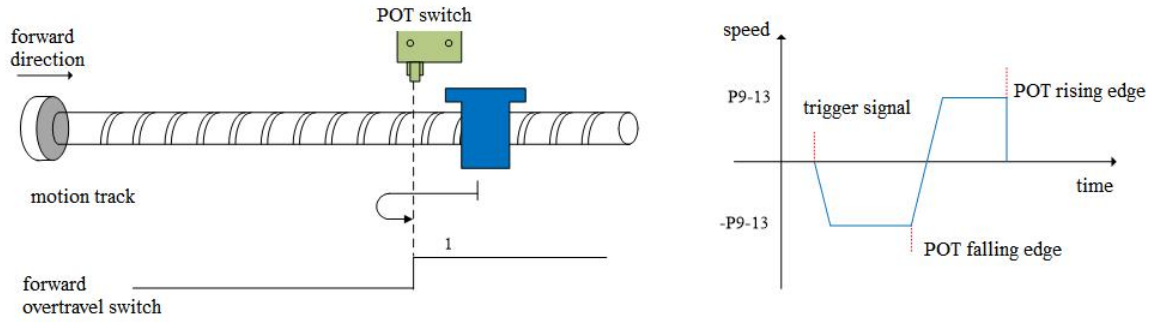
Continue reverse operation at low speed using the setting specified by P9-13 (return to origin at low speed). Upon encountering the rising edge of the first Z signal, stop immediately. Once the motor has completely ceased rotation, proceed with a fixed number of pulses according to the preset mechanical offset value and direction (which may be either negative or positive, but must involve movement between the origin switch and NOT position). Subsequently, drive the motor at the speed set by P9-13 (return to origin at low speed) for a predetermined distance before stopping the motor.

2) The forward travel switch (POT) (P5-22) is activated when the motor starts moving.

The servo motor directly uses the set value-P9-13 (low-speed return-to-origin speed) to perform a reverse low-speed search for the falling edge of the forward travel limit switch signal (POT). Upon detecting this falling edge, the subsequent return-to-origin operation proceeds in one of four scenarios:

① The number of Z phases (P9−11.0) is 0, and the mechanical offset values (P9−19, P9−20) are 0:

Reverse deceleration (i.e., return to forward mode): Use P9-13 (return to origin low-speed setting) to search for the rising edge of the POT signal at low speed in forward direction; during forward acceleration or constant-speed operation, immediately stop upon detecting the POT rising edge.

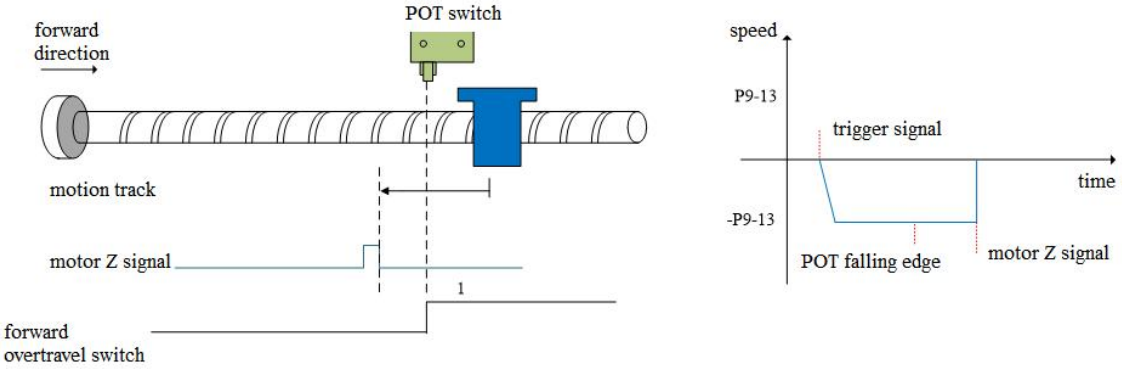


② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

Reverse deceleration (i.e., return to forward motion): Using P9-13 (returning to the origin at low speed), perform a low-speed forward search for the rising edge of POT. During forward acceleration or constant-speed operation, immediately stop upon detecting the POT rising edge; once the motor has completely ceased rotation, proceed with a predetermined number of pulses and direction (only negative direction, i.e., movement between the origin switch and NOT) based on the set mechanical offset value, then drive the motor at the speed specified by P9-13 (returning to the origin at low speed) for a fixed distance (P9-19, P9-20), after which the motor stops.

③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

Continue low-speed reverse operation set to-P9-13 (returning to origin at low speed), then stop immediately upon encountering the rising edge of the first Z signal.



④ The number of Z phases is P9−11.0 = 1, and the mechanical offsets (P9−19, P9−20) are not zero:

Continue reverse operation at the low speed setting specified by P9-13 (returning to the origin at low speed). Upon encountering the rising edge of the first Z signal, stop immediately. Once the motor has completely ceased rotation, proceed according to the preset number of pulses and direction for mechanical offset (which may be either negative or positive, but must involve movement between the origin switch and NOT position), then drive the motor at the speed set by P9-13 (returning to the origin at low speed) for a predetermined number of pulses (P9-19, P9-20), after which the motor stops.

(6) Origin Return Mode 5 – Reverse zero return, where the deceleration point and origin are defined by the reverse overtravel switch NOT (P5-23) (P9-11.2=5).

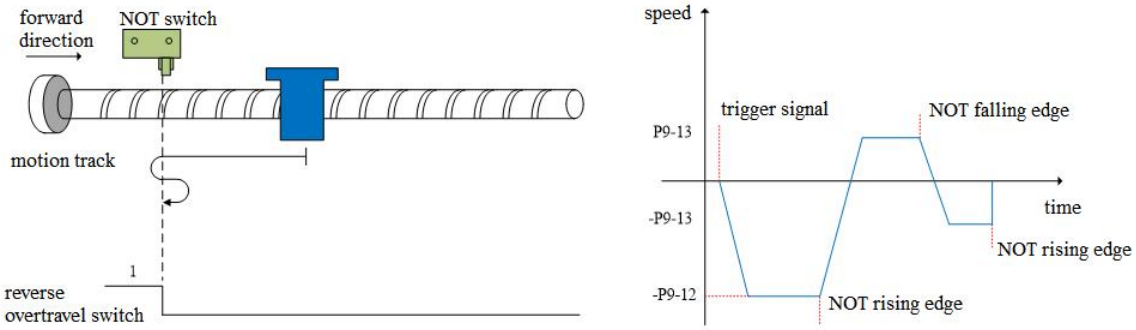
To use this mode, connect POT and NOT.

1) The reverse overtravel switch (NOT) is invalid when the motor starts moving.

The servo motor first performs a reverse high-speed search for the NOT switch using the setting value-P9-12 (high-speed return to origin). Upon detecting the rising edge of NOT, it gradually decelerates and reverses direction according to the setting P9-14 (acceleration/deceleration time for origin return). Then, it conducts a forward low-speed search for the NOT's falling edge using the setting P9-13 (low-speed return to origin). After identifying the falling edge of NOT, the subsequent return-to-origin operation proceeds in one of four scenarios:

① The number of Z phases (P9−11.0) is 0, and the mechanical offset values (P9−19, P9−20) are 0:

Reverse the deceleration (i.e., restore reverse mode), then use-P9-13 (return to initial low-speed state) to perform a reverse low-speed search for the NOT rising edge. During reverse acceleration or constant reverse speed operation, immediately stop when encountering the NOT rising edge.

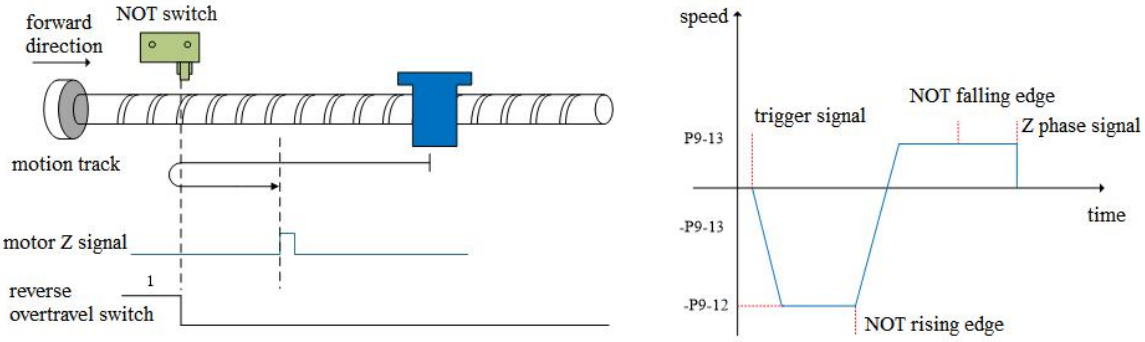


② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

Reverse deceleration (i.e., restoring reverse direction): Using P9-13 (returning to the origin at low speed), perform a low-speed search for the rising edge of the reverse overtravel switch signal (NOT). During reverse acceleration or constant-speed reversal, immediately stop upon encountering the NOT rising edge; after complete motor cessation, proceed with the motor at the speed set by P9-13 (returning to the origin at low speed) for a predetermined number of pulses in the specified direction (only forward, i.e., movement between the origin switch and POT), followed by motor shutdown.

③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

Continue operating at low speed in forward direction as set for P9-13, then stop immediately upon encountering the rising edge of the first Z signal.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

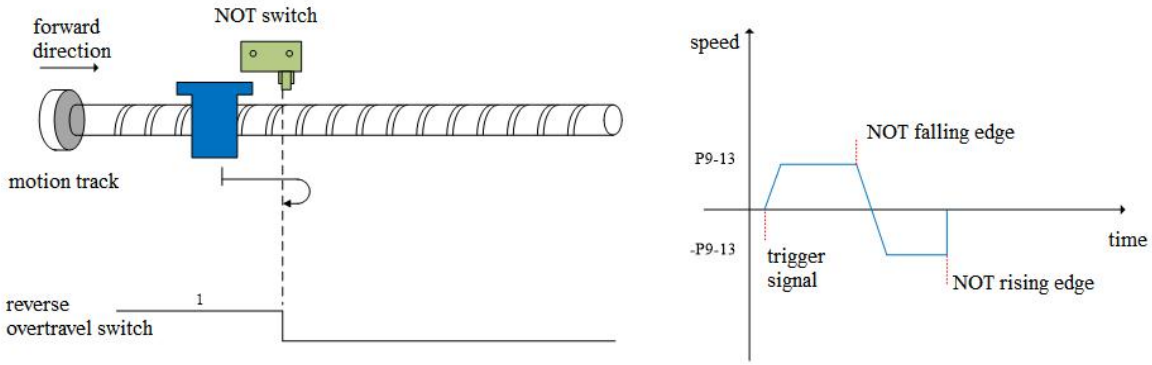
Continue forward operation at low speed set by P9-13 (returning to origin at low speed), then stop immediately upon encountering the rising edge of the first Z signal. Once the motor has completely stopped, proceed according to the preset number of pulses and direction (positive or negative, but must move between the origin switch and the POT) for a fixed distance at the speed set by P9-13 (returning to origin at low speed), after which the motor stops.

2) The reverse overtravel switch (NOT) (P5-23) is activated when the motor starts moving.

The servo motor directly detects the falling edge of the NOT signal (reverse overtravel switch signal) during its forward low-speed search using the P9-13 setting value (low-speed return to origin). Upon detecting this NOT signal, the subsequent return-to-origin operation proceeds in one of four scenarios:

① The number of Z phases (P9−11.0) is 0, and the mechanical offset values (P9−19, P9−20) are 0:

Reverse deceleration (i.e., restore reverse mode): Use-P9-13 to return to low-speed reverse operation and search for the NOT rising edge at low speed. During reverse acceleration or constant-speed reversal, stop immediately upon encountering the NOT rising edge.



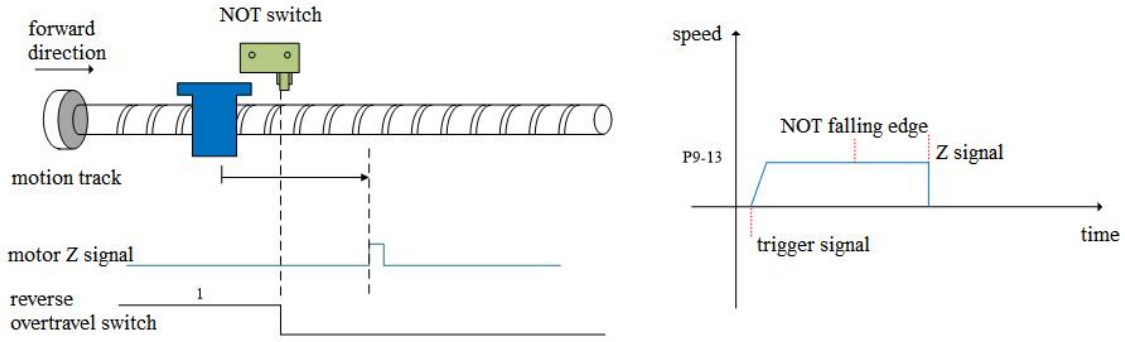
② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

Reverse deceleration (i.e., return to reverse mode): operate at low speed using-P9-13 (returning to the origin low-speed setting) to search for the NOT rising edge in reverse direction. During reverse

acceleration or constant-speed reversal, immediately stop upon encountering the NOT rising edge; after complete motor cessation, proceed with a predetermined number of pulses and direction (only forward, i.e., movement between the origin switch and POT) according to the set mechanical offset value, then drive the motor at the set speed of-P9-13 (returning to the origin low-speed setting) for a fixed distance (P9-19, P9-20), followed by motor shutdown.

③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

Continue running forward at low speed using the P9-13 setting (returning to the starting low-speed state), then stop immediately upon encountering the rising edge of the first Z signal.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

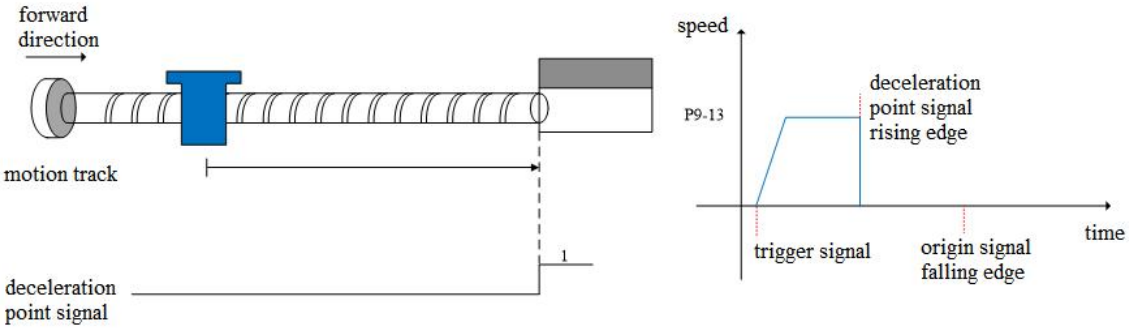
Continue forward operation at low speed set by P9-13 (returning to origin at low speed), then stop immediately upon encountering the rising edge of the first Z signal. Once the motor has completely stopped, proceed according to the preset number of pulses and direction (positive or negative, but must move between the origin switch and the POT) for a fixed distance at the speed set by P9-13 (returning to origin at low speed), after which the motor stops.

(7) Origin Return Mode 6 − Forward zero return: the deceleration point and origin correspond to the forward mechanical limit position (P9-11.2=6).

With this mode, you don't need to connect the POT, NOT, or origin switches.

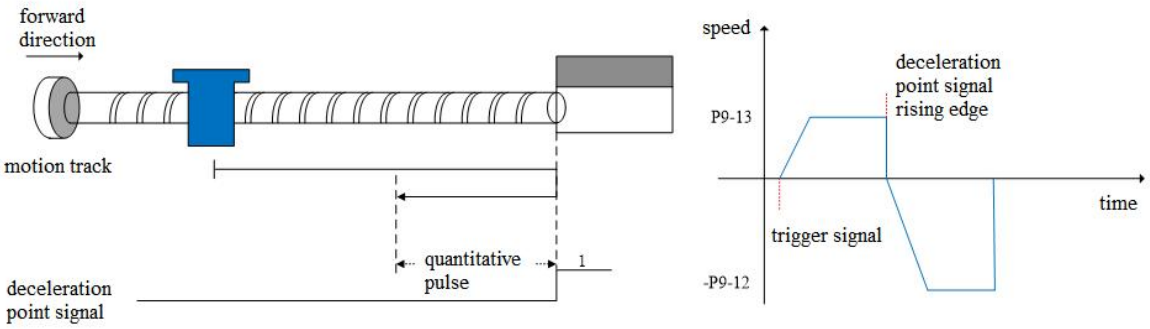
The servo motor first operates forward at low speed using the P9-13 setting (low-speed return to origin). Upon reaching the mechanical limit position, if the absolute torque value reaches the upper limit of P9-17 (stop-triggered return-to-origin torque threshold) while the absolute speed remains below the set value of P9-16 (stop-triggered return-to-origin speed threshold), and this condition persists for the duration specified by P9-18 (stop-triggered return-to-origin time threshold), the system determines that the mechanical limit position has been reached. The subsequent return-to-origin procedure proceeds according to one of four scenarios:

① If the number of Z-phases (P9-11.0) is 0 and the mechanical offset values (P9-19, P9-20) are both 0, stop immediately.



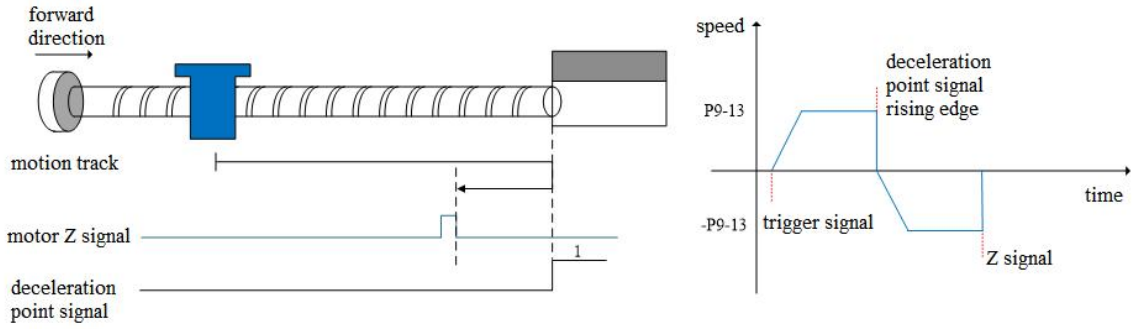
② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

The servo motor stops immediately. Once fully stationary, it moves backward for a predetermined number of pulses (P9-19 and P9-20) at the speed set by-P9-13 (low-speed return to origin), then shuts down.



③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

Perform low-speed reverse operation set to-P9-13 (low-speed return to origin), then stop immediately upon encountering the rising edge of the first Z signal.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

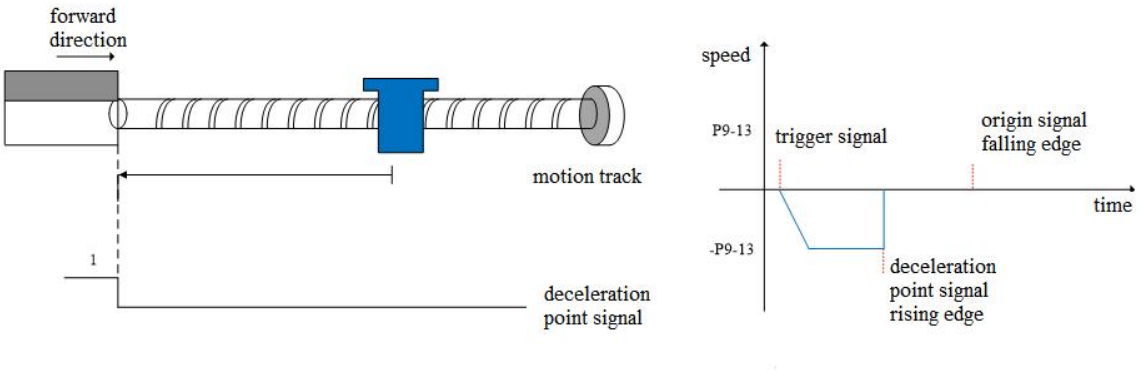
Perform low-speed reverse operation set to-P9-13 (low-speed return-to-origin speed), then stop

immediately upon encountering the rising edge of the first Z signal. After complete cessation, the motor will execute a fixed number of pulses at the speed set by-P9-13 (low-speed return-to-origin speed)—— either in forward or reverse direction, but strictly within the mechanical limit range——before stopping completely.

(8) Origin Return Mode 7 – Reverse zero return: the deceleration point and origin correspond to the reverse mechanical limit positions (P9-11.2=7)

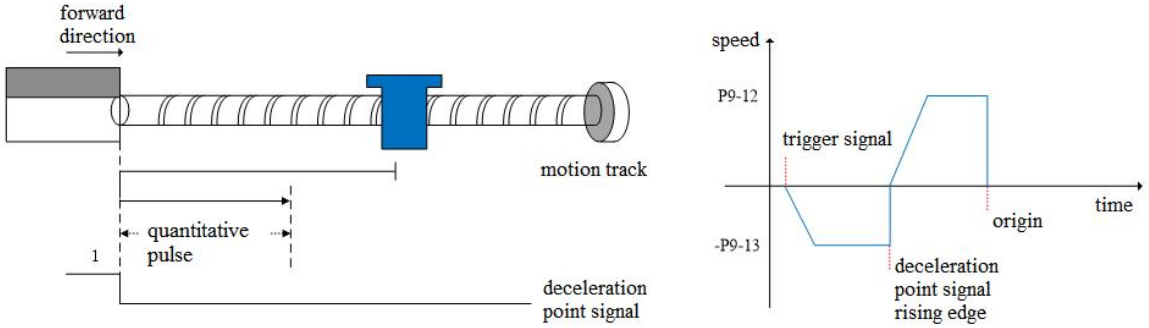
With this mode, you don't need to connect the POT, NOT, or origin switches.
The servo motor first operates in reverse at low speed using the set value P9-13 (low-speed return to origin). Upon reaching the mechanical limit position, if the absolute torque value exceeds P9-17 (stop-triggered return-to-origin torque threshold) while the absolute speed remains below P9-16 (stop-triggered return-to-origin speed threshold), and this condition persists for the duration specified by P9-18 (stop-triggered return-to-origin time threshold), the system determines that the mechanical limit position has been reached. The subsequent return-to-origin procedure proceeds according to one of four scenarios:

① If the number of Z-phases (P9-11.0) is 0 and the mechanical offset values (P9-19, P9-20) are both 0, stop immediately.



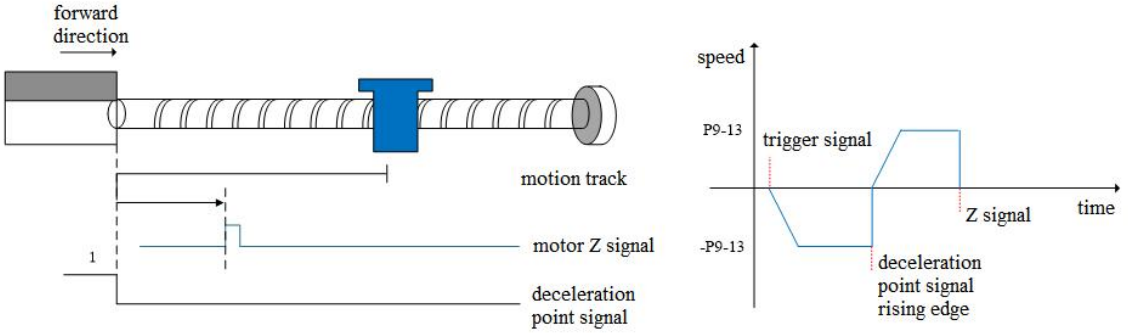
② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

The servo motor stops immediately; once fully stationary, it moves forward for a predetermined number of pulses at the speed set via P9-13 (low-speed return to origin) based on the specified mechanical offset value (P9-19 and P9-20), after which the motor shuts down.



③ The number of Z phases (P9−11.0) is 1, and the mechanical offset values (P9−19, P9−20) are 0:

Operate forward at low speed using the P9-13 setting (return-to-origin low-speed mode), then stop immediately upon encountering the rising edge of the first Z signal.



④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

Operate forward at low speed using setting P9-13 (return-to-origin low-speed speed). Upon encountering the rising edge of the first Z signal, stop immediately; once fully stopped, the motor will execute a predetermined number of pulses (P9-19 and P9-20) at the speed set by P9-13 (return-to-origin low-speed speed)—either in forward or reverse direction, but strictly within the mechanical limit range—before stopping completely.

The following applies only to Return to Origin Modes 6 and 7:

- For return-to-origin modes 6 and 7, once either of these modes is triggered, the maximum torque during the return process equals 1.1 times the set value of P9-17 (the touch-stop return-to-origin torque threshold). If both internal forward/reverse torque limits P3-28 and P3-29 are lower than 1.1 times P9-17, the torque limit shall be set to P3-28 or P3-29. Similarly, if external forward/reverse torque limits P3-30 and P3-31 are enabled, the actual torque limit shall be the minimum value among the internal torque limit, the external torque limit, and 1.1 times P9-17.
- The torque limit P9-17 (touch-stop return-to-origin torque threshold) set value multiplied by 1.1 only takes effect when both of these return-to-origin modes are activated. If only the return-to-origin function is enabled and (return-to-origin mode) P9-11.2 = 6 or 7, but the return-to-origin does not occur, the torque limit P9-17 set value multiplied by 1.1 remains inactive.

5.3.1.10 Interrupt Length

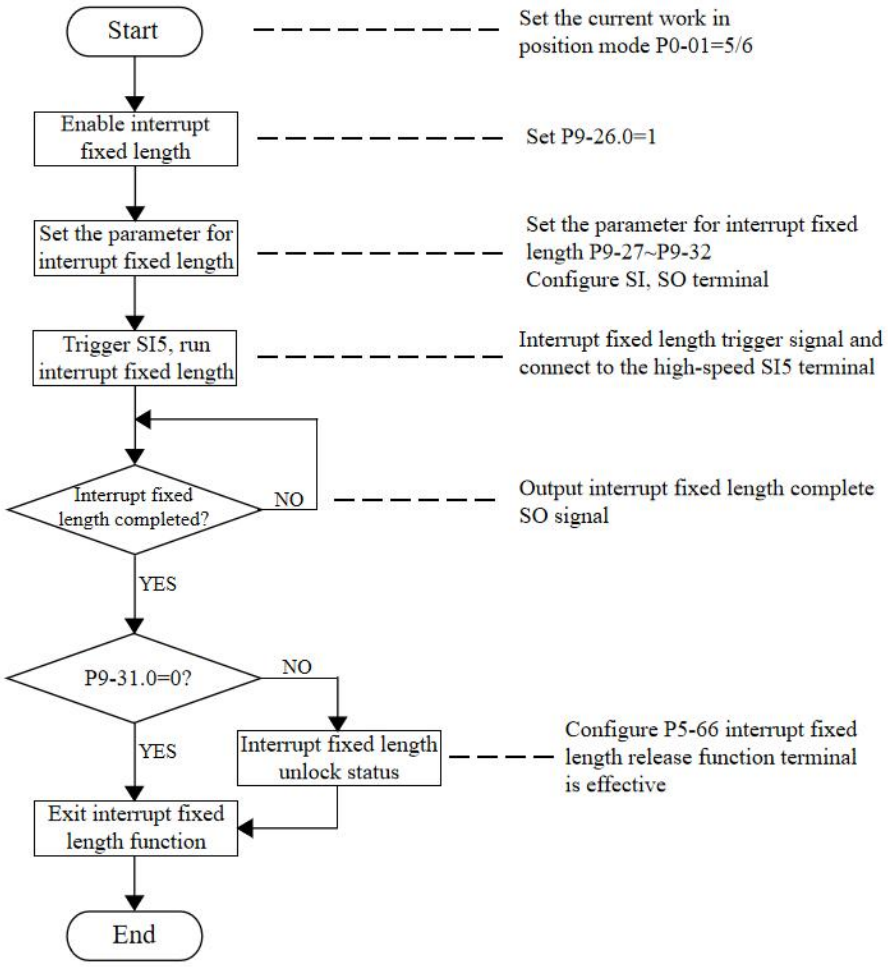
1. Functional Overview

The interrupt-based fixed-length function refers to a mechanism that, under position control modes (Mode 5 and Mode 6), interrupts the servo's current operating state and executes a pre-programmed fixed-length command. Specifically, when the servo is in the ON state during position control mode, activating this function causes the servo motor to execute the specified position command in the same rotation direction as before activation.

During interrupt-based fixed-length operation, the driver masks all other internal and external position commands (including re-triggered interrupt-based fixed-length commands). Upon completion of this operation, depending on user-defined parameter P9-31.0, the driver either maintains the masked state for position commands or resumes responding to them, but all position commands entered during the interrupt-based fixed-length operation will be discarded.

Upon completion of the interrupt-based fixed-length process, the servo driver simultaneously outputs both an interrupt completion signal and a positioning completion signal. Upon receiving the interrupt completion signal, the host computer can confirm that the process has finished.

- The fixed-length interruption function cannot be used simultaneously with the real-time modification of electronic gear ratio values.
- The origin reset function is in progress; the fixed-length interrupt trigger signal is invalid.



2. Relevant Key Parameters

Parameter	Name	Setting scope	Meaning	Setting time	Come into force time	Leave the factory Default
P9-26.0	Use of Fixed Length for Interrupts	0, 1	P9-26.0=1: Use the fixed-length interrupt function P9-26.0=0: Disables the fixed-length interrupt function	servo off	again power on	0
P9-27	Interrupt fixed-length displacement bit	0~9999	Interrupt fixed-length displacement bit	at any time	immediately	0
P9-28	Interrupt for fixed-length displace	0~32760	Interrupt for fixed-length displacement at high level	at any time	immediately	0

Parameter	Name	Setting scope	Meaning	Setting time	Come into force time	Leave the factory Default
	ment at high level					
P9-29	Maximum speed with fixed-length interruption	1~6000	The maximum speed during intermittent fixed-length operation is independent of the electronic gear ratio.	at any time	immediately	300
P9-30	Intermittent fixed-length acceleration and deceleration time	1~1000	The time it takes for the motor to accelerate uniformly from 0 rpm to 1000 rpm	√	immediately	100
P9-32	Intermittent fixed-length delay time	10~3000	When a fixed-length interrupt ends, a delay period is required for the process to complete fully. The longer this delay, the more extended the output signal will be delayed.	servo off	immediately	1000
P9-31.0	Enable the interrupt fixed-length locking release signal	0: Disabled 1: Enable	After completing the interrupt-based fixed-length measurement, if P9-31.0 = 1, the SI terminal set by P5-66 must be used to unlock the state. If P9-31.0 = 0, the interrupt-based fixed-length measurement function terminates immediately and	at any time	immediately	1

Parameter	Name	Setting scope	Meaning	Setting time	Come into force time	Leave the factory Default
			responds to other instructions.			
P9-31.1	Intermittent Constant Length Speed Selection	0: P9-29 Speed 1: Speed before fixed length	Select the speed for fixed-length operation during interruption. When P9-31.1=1: if the pre-fixed-length speed (absolute value) is less than 0.1 rpm, the servo continues operating at the speed set by P9-29; if the pre-fixed-length speed (absolute value) is greater than or equal to 0.1 rpm, the servo runs at the pre-fixed-length speed. When P9-31.1 = 0, the servo operates at the speed set by P9-29.	at any time	immediately	0

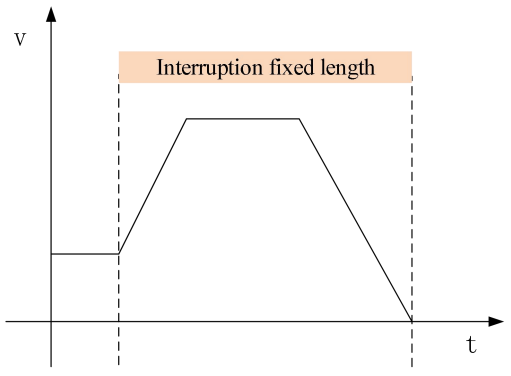
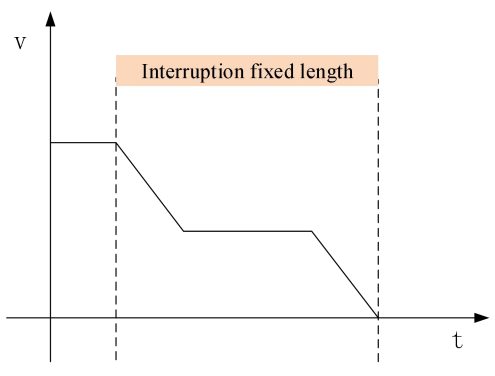
Parameter	Name	Meaning	Effectiveness Mechanism
P5-66	Unlock the fixed-length locking state after interruption	This terminal is valid only when P9-26.0 = 1, P9-31.0 = 1, and the fixed-length interrupt has been completed. Signal valid: Release the fixed-length locking state; the servo responds to other position commands. Signal invalid: Maintain fixed-length locking state; the servo does not respond to other position commands	Edge Valid
P5-67	Interrupt Fixed Length Prohibition	Signal valid: Prevents triggering the fixed-length interrupt function Invalid signal: permite triggering the fixed-length interrupt function The terminal becomes active only when the fixed-length interrupt function is enabled (P9-26.0=1).	Level valid

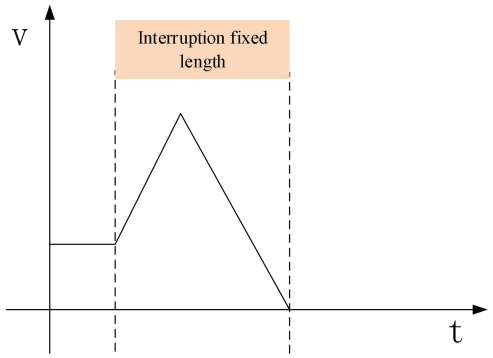
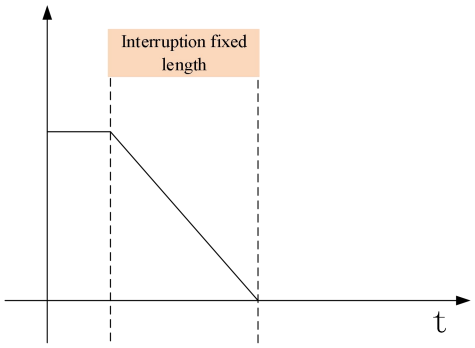
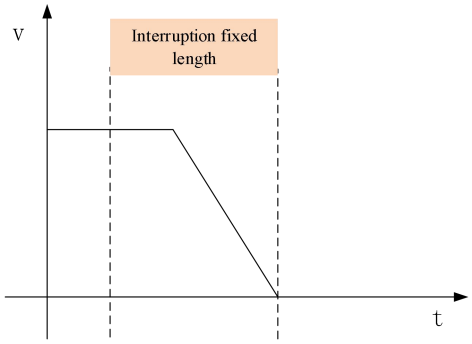
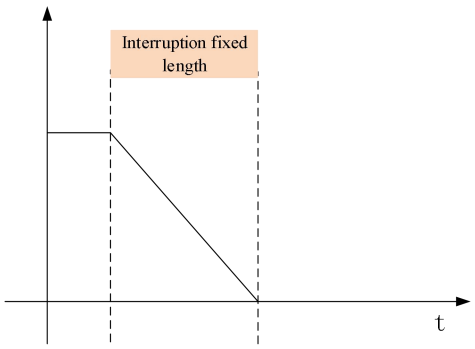
Parameter	Name	Meaning	Effectiveness Mechanism
P5-32	Pulse instruction prohibition	Signal valid: Terminate the interrupt's fixed-length execution Signal invalid: The interrupt of fixed length is operating normally This terminal is also suitable for the fixed-length interruption function.	Edge Valid
P5-55	Output of the completion signal for interrupt-based fixed-length processing	Signal valid: End of fixed-length interrupt operation (full displacement completed) Signal invalid: The fixed-length run has not finished (run incomplete or interrupted during execution)	output level

- The fixed displacement is calculated as P9-27 + P9-28 × 10,000 (instruction unit); the actual fixed displacement measured by the encoder requires multiplication by the electronic gear ratio.
- After enabling the power supply, no interrupt-based fixed-length completion signal is output. Once the fixed-length movement concludes, this signal will be triggered regardless of whether the P9-31.0 fixed-length locking release signal is enabled. Even when returning to the pre-fixed-length position mode, the interrupt-based fixed-length completion signal remains active. Its status remains unaffected when encountering an out-of-range signal during operation. If the position command that activates P5-32 is triggered during fixed-length operation, the process terminates without generating the interrupt-based fixed-length completion signal.

3. Interrupting a fixed-length trigger

The interrupt fixed-length trigger terminal must be a high-speed SI terminal. The DS5K2 connects to the SI5 terminal and uses edge-triggering (P9-26 = 1).
The fixed-length segmentation is interrupted under the following four conditions:

There is a constant-speed section where the final speed is greater than the initial speed.	There is a constant-speed section with a fixed speed <the previous fixed speed.
	

No constant-speed section; fixed-length speed> previous fixed-length speed	No constant-speed section; fixed-length speed <pre-fixed-length speed
	
There is a constant-speed section; the fixed-length velocity equals the previous fixed-length velocity.	**No constant-speed section; fixed-length velocity = initial velocity at the fixed length.**
	

5.3.2 Position Control (External Pulse Position Command)

Parameter	Essentials	Reference Chapter
P0-01 Control Method Selection	Set to 6: External Pulse Mode	5.3.2.1 External Pulse Position Mode
P0-10 Pulse Instruction Pattern	Set Pulse Shape 0: CW/CCW 1: AB 2: P+D	5.3.2.4 Selection of Pulse Instruction Format
P0-11 Set the number of pulses per motor revolution *1 P0-12 Sets the number of pulses per motor revolution * 10,000 P0-13 Electronic Gear Ratio (Molecular) P0-14 Electronic gear ratio (denominator) P0-92 ~ P0-93: A 32-bit electronic gear ratio module P0-94 ~ P0-95: A 32-bit electronic gear ratio with a denominator	Number of command pulses required for the motor to complete one full rotation Both P0-11 and P0-12 are set to zero; P0-13 and P0-14 take effect. The values for P0-11 to P0-14 are all zero, while those for P0-92 to P0-95 are valid. 32-bit gear ratio numerator: P0-92*1 + P0-93*10000 32-bit gear ratio denominator: P0-94*1 + P0-95*10000	5.3.1.1 Electronic Gear Ratio
P0-09 Pulse Instruction Settings	Each component can set the direction of low-speed pulse commands and the filtering time constant for the low-speed pulse input pin.	5.3.2.6 Selection of the Positive Direction for Pulse Instructions
P0-88 High-Speed Pulse Mode Selection Switch	0-Normal Pulse Mode 1-High-speed Pulse Mode (Long-line Drive)	5.3.2.2 Pulse Instruction Input Channel Switching
P0-89 High-speed Pulse Instruction Filtering Time	High-speed pulse input pin filtering time constant	5.3.2.6 Selection of the Positive Direction for Pulse Instructions

5.3.2.1 External Pulse Position Mode

Parameter	Set Value	Meaning	Revise	Come into force
P0-01	6	Use external pulse sequence commands for position control	servo OFF	immediately

5.3.2.2 Pulse Instruction Input Channel Switching

The DS5K2 series servo drivers have three pulse input terminals, with only one channel allowed per terminal; simultaneous use is not permitted.

- The low-speed pulse input terminals (P-/P+24/D-/D+24) accept a 24 V collector open-circuit input (with a maximum single-channel input frequency of 200 kpps).
- The differential pulse input terminals (P-/P+5/D-/D+5) accept differential 5V pulse inputs (with a maximum single-channel input frequency of 500 kpps).
- High-speed pulse input terminals (HPUL+, HPUL-, HDIR+, HDIR-) accept only differential inputs (maximum single-channel input frequency: 2 Mpps).

Parameter	Set Value	Meaning	Revise	Come into force
P0-88.0	0	High/Low Speed Pulse Command (Long Line Drive) Input Mode Switch: 0: Standard pulse command input mode; 1: High-speed pulse command input mode.	servo OFF	Power On Again

5.3.2.3 Pulse Input Specifications

Pulse Specifications		Maximum Input Frequency	Voltage Specification	Forward Current
Low-speed pulse	Differential Signal	500Kpps	3.3~5V	<25mA
	The collector is open-circuited.	200Kpps	24V	<25mA
High-speed pulse	Differential Signal	2Mpps	3.3~5V	<25mA

5.3.2.4 Selection of Pulse Instruction Format

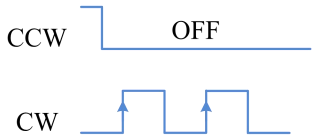
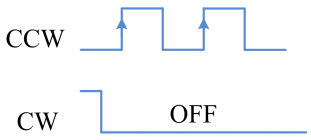
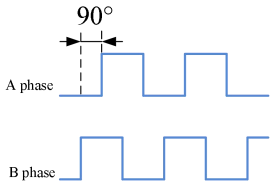
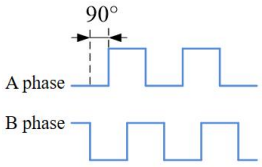
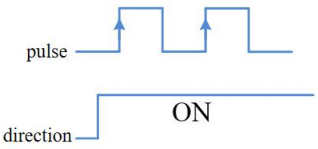
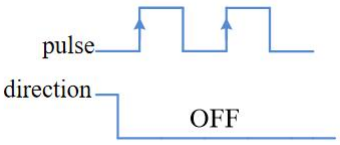
Set the pulse waveform received by the servo driver according to the host computer or other pulse output devices:

- Dual pulses (CW + CCW);
- Orthogonal pulses of Phase A and Phase B, with a 4-fold frequency;
- Pulse + Direction (positive logic or negative logic).

Parameter	Meaning	Setting	Meaning	Revise	Come into force
P0-10 n.xxx□	Pulse Instruction Format	0	CW、CCW	servo OFF	immediately
		1	AB Xiang		
		2	Pulse + Direction (Default)		
P0-10	Effective	0	Downside effect is enabled (default)	servo	immediately

Parameter	Meaning	Setting	Meaning	Revise	Come into force
n.xx□x	edge of the pulse signal	1	Valid rising edge	OFF	

5.3.2.5 Logical Form of Command Pulses

P0-10.0	Corotation	Reversal
0：CW/CCW		
1：AB		
2：P+D		

5.3.2.6 Selection of the Positive Direction for Pulse Instructions

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-09.0 n.xxx□	Pulse instruction positive direction	0	-	0/1	servo OFF	Power On Again
The P0-09 parameter changes the counting direction of the servo's internal counter, which determines the motor's rotation direction. Therefore, in position mode, this parameter can be adjusted if the motor's actual rotation direction differs from the desired one.						

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-09.2 n.x□xx	Low-speed Pulse Instruction Filtering Configuration	3	4.167ns	0~4	servo OFF	Power On Again
P0-09.2=0: Turn off the noise filter; P0-09.2=1~4: Enable the noise filter to remove pulses with pulse width less than 3 × 4^(n−1)/100 [μs].						

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-89	High-Speed Pulse Instruction Filtering Configuration	2	41.67ns	0~4	servo OFF	immediately

5.3.3 Position Control (Internal Position Command)

Parameter	Essentials	Reference Chapter
P0-01 Control Method Selection	Set to 5: Internal Position Mode	5.3.3.1 Internal Position Pattern
P4-03 Internal Position Given Mode P4-04 Number of valid segments P4-10~P4-254: Internal position parameter settings for paragraphs 1 to 35	The control parameters for the internal positioning mode are specified, including step change method, positioning method, and adjustment time. Configuration of pulse displacement, velocity, acceleration/deceleration time, etc., for each section	5.3.3.3 Parameter settings for paragraphs 1 to 35
P5-35 Step-change Signal/GHGSTP	Common Terminal Function	5.3.3.4 Step-change Signal

Parameter	Essentials	Reference Chapter
P5-32 Pause the current segment signal/INHIBIT P5-31 Skip current section number / Z-CLAMP	Allocation	(/CHGSTP) 5.3.1.4 Instruction Pulse Inhibition (/INHIBIT) 5.3.3.5 Skip the current segment signal (/ZCLAMP)
P4-00.0 Number of Z-phase signals after passing the departure limit switch P4-00.3 Restore the encoder zero position to its original automatic calibration setting P4-01 Speed of Impact on the Proximity Sensor P4-02 Speed of Departure from the Proximity Sensor P5-28: In position mode, rotate forward to locate the reference origin/SPD-A P5-29: Find the reference origin on the reversal side in position mode / SPD-B	Internal Position Return to Origin Settings Parameters	5.3.1.8 Reference Origin
Any setting for position F2-09 35	Number of Communication Settings Sections	5.3.3.6 Communication Setting Segment Number

5.3.3.1 Internal Position Pattern

Parameter	Set Value	Meaning	Revise	Come into force
P0-01	5	Use preset values in the servo unit's internal registers for position control.	servo OFF	immediately

5.3.3.2 Internal Position Pattern Settings

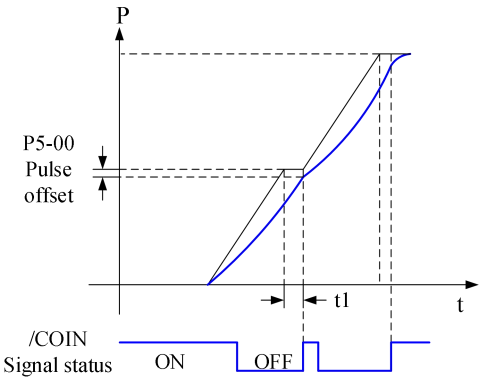
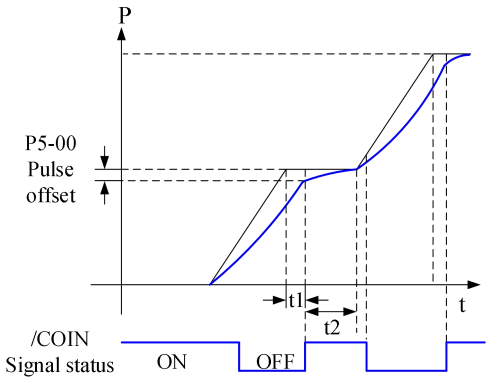
Parameter	Parameter Functions	Set Unit	Factory Settings	Applicable Mode	Revise	Come into force
P4-03	Internal Location Mode Settings	-	n.0000	5	servo bb	immediately
	Parameter Setting	Functionality Overview	Factory Settings	Set Range		
	n.□xxx	insignificance				
	n.x□xx	Waiting Mode	0	0 ~ 1		
	n.xx☑x	Step Change Mode	0	0 ~ 6		

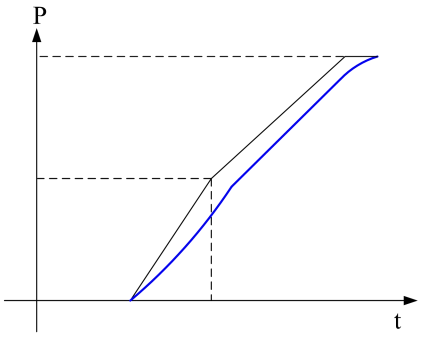
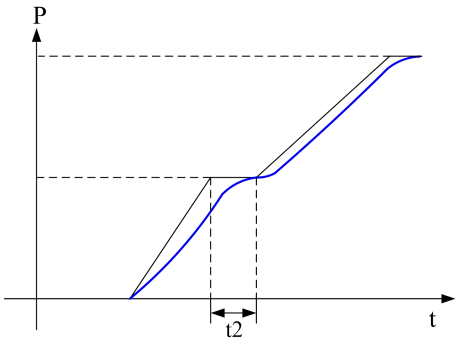
	n.xxx□	positioning mode	0	0 ~ 2

1. Wait Mode

n.x□xx	Meaning
0	Waiting for the process to complete
1	Do not wait for positioning to complete

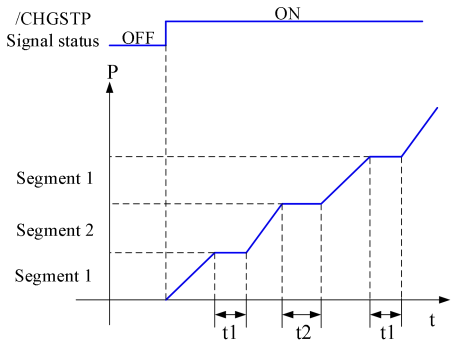
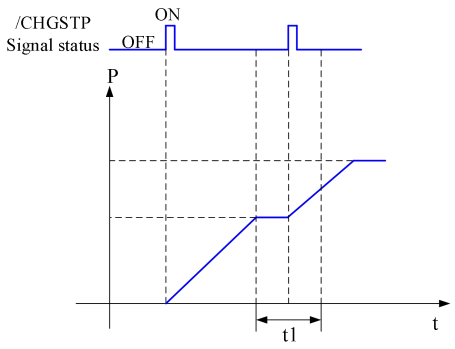
Note: Wait mode determines whether to wait for motor positioning completion after sending a position command to the drive when the internal position is set. This mode applies in all step-change modes.

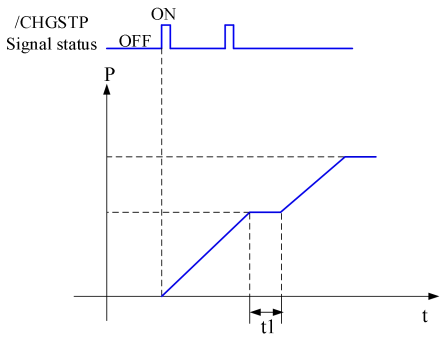
Waiting Mode = 0, Adjustment Time = 0 ms	Waiting Mode = 0, Adjustment Time> 0 ms
	
After sending a position command, the driver waits until the motor completes positioning before immediately initiating the next position command. In the diagram, t1 represents the positioning time—the interval between pulse transmission and the output of the positioning completion signal.	After issuing a position command, the driver waits for the motor to complete positioning before initiating the next command after a "adjustment period." In the diagram, t1 denotes the positioning time and t2 the adjustment time; in this example, these correspond to parameter P4-16.

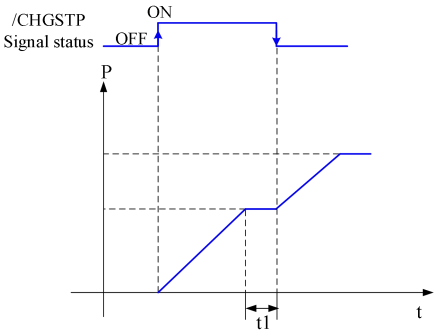
Waiting Mode = 1, Adjustment Time = 0 ms	Waiting Mode = 1, Adjustment Time> 0 ms
	
After sending a position command, the driver immediately proceeds to the next command without waiting for the motor to complete positioning.	After issuing a position command, the driver does not wait for the motor to complete positioning but only starts the next position command after the adjustment period. In the

	figure, t2 represents the adjustment time, which corresponds to parameter P4-16 in this example.

2. Step Change Mode

n.xx□x	Define	
0 Switch steps when Signal ON is active; can cycle.		In the figure, t1 = P4−16 and t2 = P4−23. 1. If the CHGSTP signal remains ON, the servo unit will continuously cycle through the preset position segments. 2. If the CHGSTP signal is set to OFF during a specific segment, the servo will continue executing that segment without proceeding to the next one. 3. In this mode, the step-change signal/CHGSTP is triggered by a high level. 4. During operation, if servo enable is turned off, the motor will shut down according to the servo OFF shutdown procedure; after shutdown completion, positioning is invalid. 5. After each segment is completed, both the positioning completion and positioning proximity signals remain valid. 6. In this mode, the adjustment time for each section is valid.
1 Signal rising edge step-change, executed in single steps;		Taking the two-stage setup as an example, t1 = P4-16 in the figure. 1. As shown in the figure, under this step-change mode, the preset adjustment time is ineffective; once the previous sequence of position commands has been executed, the system immediately proceeds to the next command upon receiving a new step-change signal. 2. In this mode, the step-change signal/CHGSTP is triggered by its rising edge.

<table>
<tr><th>n.xx□x</th><th colspan="2">Define</th></tr>
<tr><td></td><td></td><td>3. After each segment runs, all positioning completion and near-positioning signals remain valid.
4. During operation, if servo enable is turned off, the motor will shut down according to the servo OFF shutdown procedure; after shutdown completion, positioning is invalid.
5. Adjustments made in this mode are invalid.</td></tr>
<tr><td>2
The signal rising edge initiates execution of all steps sequentially without looping.</td><td> 
</td><td>Set two bit positions; in the diagram, t1 = P4-16.
1. The /CHGSTP signal before a complete cycle is not counted, as shown in the second /CHGSTP signal in the figure.
2. In this mode, the step-change signal/CHGSTP is triggered by its rising edge.
3. After each segment runs, all positioning completion and near-positioning signals remain valid.
4. During operation, if servo enable is turned off, the motor will shut down according to the servo OFF shutdown procedure; after shutdown completion, positioning is invalid.
5. Time adjustments are effective in this mode.</td></tr>
<tr><td>3
Communication Setting Number</td><td colspan="2">When the drive is in RUN mode, set F2-09 to 0 and specify the operating section number for the motor to execute. Refer to Chapter 5.3.3.6.</td></tr>
</table>

<table>
<tr><th>n.xx□x</th><th colspan="2">Define</th></tr>
<tr><td>4
/CHGSTP
Bilateral Edge
Trigger</td><td> 
</td><td>In the figure, t1 = P4-16.
1. The rising edge of /CHGSTP triggers the first segment, while the falling edge triggers the second segment. To ensure complete operation of the first segment, the /CHGSTP signal remains ON until its end.
2. Only in this mode, the valid segment count of P4-04 is invalid.
3. After each segment runs, all positioning completion and near-positioning signals remain valid.
4. During operation, if servo enable is turned off, the motor will shut down according to the servo OFF shutdown procedure; after shutdown completion, positioning is invalid.
5. Adjustments made in this mode are invalid.
6. Before using this step-switching mode, the P5-35 terminals must be properly assigned; step-switching terminals cannot be assigned during operation of this mode.</td></tr>
<tr><td>5
/PREFA
(P5-57)、
/PREFB
(P5-58) and
/PREFC
(P5-59) are
terminal
selection
section
numbers,
selectable
from sections
1 to 3.</td><td colspan="2"><table>
<tr><th>/PREFC</th><th>/PREFB</th><th>/PREFA</th><th>Segment Number</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>not have</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1 (First paragraph position)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>2 (second paragraph)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>3 (third paragraph position)</td></tr>
</table>
1. After each run, all positioning completion and near-positioning signals remain valid.
2. During operation, if servo enable is turned off, the motor will shut down according to the servo-off shutdown procedure; after shutdown completion, the positioning status becomes invalid.
3. Time adjustments are effective in this mode.
4. The /CHGSTP step-change signal is invalid only in this mode.
5. The section number selection terminal can either trigger step switching upon edge detection or remain ON. This mode supports continuous repetition of a specific section. If the terminal remains ON, the motor will stop upon receiving an overtravel signal; in this case, the terminal must be switched to OFF. Otherwise, the motor will execute the target section even after the overtravel signal is cleared.</td></tr>
</table>

<table>
<tr><th>n.xx□x</th><th>Define</th></tr>
<tr><td>6
/PREFA
(P5-57)、
/PREFB
(P5-58)、
/PREFC
(P5-59)、
/P PREFD
(P5-60):
Select a terminal section number from 1 to 16</td><td>
<table>
<tr><th>/PREFD</th><th>/PREFC</th><th>/PREFB</th><th>/PREFA</th><th>Segment Number</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1 (First paragraph position)</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>2 (second paragraph)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>3 (third paragraph position)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>4 (position in the fourth paragraph)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>5 (at the fifth paragraph)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>6 (at the sixth paragraph)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>7 (Position in Paragraph 7)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>8 (Position in Paragraph 8)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>9 (position in the ninth paragraph)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>10 (Position in Paragraph 10)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>11 (at paragraph 11)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>12 (at paragraph 12)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>13 (at paragraph 13)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>14 (at paragraph 14)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>15 (at paragraph 15)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>16 (at paragraph 16)</td></tr>
</table>
1. During operation, if servo enable is turned off, the motor will shut down according to the servo-off shutdown procedure; after shutdown completion, the positioning status becomes invalid.
2. Adjustments made in this mode are invalid.
3. After each segment runs, all positioning completion and near-positioning signals remain valid.
4. After selecting the section number, the position section can only be activated when triggered by the rising edge of the P5-35/CHGSTP step-change signal; triggering during section operation is invalid.
5. The terminal logic for section number selection is level-sensitive: high input levels are valid, while low input levels are invalid.

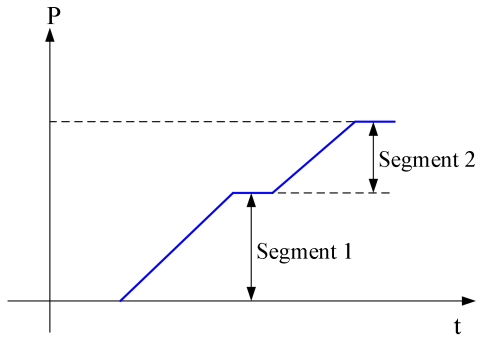
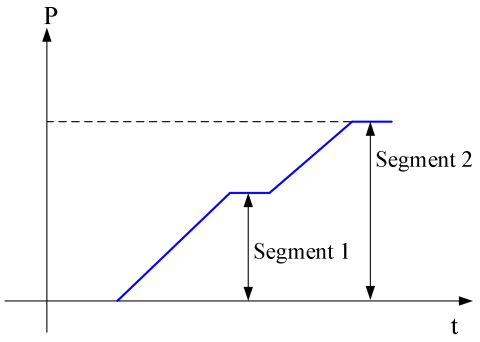
Note: The rising edge of the P5-35 step-change signal triggers each position segment (the rising edge is invalid during operation).
</td></tr>
</table>

Use the following input signals to switch between internal positions 1−3 and 1−16.

Parameter	Signal Name	Leave the factory setting	Suit pattern	Set Range	Revise	Come into force
P5-57	Internal Position – First Segment Selection/PREFA	n.0000	5	Parameter range: 0000–001A, assigned to other input interfaces via parameters P5–57	at any time	immediately
P5-58	Internal Position – Second Section Selection/PREFB	n.0000	5	Parameter range: 0000–001A, assigned to other input interfaces via parameters P5–58		
P5-59	Internal Position – Third Section Selection/PREFC	n.0000	5	Parameter range: 0000–001A, assigned to other input interfaces via parameters P5–59		
P5-60	Internal Position – Third Section Selection/PREFD	n.0000	5	Parameter range: 0000–001A, assigned to other input interfaces via parameters P5–60		

3. Positioning Mode

n.xxx□	Meaning
0	relative localization
1	Absolute Positioning (Disables Maintenance)
2	Absolute Positioning (Disabling Maintenance)
0: Relative Positioning	1/2: Absolute Positioning Using the reference origin as the absolute zero point

n.xxx□	Meaning
	

5.3.3.3 Parameter settings for paragraphs 1 to 35

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P4-10+（n-1）*7	Pulse Count (Low Bit)	0	1 Pulse	-9999 ~ 9999	at any time	immediately
P4-11+（n-1）*7	Pulse Count (High Bit)	0	10,000 pulses	-32767 ~ 32767	at any time	immediately
P4-12+（n-1）*7	speed	0	0.1rpm	0 ~ 65535	at any time	immediately
P4-13+（n-1）*7	Trapezoidal acceleration time	0	ms	0 ~ 65535	at any time	immediately
P4-14+（n-1）*7	Trapezoidal deceleration time	0	ms	0 ~ 65535	at any time	immediately
P4-15+（n-1）*7	retention parameter	-				
P4-16+（n-1）*7	adjust the time	0	ms	0 ~ 65535	at any time	immediately

Explain ：

① Set pulse count = (high-order bit value × 10,000) + (low-order bit value); the number of pulses per revolution is determined by the electronic gear ratio or per-turn pulse count parameter.

② In the formula P4-10+ (n−1) * 7, n represents the segment number of the internal location, ranging from 1 to 35; parameters for segments 1−12 can be configured via the panel, while those for segments 13−35 require writing through communication (RS232 or RS485).

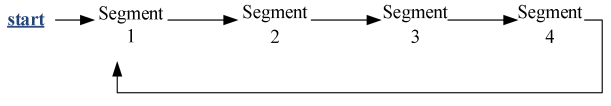
Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
③ If the speed of any section is set to zero, it will be skipped during execution and the next section will be processed. ④ In relative positioning mode, if the speed setting for a segment is non-zero but the pulse count is set to zero, the motor in that segment will not operate during execution; however, its designated waiting mode remains active, meaning it must wait until the adjustment period ends before proceeding to the next segment. ⑤ In absolute positioning mode, if the speed setting for a specific section is non-zero but the pulse count is set to zero, the motor will return to the reference origin at that section's preset speed when executing it. ⑥ In absolute positioning mode, if the speed settings for two consecutive segments are both non-zero and the pulse count settings are identical, the motor in the latter segment will not operate, but the designated waiting mode for that segment remains active.						

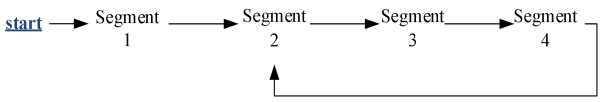
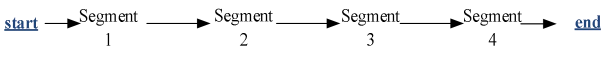
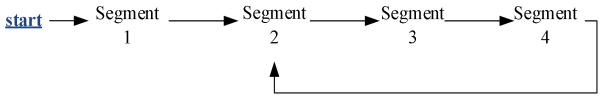
Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P4-04	Number of valid segments	0	-	0 ~ 35	servo bb	immediately

There are 35 internal positions in total. If process requirements require switching between operating 10 positions and 5 positions, you can configure the valid position count. For example, if all positions 1−10 have parameters set, set P4−04 to 5 to enable positions 1−5; set it to 10 to enable positions 1−10.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P4-08	Internal Location Pattern Starting Segment Number	1	-	0 ~ 35	servo bb	immediately

P4-08 sets the starting run segment number after the first round; only Step Change Mode P4-03.1 uses values 0 or 1. The following Explains the settings: valid values are configured for segments No.1 through No.8.

Step Change Mode	Set Up	Parameter Setting	Specific Phenomenon
P4-03.1=0	P4-08=0 or P4-08>P4-04	P4-08=8 P4-04=4	

Step Change Mode	Set Up	Parameter Setting	Specific Phenomenon
	1 ≤ P4-08 ≤ P4-04	P4-08=2 P4-04=4	
P4-03.1=1	P4-08=0 or P4-08>P4-04	P4-08=8 P4-04=4	
	1 ≤ P4-08 ≤ P4-04	P4-08=2 P4-04=4	

5.3.3.4 Step-change Signal (/CHGSTP)

Parameter	Signal Name	Setting	Meaning	Modification Scope
P5-35	Step Change Signal/CHGSTP	n.0000	Default Unassigned Terminal Input Refer to 5.4.2 for the application of step change signals in the step change mode table.	The parameter range is 0000－001A, assigned to the input interface via parameters P5－35. Setting it to 0001 indicates signal input from terminal SI1.

5.3.3.5 Skip the current segment signal (/ZCLAMP)

Parameter	Signal Name	Setting	Meaning	Modification Scope
P5-31	Skip current section / Z-CLAMP	n.0000	Default Unassigned Terminal Input	The parameter range is 0000−001A, assigned to the input interface via parameters P5−31. Setting it to 0001 indicates signal input from terminal SI1.

Under different step-switching modes, skipping the current segment produces different effects, as shown below:

Step Change Mode P4-03 n.xx□x	Skip the current section	Execution Action
0	/Z-CLAMP	Cancel the current section and proceed to the next one immediately
1		Cancel the current section and proceed to the next section when starting the transition signal

Step Change Mode P4-03 n.xx□x	Skip the current section	Execution Action
2		Cancel the current section and proceed to the next one immediately
3		Current section canceled; F2-09 redefined

When using the skip current segment function, the SI terminal assigned to P5-31 requires a rising edge for triggering.

5.3.3.6 Communication Setting Segment Number

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
F2-09	Communication Setting Number	0	-	0 ~ 35	at any time	immediately
Set this parameter to a specific paragraph number to execute that section without requiring a step change signal. The parameter can be modified via communication. Recommendation: After modifying F2-09, the value will reset automatically; simply assign a value directly. To ensure data integrity and prevent conflicts between the cache and the current segment, use the rising edge for communication to avoid multiple cache writes.						

5.3.3.7 Movement Start Signal (/MRUN)

Parameter	Signal Name	Factory Settings	Meaning	Revise
P5-50	Exercise Start/MRUN	n.0000	Default unallocated terminal output. Valid only in internal position mode, similar to the positioning completion signal in external pulse mode; generates output when the motor is running and no output when the motor stops.	The parameter range is 0000－0018, allocated to the output interface via parameters P5－50. Setting it to 0001 outputs a signal from terminal SO1.

5.3.3.8 IO Point Movement Function

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-18	Click Speed	100	RPM	0 ~ 1000	servo bb	immediately
P5-72	/JOG-P	0	-	0~ff	at any	immediately

					time	
P5-73	/JOG-N	0	-	0~ff	at any time	immediately

In internal position mode, when the speed is set to 0, the input SI signal can be used to control jogging operation/JOG-P (P5-72) or/JOG-N (P5-73), where the JOG-P terminal indicates positive direction and the JOG-N terminal indicates negative direction; the jogging speed is set to P3-18.

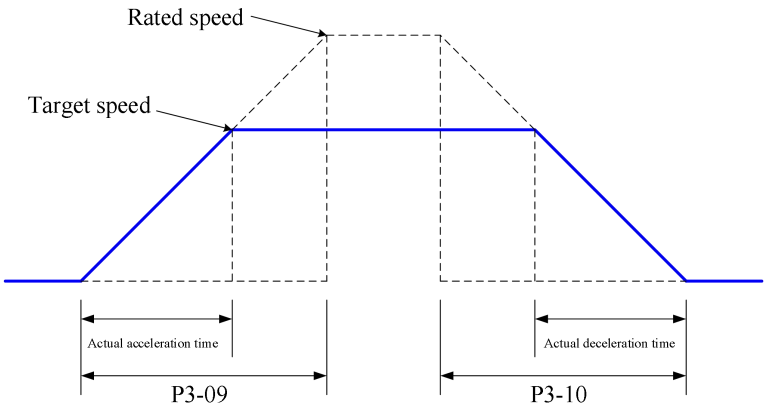
5.4 Speed Control

5.4.1 General Control for Speed Modes

5.4.1.1 Soft Start

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-09	Soft start acceleration time	200	ms	0 ~ 65535	servo bb	immediately
P3-10	Soft-start deceleration time	200	ms	0 ~ 65535	servo bb	immediately

Soft start acceleration/deceleration times apply to modes 3, 4, and 7; smooth speed control is available when a step-speed command is entered or an internal set speed is selected.
P3-09: Time required to operate from the stopped state to the rated speed;
P3-10: Time from operating at rated speed to stopping.



5.4.1.2 Zero Clamping Function (/ZCLAMP)

1. Functional Overview

This advanced function uses a "speed command" input and is applicable in systems without a "position loop" configuration. It must stop the motor when the speed command is non-zero and is intended for use when the servo is locked.
When the "Zero Clamping" function is set to "ON", it temporarily configures a position loop internally, causing the motor to clamp within ±1 pulses at that position. Even when rotated under external force, the motor will return to the zero-clamped position.
When using zero clamping, the current speed must be below the zero-clamping threshold for the function to activate, securing the motor shaft in place. Upon enabling zero-clamping, the motor switches from speed mode to position mode; rotating the shaft and releasing it will restore it to its original position,

whereas in speed mode rotation does not return the shaft to its initial position due to the absence of position feedback.

2. Input Signal Settings

Parameter	Signal Name	Setting	Meaning	Modification Scope
P5-31	Zero Clamping / ZCLAMP	n.0000 (Default)	Default: No output terminals assigned	Parameter range: 0001–001A The parameter P5-31 can be assigned to other input terminals.
		n.0002	Enter the signal using the SI2 terminal	

3. Setting of Relevant Parameters

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-13	Zero clamping speed	10	rpm	0 ~ 300	servo bb	immediately
P3-12	Zero Clamping Mode	0	-	0 ~ 4	servo bb	immediately

Settings for P3-12	Content
0	When the ZCLAMP input signal is ON, the forced speed command is set to 0. Once the actual speed drops below P3-13, the system switches to position mode control and locks the position servo.
1	When the ZCLAMP input signal is ON, the speed command is forcibly set to 0.
2	When the ZCLAMP input signal is set to ON and the feedback speed falls below P3-13, the system switches to position mode control and enters position servo lock. Note: Once zero-clamping mode is activated, the motor will not operate even at speeds exceeding those specified for the P3-13 motor. The mode can only be exited and operation resumed when the ZCLAMP input signal is set to OFF.
3	When the ZCLAMP input signal is ON and the set speed falls below P3-13, the system switches to position mode control and locks the motor at that position. If the set speed exceeds P3-13, the motor resumes operation.
4	Automatic zero-clamping mode: When the speed command is <0.8 rpm and the speed feedback falls below the zero-clamping speed P3-13, the control mode automatically switches to position mode, the position command is set to 0, and zero-clamping begins. Note: Starting with version 4230, automatic zero-clamping mode is supported.

5.4.1.3 Speed arrival signal (/V-RDY)

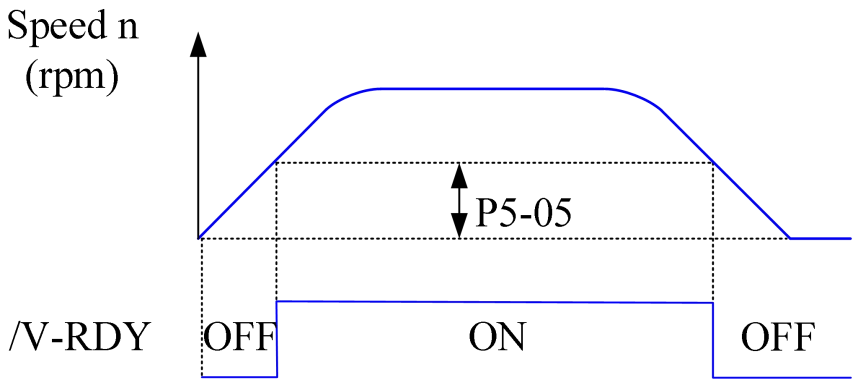
- relevant parameter

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-51	Speed Ratio / V-RDY	n.0000	3、4、7	Speed Arrival Signal	at any time	immediately

Parameter	Signal Name	Factory Settings	Unit	Set Range	Revise	Come into force
P5-05	Detection speed reached	1000	rpm	0 ~ 10000	at any time	immediately

1. Speed reaches the signal output condition

When the actual motor speed exceeds the detection threshold specified in P5-05, the output speed reaches the signal (/V-RDY).

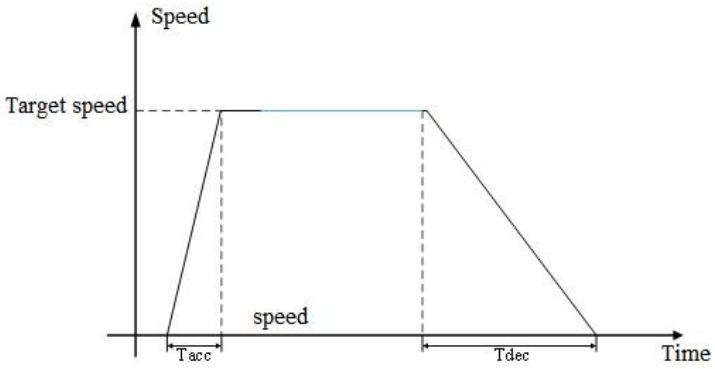


5.4.1.4 Speed Command Filter

- relevant parameter

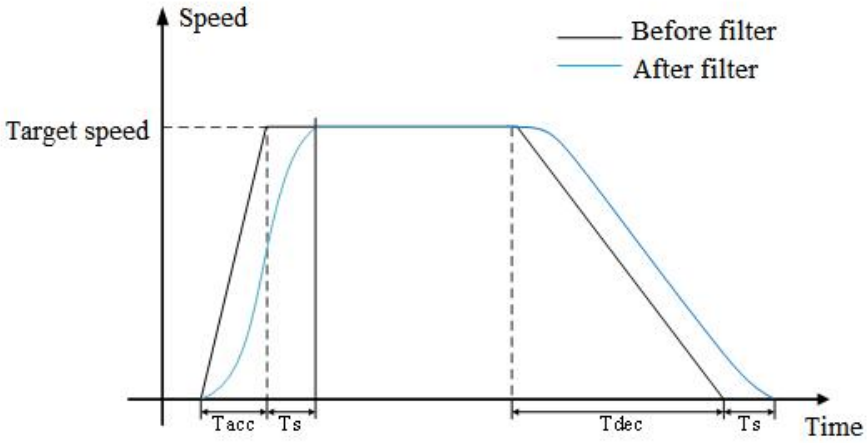
Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P1-23	Speed Command Filter Time Constant	0	0.1ms	0 ~ 65535	servo bb	immediately
P3-09	acceleration time	200	1ms	0 ~ 65535	servo bb	immediately
P3-10	deceleration time	200	1ms	0 ~ 65535	servo bb	immediately
P3-11	Sliding Average Filtering Time Constant	0	0.1ms	0 ~ 65535	servo bb	immediately

First, set P3-09 and P3-10. Then plan the acceleration and deceleration times for the speed command.



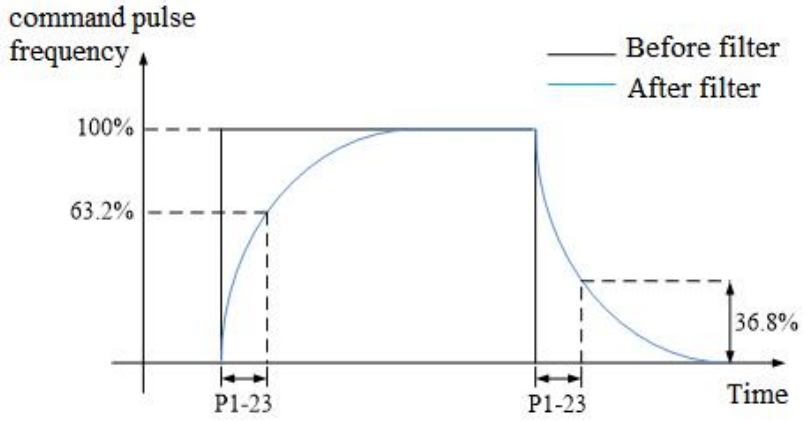
Where the acceleration time Tacc = (target speed / rated speed) × P3-09 [ms], and the deceleration time Tdec = (target speed / rated speed) × P3-10 [ms].

Set the appropriate moving average filter time constant P3-11 (S-type acceleration/deceleration time constant): Ts = P3-11 × 0.1 [ms].



The sliding average filter time constant must meet the requirements: Ts <0.5*Tacc and Ts <0.5*Tdec. Otherwise, an excessively large filtering time will result in excessive deceleration periods, violating the specifications in P3-09 and P3-10.

When P3-09 and P3-10 are set to 0, setting the moving average filtering time converts the speed command into a trapezoidal acceleration/deceleration command. Setting P1-23 (speed command filtering time constant) and P1-24 (first-order low-pass filter time constant) produces the following effects:



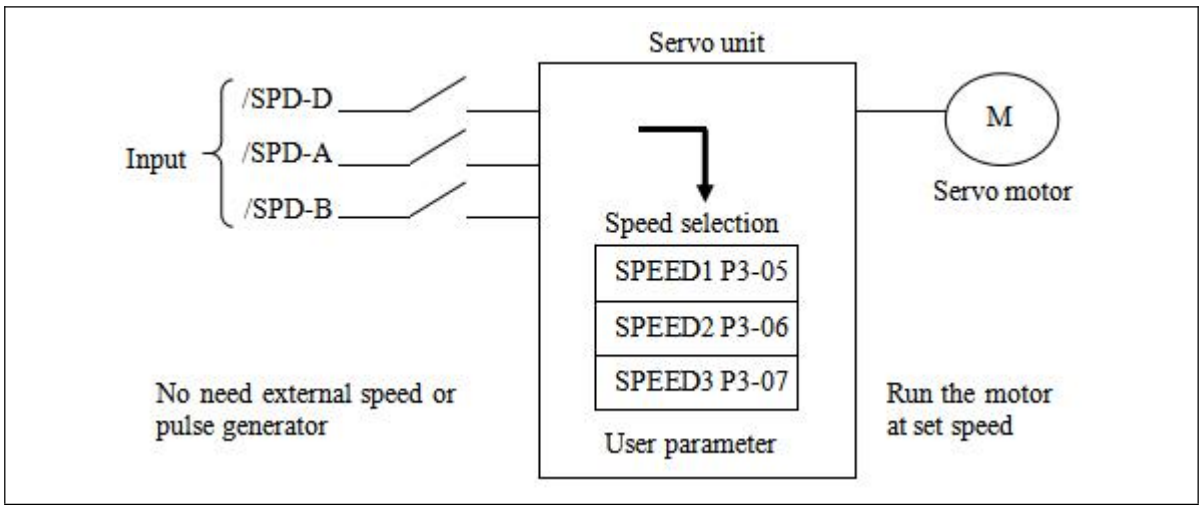
When acceleration and deceleration are set, a first-order low-pass filter increases the delay of the speed command.

5.4.2 Speed Control (Internal Set Speed)

Parameter	Essentials	Reference Chapter
P0-01 Control Method Selection	Set to 3: Internal Speed Control Mode	5.4.2.1 Internal Speed Mode
P3-05 Internal Set Speed 1 P3-06 Internal Set Speed 2 P3-07 Internal Set Speed 3	Speed value setting for the internal 3-speed stage, in rpm	5.4.2.1 Internal Speed Mode
P5-28 Internal Speed Selection/SPD-A P5-29 Internal Speed Selection/SPD-B	The combination of terminals determines the corresponding section speed.	5.4.2.1 Internal Speed Mode
P5-27 Internal Speed Direction Selection/SPD-D	Switch direction; default is n.0000. By applying a commutation signal via terminal SI2, P5-27 can be set to n.0002.	5.4.2.1 Internal Speed Mode
P3-09 Soft-start acceleration time P3-10 Soft-start deceleration time	Set acceleration and deceleration times in ms	5.4.1.1 Soft Start

5.4.2.1 Internal Speed Mode

Parameter	Set Value	Meaning	Revise	Come into force
P0-01	3	Speed Control: Internal Speed Selection	servo bb	immediately
Function Overview: The internal speed selection feature allows users to pre-set three motor speeds via user parameters within the servo unit and select the desired speed using external input signals for precise speed control operation, eliminating the need for external speed generators or pulse generators.				



- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-05	Internal Set Speed 1	0	rpm	-9999 ~ +9999	at any time	immediately
P3-06	Internal Set Speed 2	0	rpm	-9999 ~ +9999	at any time	immediately
P3-07	Internal Set Speed 3	0	rpm	-9999 ~ +9999	at any time	immediately

Parameter	Signal Name	Factory Settings	Set Range	Revise	Come into force
P5-27	Internal Direction Selection/SPD-D	n.0000	Parameter range 0000 – 001A, assigned to other input interfaces via parameters P5–27.	at any time	immediately
P5-28	Internal Speed Selection/SPD-A	n.0000	Parameter range 0000 – 001A, allocated to other input interfaces via parameters P5–28.		
P5-29	Internal Speed Selection/SPD-B	n.0000	Parameter range 0000 – 001A, assigned to other input interfaces via parameters P5–29.		

1. The relationship between operating speed and terminal signals

Incoming signal			Running speed
/SPD-D (P5-27)	/SPD-A (P5-28)	/SPD-B (P5-29)	
0 <Forward>	0	0	Internal Instruction: 0 Speed
	0	1	P3-05: SPEED1
	1	1	P3-06: SPEED2
	1	0	P3-07: SPEED3
1 <Reversal>	0	0	Internal Instruction: 0 Speed
	0	1	P3-05: SPEED1
	1	1	P3-06: SPEED2
	1	0	P3-07: SPEED3

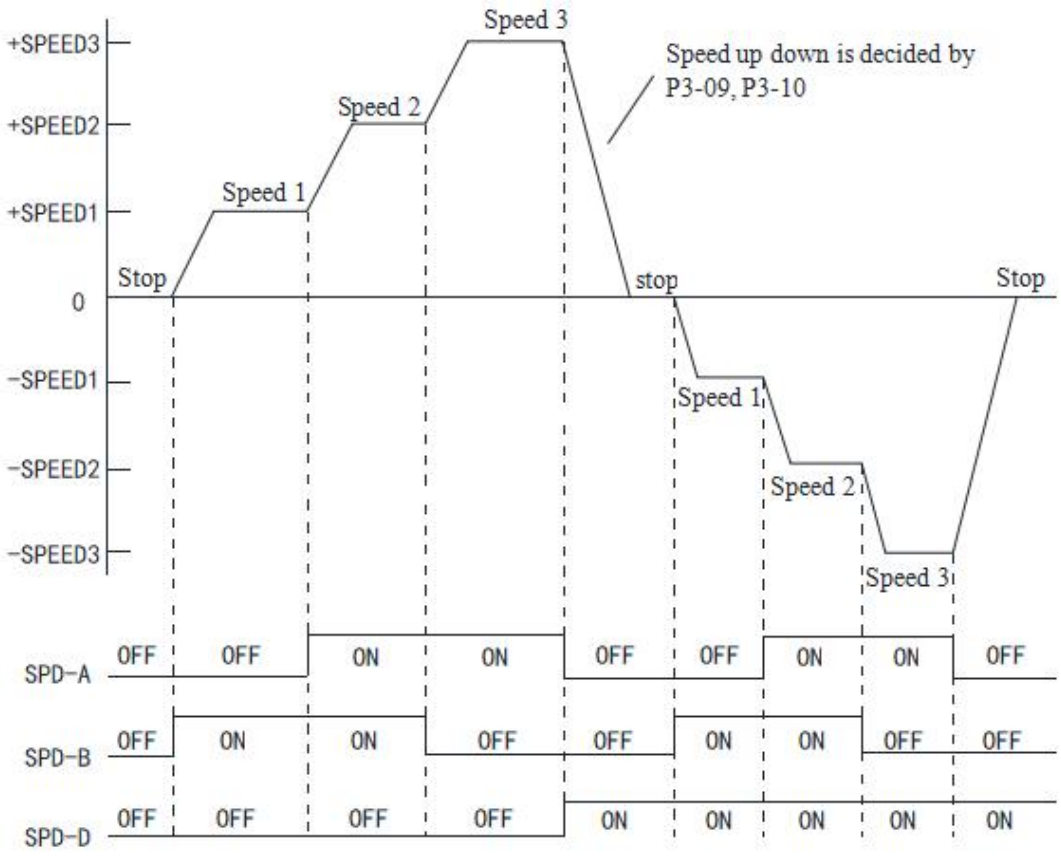
- The SPD-D signal controls direction; the input SI terminal can be changed according to P5-27. The validity of the terminal signal determines the motor direction.
- The combination of the validity status of the SPD-A and SPD-B input terminals determines the speed settings for each section.
- In the table above, 0/1 indicates signal validity: 0 means the terminal input is invalid, and 1 means it is valid.

2. Description of Terminal Validity

The table below uses /SPD-D as an example; the same applies to /SPD-A and /SPD-B signals.

Parameter Setting Status	Signal/SPD-D Terminal Input Status	Signal/SPD-D Terminal Logic
P5-27=n.0000	No external terminal input required	invalid
P5-27=n.000□	The SI□ terminal has no signal input.	
P5-27=n.001□	The SI□ terminal has a signal input.	
P5-27=n.0010	No external input terminals required	valid
P5-27=n.000□	The SI□ terminal has a signal input.	
P5-27=n.001□	The SI□ terminal has no signal input.	

3. Operation Example



5.4.3 Speed Control (External Pulse Frequency Command)

Parameter	Essentials	Reference Chapter
P0-01 Control Method Selection	Set to 7: External Pulse Speed Mode	5.4.3.1 External Pulse Speed Mode
P0-10 Pulse Instruction Pattern	Set Pulse Shape 0: CW/CCW 2: P+D	5.3.2.2 Positive Direction of Pulse Instructions and Pulse Shape
P0-15 Instruction pulse frequency at rated speed	Determine the linear relationship between the pulse frequency and rotational speed.	5.4.3.3 Instruction pulse frequency at rated speed
P0-16 Speed Command Pulse Filtering Time	When the instruction pulse frequency is relatively low, appropriately setting this parameter can reduce speed fluctuations.	5.4.3.4 Speed Command Pulse Filtering Time
P5-71 Pulse Speed Mode Direction Terminal Function Selection	Change Pulse Direction	5.4.3.5 Direction Selection for Speed Command Pulses

5.4.3.1 External Pulse Speed Mode

Parameter	Set Value	Meaning	Revise	Come into force
P0-01	7	Speed Control: Pulse Frequency Speed Command	servo bb	immediately
Function Overview: The speed command is determined by the frequency of external pulses and independent of the total number of pulses. The circuit connection and position instructions remain identical, allowing selection of CW/CCW modes, AB phases, or a "direction + pulse" pulse configuration.				

5.4.3.2 Pulse Frequency Instruction

The pulse frequency instruction is the same as when using position control (external pulse sequence instruction); refer to Section 5.3.2 Pulse Instructions.

5.4.3.3 Instruction pulse frequency at rated speed

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-15	The rated speed corresponds to the pulse frequency.	1000	100Hz	0 ~ 10000	servo bb	immediately
Note: The unit of measurement here is 100 Hz. For example, when the P0-15 parameter is set to 300, the command pulse frequency at the corresponding rated speed is 30 kHz. When the P0-15 parameter is set to 1000, the command pulse frequency at the corresponding rated speed is 100 kHz.						

5.4.3.4 Speed Command Pulse Filtering Time

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-16	Speed Command Pulse Filtering Time	100	0.01ms	0 ~ 10000	servo bb	immediately
When the instruction pulse frequency is low, appropriately setting this parameter can reduce speed fluctuations.						

5.4.3.5 Direction Selection for Speed Command Pulses

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-71	Pulse Velocity Mode Direction Terminal Function Selection	0	-	0 ~ 1	servo bb	immediately

5.4.4 Speed Control (External Analog Signal)

Parameter	Essentials	Reference Chapter
P0-01 Control Method Selection	Set to 4: External Analog Speed Mode	5.4.4.1 External Analog Speed Mode
P3-01: The rated rotational speed corresponds to the analog voltage value.	Set the speed command voltage required for the servo motor to operate at its rated speed, in units of 0.001 V	5.4.4.2 Rated Speed Corresponding to Analog Signal
P3-09 Soft-start acceleration time P3-10 Soft-start deceleration	Set acceleration and deceleration times in ms	5.4.1.1 Soft Start

time		
P3-02 Analog Voltage and Speed Signal Filtering	Unit: 0.01 ms	5.4.4.3 Simulation Quantity Voltage and Speed Filtering
P3-03: Dead zone voltage for speed command input	Unit: 0.001 V	5.4.4.6 Dead Zone Voltage for Speed Command Input
P3-04 Analog Signal Speed Direction Switching	Switch the input direction of the analog speed control command	5.4.4.4 Switching the Direction of Analog Speed Measurement

5.4.4.1 External Analog Speed Mode

Parameter	Set Value	Meaning	Revise	Come into force
P0-01	4	Speed Control: External Analog Signal	servo bb	immediately
Function Overview: The speed command is specified by an external analog signal. The analog voltage command input from the V-REF terminal serves as the speed control signal for regulating rotational speed.				

- Direction switching: Both positive/negative voltage and SPD-D (P5-27) can control the direction.
- For hardware wiring details, refer to Chapter 3.2.4 on Analog Input Circuits.

5.4.4.2 Analog Speed Control Mode Switching Based on Digital Control

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-65	Analog speed control mode with digital switching mechanism	0	-	0000~ffff	immediately	immediately

P5-65 defaults to 0000, indicating that the analog speed mode switch is inactive and Mode 4 (analog speed mode) functions normally; setting it to 0010 prevents Mode 4 from being used. When assigning SI terminals, their functionality determines whether the analog speed mode is enabled or disabled. For example: using a normally open contact at SI1 to control the analog speed function switch requires setting P5-65 to 0001; when no signal is present at SI1, Mode 4 operates normally; when a signal is present at SI1, Mode 4 becomes inoperative.

5.4.4.3 Rated Speed Corresponding to Analog Value

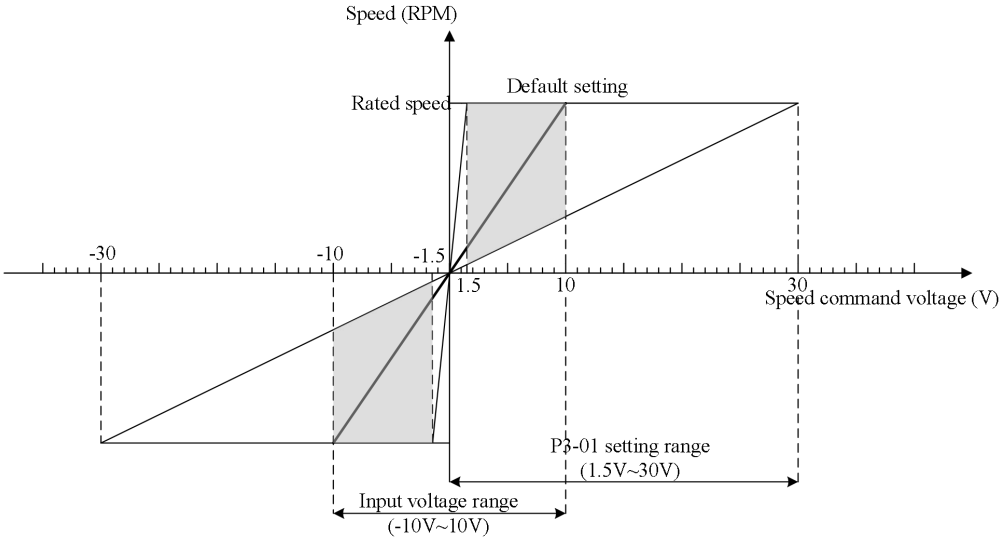
Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-00	V-REF Function Allocation	0	-	0~2	servo bb	immediately
P3-01	The rated speed	10000	0.001V	1500~30000	servo	immediately

	corresponds to the analog voltage value.				bb	

Function Description: Sets the speed command voltage (V-REF) required for the servo motor to operate at its rated speed.

For example: P3-01=5000 indicates that the motor operates at its rated speed when the analog input voltage is 5.00 V.

P3-01=8000 indicates that the motor operates at its rated speed when the analog input voltage is 8.00 V.



- The input for analog voltage commands used for speed limiting has no polarity. The absolute value is taken regardless of whether the voltage is positive or negative, and the resulting speed limit applies to both forward and reverse directions.
- The maximum allowable voltage for analog input signals is ±10 V; do not apply voltages exceeding ±10 V.

5.4.4.4 Analog Voltage and Speed Filtering

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-02	Analog voltage velocity filtering	2	0.01ms	0~10000	at any time	immediately

5.4.4.5 Switching of Simulation Quantity's Rotation Direction

Three methods exist for direction switching in analog speed control:

① Changes in control parameters, ② Positive/negative voltages, ③ Pulse signal from SPD-D (P5-27)

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force

P3-04	Analog speed direction switching	0	-	0~1	at any time	immediately

5.4.4.6 Automatic Adjustment of Speed Command Offset (F1-03)

When using the analog voltage speed mode, the motor may rotate at a slight speed even when the command voltage is 0 V. This slight movement occurs when there is a minor deviation (in mV) in the command voltage from the upper control device or external circuit. In such cases, the panel operator can automatically adjust the command offset.

When servo enable is turned off (i.e., in BB state), disconnect the analog signal from driver port CN0 and perform the following steps:



Press Status/ESC to exit this feature.

- The current analog voltage is 0 V. According to the calibration procedure shown in Figure F1-03,0 V corresponds to 0 rpm: a voltage below 0 V indicates the motor running in reverse, while above 0 V indicates forward rotation. Similarly, if the current analog voltage is 5 V, 5 V corresponds to 0 rpm: a voltage below 5 V indicates reverse rotation, and above 5 V indicates forward rotation.
- If slight movement persists after automatic offset adjustment, apply zero clamping or increase parameter P3-03 to 5 to set the dead zone voltage at 0.005 V.

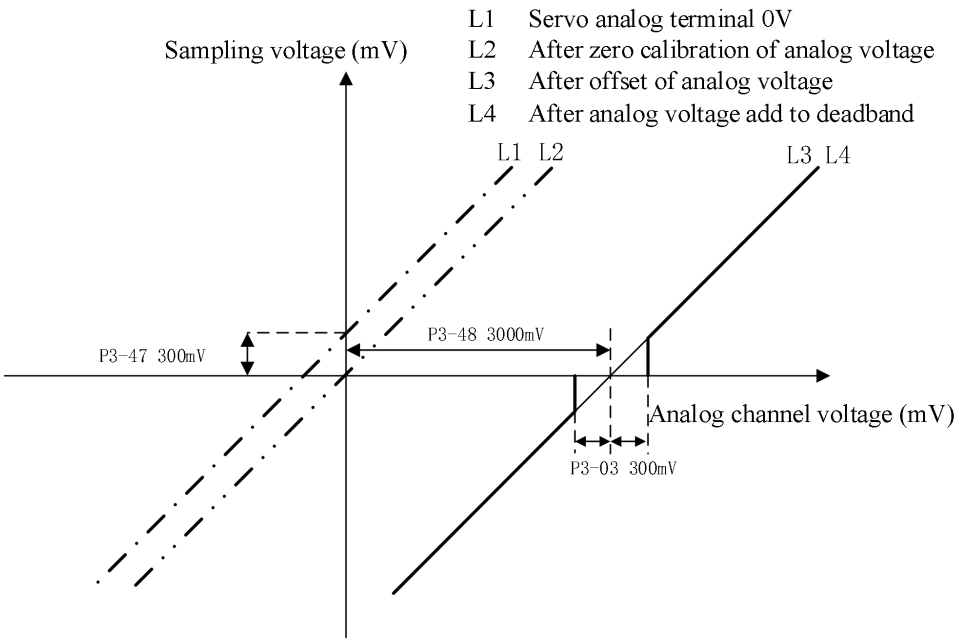
5.4.4.7 Dead Zone Voltage for Speed Command Input

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-03	Speed Command Input Dead Zone Voltage	0	0.001V	0~500	at any time	immediately
P3-47	V-REF Analog Signal Zero Drift Correction	0	-	-1000~1000	at any time	immediately
P3-48	V-REF Analog Voltage Bias	0	mV	-9999~9999	at any time	immediately

Explain ：

(1) When the input speed command voltage falls within the specified range, the input command is considered zero.

(2) If minor adjustments remain after automatic offset adjustment, simply increase the dead zone voltage accordingly.


L1 Servo analog terminal 0V
L2 After zero calibration of analog voltage
L3 After offset of analog voltage
L4 After analog voltage add to deadband
Sampling voltage (mV)
L1 L2
L3 L4
P3-47 300mV
P3-48 3000mV
Analog channel voltage (mV)
P3-03 300mV

5.5 Torque Control

5.5.1 General Torque Mode

5.5.1.1 Internal Speed Limitation During Torque Control

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-16	Internal forward speed limit during torque control	Motor Rating	rpm	5 ~ 65535	at any time	immediately
P3-17	Internal reverse speed limit during torque control	Motor Rating	rpm	5 ~ 65535	at any time	immediately

Even if the set speed for this parameter exceeds the P3-14 speed limit, only the lower speed limit applies. (The maximum speed is the smaller value between P3-14/P3-15 and P3-16/P3-17)

5.5.1.2 Speed Limit Detection (/VLT)

In torque mode, if the absolute value of the servo motor's actual speed exceeds the speed limit, the system recognizes that the speed is restricted and the servo driver may output a VLT signal; otherwise, the speed restriction signal is invalid.

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-43	/VLT	n.0000	1、2	Speed Limit Detection	at any time	immediately
By default, no terminals are assigned; the parameter range is 0000−0018 and is assigned to the output interface via parameter P5-43. Setting it to 0002 enables signal output from the SO2 terminal. The VLT signal only applies in torque mode.						

5.5.2 Torque Control (Internal Setting)

Parameter	Essentials	Reference Chapter
P0-01 Control Method Selection	Set to 1: Internal Torque Mode	5.5.2.1 Internal Torque Mode
P3-33 Internal Torque Instruction Given	Given a percentage value of the rated torque	5.5.2.2 Internal Torque Command Setting

P3-16 Internal forward speed limit during torque control P3-17 Internal reverse speed limit during torque control P3-14 Forward Maximum Speed Limit (MAX Speed) P3-15 Reverse Maximum Speed Limit (MAX Speed)	Speed Limitation under Torque Mode	5.5.1.1 Internal Speed Limitation During Torque Control
P5-27 Speed Direction Switching/SPD-D	Switch direction, default is n.0000; By applying a commutation signal through terminal SI2, P5-27 can be set to n.0002.	

5.5.2.1 Internal Torque Mode

Parameter	Set Value	Meaning	Revise	Come into force
P0-01	1	Torque Control: Internal Setting	servo bb	immediately
Function Overview: Uses the internally set torque as a torque command for torque control.				

5.5.2.2 Internal Torque Command Setting

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-33	Default Torque 1	0	1% rated torque	-1000 ~ +1000	at any time	immediately
P3-34	Default Torque 2	0	1% rated torque	-1000 ~ +1000	at any time	immediately
P3-35	Default Torque 3	0	1% rated torque	-1000 ~ +1000	at any time	immediately
P3-51	Method for determining the internal torque mode	0	-	0 ~ 1	OFF	immediately
Set P3-51 to 0 and use preset torque 1 directly. Set P3-51 to 1 and use the external terminals /SPD-D (P5-27), /SPD-A (P5-28), and /SPD-B (P5-29) to select preset torque values 1–3. The unit of the internally preset torque command is 1% of the rated torque, with positive and negative values indicating forward and reverse rotation of the motor. For example: setting P3-33 to 50 indicates that the motor operates in forward direction at 50% of its rated torque. Set P3-33 to-20, indicating the motor operates in reverse at 20% of its rated torque.						

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
In addition to controlling the servo direction using torque values, the internal torque mode also supports switching between speed directions via P5-27 or SPD-D control.						

5.5.3 Torque Control (External Analog Signal)

Parameter	Essentials	Reference Chapter
P0-01 Control Method Selection	Set to 2: External Analog Torque Mode	5.5.3.1 Analog Quantity Torque Mode
P3-24: The rated torque corresponds to the analog voltage value.	Set the speed command voltage required for the servo motor to operate at its rated speed, in units of 0.001 V	5.5.3.2 The rated torque corresponds to an analog value
P3-25 Analog Voltage to Torque Command Filter Simulation	Unit: 0.01 ms	5.5.3.3 Simulation Quantity Voltage and Speed Filtering
P3-26 Torque Command Input Dead Zone Voltage	Unit: 0.001 V	5.5.3.5 Dead Zone Voltage for Torque Command Input

5.5.3.1 Analog Quantity Torque Mode

Parameter	Set Value	Function	Revise	Come into force
P0-01	2	Torque Control: Analog Voltage Command	servo OFF	immediately
Function Overview: Uses the analog voltage input from the T-REF terminal as the command signal for torque control.				

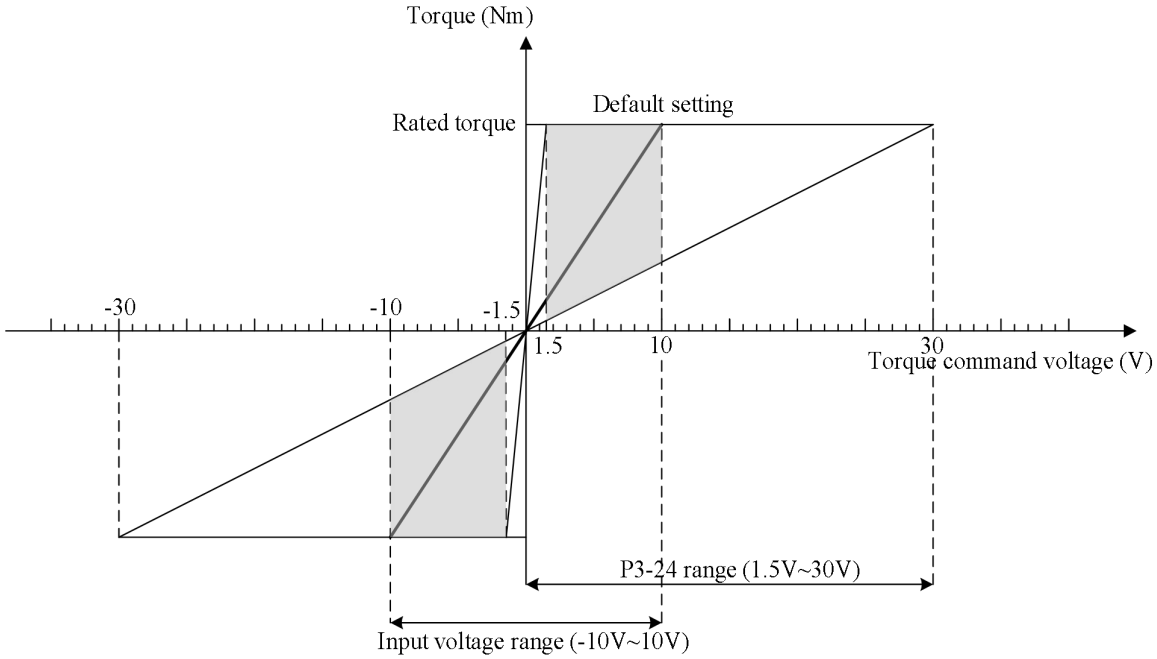
- Direction switching: Both positive/negative voltage and SPD-D (P5-27) can control the direction.
- The hardware wiring section follows Chapter 3.2.4.

5.5.3.2 The rated torque corresponds to an analog value

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-24	The rated torque corresponds to an analog value.	10000	0.001V	1500~30000	servo bb	immediately

Function Description: Sets the torque command voltage (T-REF) required for the servo motor to operate at its rated torque.

For example: P3-24=5000 indicates that the motor operates at rated torque when the analog input voltage is 5.00 V.
P3-24=8000 indicates that the motor operates at its rated torque when the analog input voltage is 8.00 V.



- The input for analog voltage commands used in torque limitation has no polarity. The absolute value is applied regardless of whether the voltage is positive or negative, and the resulting torque limit applies to both forward and reverse rotation directions.
- The maximum allowable voltage for analog input signals is ±10 V; do not apply voltages exceeding ±10 V to the motor.

5.5.3.3 Analog Voltage-Torque Conversion Filtering

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-25	Analog Voltage-Torque Command Filter	0	0.01ms	0~10000	at any time	immediately

Pass the torque command through a single delay filter to smooth it. Setting this value too high will reduce responsiveness.

5.5.3.4 Automatic Adjustment of Torque Command Offset (F1-04)

When using the analog voltage-torque mode, the motor may rotate at a slight speed even when the command voltage is 0 V. This slight rotation occurs when there is a minor deviation (in mV) in the command voltage from the higher-level control device or external circuit. In such cases, the panel operator can automatically adjust the command offset.

When servo enable is turned off (i.e., in BB state), disconnect the analog signal from driver port CN0 and perform the following steps:



Press Status/ESC to exit this feature.

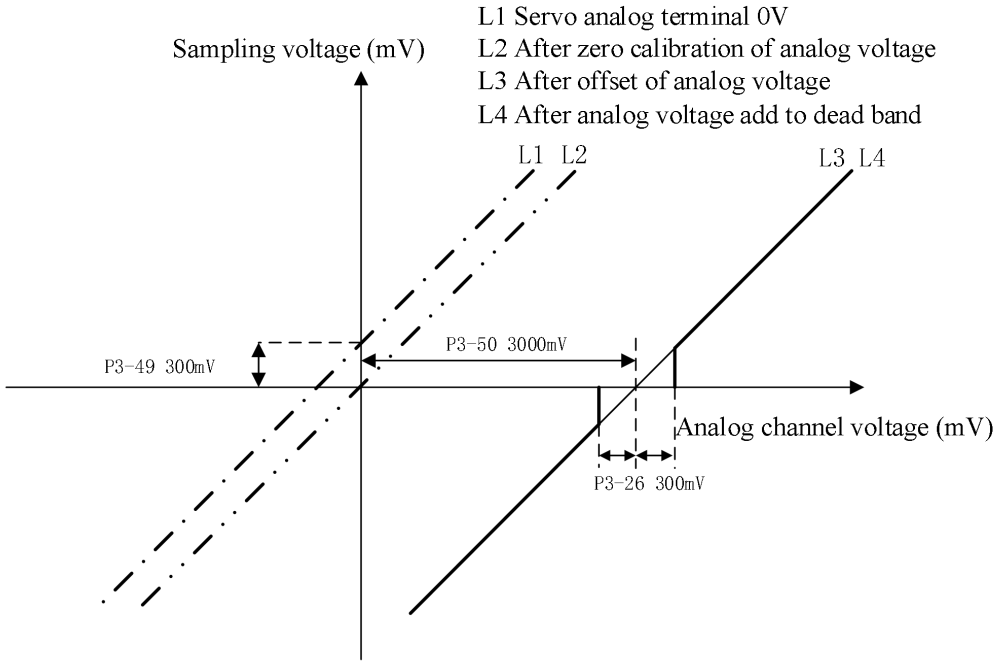
- When the current analog voltage is 0 V, calibration per Figure F1-04 defines this level as 0% output torque: below 0 V corresponds to the motor's reverse output torque, while above 0 V corresponds to its forward output torque. Similarly, when the current analog voltage is 5 V, calibration per the same figure specifies 5 V as 0% output torque—below the motor's reverse output torque but above its forward output torque.
- If slight movement persists after automatic offset adjustment, increase parameter P3-26 appropriately to 5, setting the dead zone voltage to 0.005 V.

5.5.3.5 Dead Zone Voltage for Torque Command Input

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-26	Torque command input dead zone voltage	0	0.001V	0~500	at any time	immediately
P3-49	T-REF Analog Signal Zero Drift Correction	0	-	-1000~1000	at any time	immediately
P3-50	T-REF Analog Voltage Bias	0	mV	-9999~9999	at any time	immediately

Explain ：

(1) When the input torque command voltage is lower than the set value of this parameter, the input torque command is considered zero.
(2) If minor adjustments remain after automatic offset adjustment, simply increase the dead zone voltage accordingly.



5.6 Absolute Value System

5.6.1 Configuration of the Absolute Value System

To store the position data of the absolute encoder, a battery unit must be installed.

Install the battery on the battery Battery equipped with an encoder cable containing the battery unit (internal).

When not using an encoder cable with a battery unit, set P0-79 to 1 to treat the multi-turn absolute encoder as an incremental encoder.

Parameter	Signal Name	Setting	Meaning	Setting scope
P0-79	Absolute Encoder Settings	0	Use an absolute encoder normally and store the position using batteries.	0~2
		1 (Default)	When used as an incremental encoder, it no longer remembers positions beyond multiple turns.	
		2	Used as an absolute encoder, but the multi-turn overflow alarm is ignored.	

After replacing the multi-turn motor, an E-222 alarm will be triggered, automatically resetting the count of overflowed turns; otherwise, significant positional deviation may occur, posing a hazard.

5.6.2 Replace the Battery

When replacing the battery, ensure the driver is properly connected to the motor and the control power supply is turned on. Replacing the battery with the control power supply off will result in loss of data stored in the encoder.

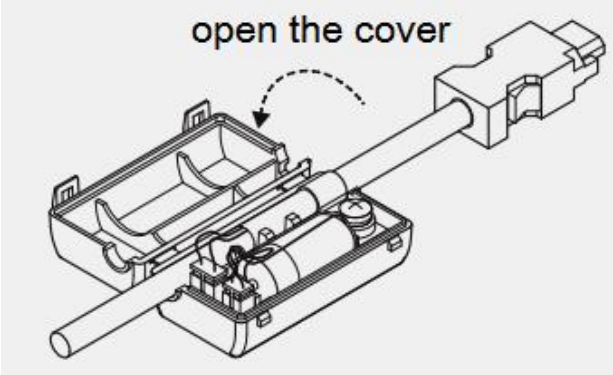
Absolute encoder battery case model (This battery cannot be charged)

- Battery case for standard cables: CP-B-BATT
- Specialized battery case for tank line systems: CPT-B-BATT

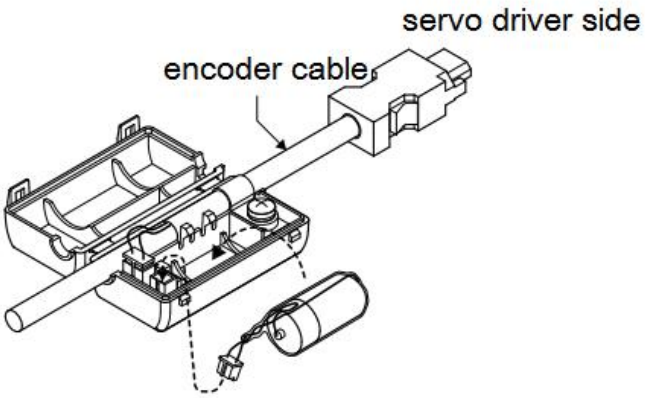
Steps for replacing the battery

When using encoder cables with battery units

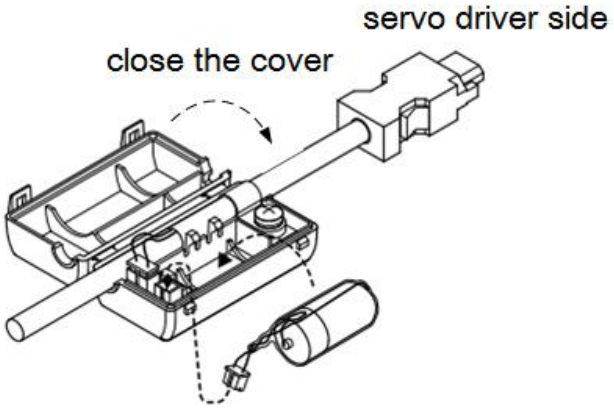
1. Connect only the control power supply to the servo unit;
2. Open the cover of the battery unit;



3. Remove the old battery and install a new one;



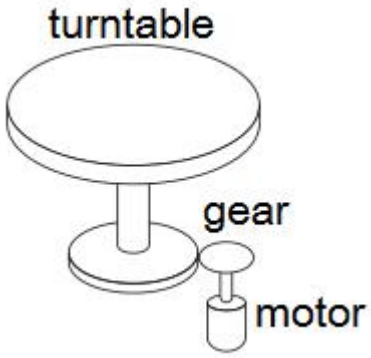
4. Close the box cover of the battery unit;



5. After replacing the battery, clear the alarm (F0-00=1) twice to eliminate the "Encoder Battery Alert (E-222)" display (only once required for version 3770 and later).
6. Re-power the servo unit;
7. Confirm that error messages have disappeared and the servo unit is functioning properly.

5.6.3 Maximum Number of Rotations Setting Value

The maximum number of rotation cycles can be used for position control of rotating bodies such as turntables.
For example, consider a machine whose rotating platform moves only in one direction, as shown below.



Since it can only rotate in one direction, after a certain period of time, the total number of rotations will inevitably exceed the maximum count limit of the absolute encoder.

Servo Motor Series	Resolution ratio (Single-round data)	Serial Data with Rotation Count Output Range	Operation beyond time limit
CS/M	17	-32768~32767	When exceeding the upper limit value of the forward direction (+32767*217): Rotation sequence serial data = 32767 * 217 When it falls below the lower limit of the reversal direction (-32768*217): Rotation serial data = -32767 * 217
TL	23		When exceeding the upper limit value of the forward direction (+32767*223):

			Rotation sequence serial data = 32767 * 223 When it falls below the lower limit of the reversal direction (-32768*223): Rotation serial data = -32767 * 223

5.6.4 Communication Reading of Absolute Value Position

Essential Parameter		
User Parameters	Name	Use
U0-10	Encoder Feedback Value	The absolute position per revolution is determined by reading the hexadecimal addresses 0x100A and 0x100B via the Modbus RTU single-word address register; U0-10 + U0-11 × 10,000 represents the current encoder position per revolution.
U0-11		
U0-91	Absolute value of multiple loops: Current loop count	Read the hexadecimal address 0x105B using the Modbus RTU single-word read function to obtain the current encoder revolution count.
U0-57	Absolute encoder current position feedback: 32-bit low	Read the hexadecimal address 0x1039 using the Modbus RTU dual-word read function to obtain the current encoder position, which includes positive and negative pulses.
U0-58		
U0-59	Absolute encoder current position feedback: 32-bit high	Read the hexadecimal address 0x103B using the Modbus RTU dual-word read function; this represents the high-bit value of the current encoder position, with the low-bit data to be added.
U0-60 (Direction Calibration)		

The servo driver transmits encoder position data via the RS485 interface using the Modbus RTU protocol.

- 19 absolute encoders, with 524,288 pulses per revolution.
- A 23-bit absolute encoder with a pulse count of 8,388,608 per revolution.

First, read the value of U0-60 (0x103C).

① 0 represents the positive direction of the encoder's zero position. The current encoder position is calculated as U0-57*1 + U0-58*216 + U0-59*232 + U0-60*248.

② −1 represents the opposite direction of the encoder's zero position. The current encoder value is calculated as: [U0-57 + U0-58 × 216 + U0-59 × 232 + (65536 + U0-60) × 248] − 264.

Communication Parameter Description

Default communication parameters for RS485 port: baud rate 19200 bps; 8-bit data width; 1 stop bit; parity check; Modbus station ID 1.

For details of communication parameters, refer to Appendix 1 (P7−XX).

5.6.5 Absolute Encoder Clear Multiple Turns

User Parameters	Name	Description
F1-06	Absolute encoder position reset	
U0-94	Zeroable relative encoder feedback value	
U0-95		
U0-96		
U0-97 (Direction Sign)		0: Positive direction of encoder zero position -1: Encoder zero position in reverse direction
U0-57	Absolute encoder current position feedback	
U0-58		
U0-59		
U0-60 (Direction Sign)		0: Positive direction of encoder zero position -1: Encoder zero position in reverse direction

- F1-06: Clear multiple rounds

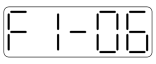
  (Effective only for multi-turn motors.) Encoder reset must be performed in servo BB mode and can be executed via the servo panel or Modbus RTU communication. Writing 1 to F1-06 will set the current absolute position count U0-91 to zero; the multi-turn counts indicated by absolute encoder position feedback signals U0-57−U0-60 and U0-94−U0-97 will also be cleared, retaining positions within one turn.

1. Clear Servo Drive Panel

When the servo is in BB mode, parameter F1-06 displays:



Press the [INC] key to set to 1 and hold [ENT] to confirm exit:



Using F1-06, you can clear the number of rotations for the absolute encoder position via the panel.

2. Modbus RTU Communication Clear

To clear the number of circles, write 1 to the hexadecimal address 0x2106 using a Modbus RTU.
The servo BB status takes effect; after clearing, set 0x2106 to 0.

5.6.6 Zero Point Calibration for Absolute Value Encoders

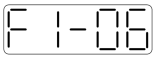
Absolute zero calibration must be performed in BB mode and can be achieved via servo panel calibration or Modbus RTU communication calibration. Writing 3 to F1-06 sets the encoder position feedback value (U0-94~97) to 0 during calibration.

1. Servo Drive Panel Calibration

When the servo is in BB mode, parameter F1-06 displays:



Press the [INC] key to set to 3 and hold [ENT] to confirm exit:



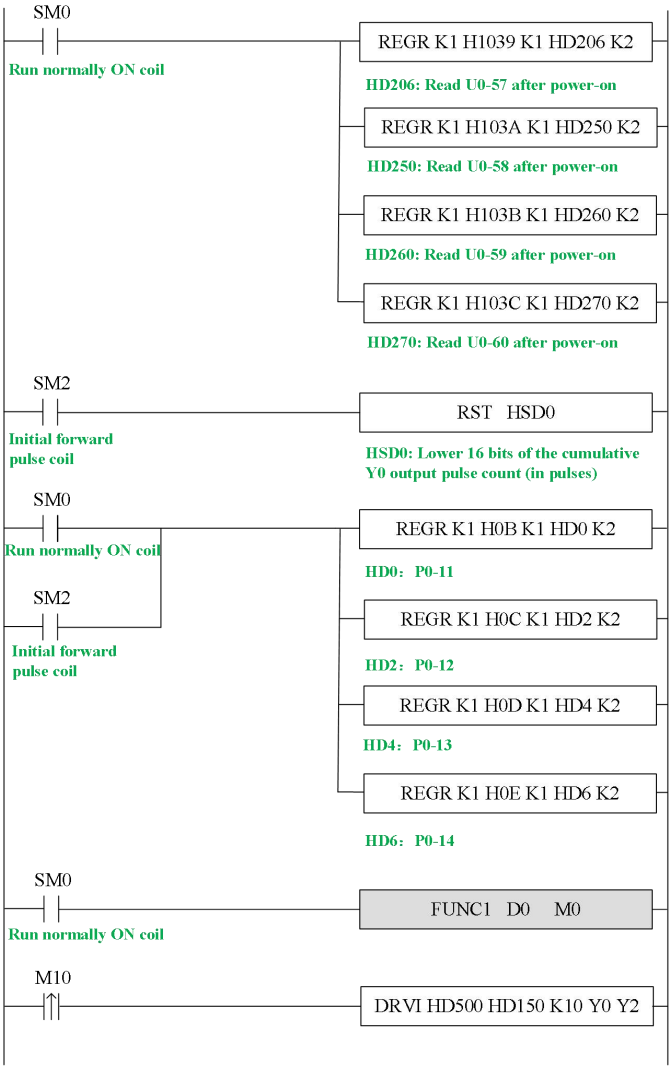
Using F1-06, the panel calibrates the encoder's current position to zero; U0-94~97 displays the calibrated encoder position.

2. Modbus RTU Communication Clear

The decimal value 3 can be written to F1-06 (Modbus address 0X2106) via Modbus RTU communication, while U0-94 to U0-97 display the calibrated absolute position of the motor.

5.6.7 Returning to the original case based on absolute values

Use the XINJE PLC to read multi-turn absolute position values via four-digit encoding. The following example demonstrates returning to the origin using encoder feedback: M1 stores the origin position, SM12 records the current position; by calling a function, the encoder feedback difference for the traveled distance is retrieved, and the DRVI instruction is used to return to the origin.



// Read U0-57 to U0-60 after power-on and store them in the specified registers. The first K1 is the servo station number, the second K1 is the number of registers, and K2 is the RS485 communication port number.

// Clear the value in HSD0 after power-on.

// Read the pulses per revolution value for C function calculation.

// Call the C function.

// Send the pulses stored in UHD[500] for homing.

```
/*****************************************************************************/
void FUNC1( WORD W , BIT B )
{
#define SysRegAddr_SFD_MD_MM_HSD_HSCD_SD_M_D

    #define DHD *(INT32S*)&HD
    #define CHD *(INT16S*)&HD
    #define FHD *(FP32*)&HD
    #define UHD *(long long*)&HD        //64位存储
    //FHD[0]   P0-11
    //HD[2]    P0-12
    //HD[4]    P0-13
    //HD[6]    P0-14
    //FHD[100] 每圈脉冲数
    //UHD[206] U0-57
    //UHD[250] U0-58
    //UHD[260] U0-59
    //UHD[270] U0-60
    //FHD[300] 当前走的圈数1
    //FHD[400] 当前走的圈数2
    //UHD[500] 需要回原的脉冲数
    //UHD[700] 当前走的编码器反馈值
    //UHD[800] 先取绝对值

    if(HD[0]==0&&HD[2]==0 )          //每圈脉冲数计算
    {
        FHD[100]=131072*HD[6]/HD[4];
    }
    else
    {
        FHD[100]=HD[0]+HD[2]*10000;
    }

    if(CHD[270]>=0)                  //U0-60正转或有正值
    {
    UHD[700]=UHD[206] + UHD[250] * 65536 + UHD[260] * 4294967296 + CHD[270] * 281474976710656 ; //走的距离
    FHD[300]=UHD[700]/131072.0;      //走的圈数
    FHD[400]=FHD[300]*FHD[100];      //发的脉冲数
    UHD[500]=0-FHD[400];             //最后发的脉冲
    }

    if(CHD[270]<0)                   //U0-60反转或有负值
    {
    UHD[700]=(UHD[206] + UHD[250] * 65536 + UHD[260] * 4294967296 + ( 65536 + CHD[270] ) * 281474976710656) - 18446744073709551616 ; //走的距离
    UHD[800]=-UHD[700];              //先取绝对值
    FHD[300]=UHD[800]/131072.0;      //走的圈数
    FHD[400]=FHD[300]*FHD[100];      //发的脉冲数
    UHD[500]=FHD[400];               //最后发的脉冲
    }
```

Define the register data word

First, calculate the number of pulses required for one revolution based on the pulses per revolution read th communication and the electronic gear ratio, and sto result in FHD[100].

① Calculate the real-time encoder feedback value and st UHD[700].

② When running in the positive direction, U0-60 > 0. Si encoder feedback resolution is different from the pulses revolution, first calculate the number of revolutions trave multiply it by the pulses per revolution to obtain the num pulses required for the actual traveled distance.

③ Since the movement is in the positive direction, negat pulses need to be output to return to the origin. Take the value and store it in UHD[500].

① When running in the reverse direction, U0-60 < 0. First, take the absolute value of the encoder feedback value corresponding to the actual traveled distance.

5.6.8 Absolute Value Function

1. Linear load (P0-79 = 0)

Monitoring Parameters	Parameter Functions	Span	Unit
U4-27	Linear Load Position Command Unit	(-9999 ~ 9999) *1	Command Unit
U4-28		(-9999 ~ 9999) *10000	

2. Rotating load (P0-79 = 2)

Parameter	Functional description	Unit	Factory Default Value	Span	Effectiveness Time	Suit scope
P9-33	Absolute rotation mode pulse count per revolution (0–65535)	Encoder Pulse	0	0~65535	○	5|6
P9-34	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 2^16	Encoder Pulse	0	0~65535	○	5|6
P9-35	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 2^32	Encoder Pulse	0	0~65535	○	5|6
P9-36	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 248	Encoder Pulse	0	0~65535	○	5|6
P9-37	Absolute Position Rotation Mode: Gear Ratio Fraction	-	65535	0~65535	○	5|6
P9-38	Absolute Position Rotation Mode Gear Ratio (numerator/denominator)	-	1	0~65535	○	5|6
P9-33 to P9-36 are valid when P0-79 = 2. P9-37~P9-38 are valid when P9-33~P9-36 is 0.						

For rotational loads, you need to set either the number of pulses per revolution in absolute position rotation mode or the gear ratio for this mode.

Assuming the motor is a 19-bit magnetic encoder motor with a reduction ratio of 1:2 (the motor rotates two full turns while the load rotates one turn), the absolute position rotation mode requires 524288 × 2

pulses per revolution. You can set P9-34 to 16 and P9-33/35/36 to 0; alternatively, set P9-33/34/35/36 to 0, P9-37 to 2, and P9-38 to 1.

Monitoring Parameters	Parameter Functions	Span	Unit
U4-20	Unit for rotational load single-turn position encoder	(0000 ~ 65535) *1	Encoder Unit
U4-21		(0000 ~ 65535) *2^16	
U4-22		(0000 ~ 65535) *2^32	
U4-23		(0000 ~ 65535) *2^64	
U4-24	Rotation Load Single-Loop Position Command Unit	(0000 ~ 9999) *1	Command Unit
U4-25		(0000 ~ 9999) *10000	
U4-26	Number of rotations for the rotating load	(0000 ~ 65535) *1	-

5.7 Auxiliary Functions

5.7.1 Anti-Backlash Protection

When the motor's operating speed falls below P0-75 (unit: 1 rpm) and remains below P0-74 (unit: ms) for the specified duration, if the current motor output torque U0-02 exceeds both the internal forward torque limit P3-38 and the internal reverse torque limit P3-39, alarm E-165 (Stalled Operation Time Limit Exceeded) is triggered.

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-74	Turn-off alarm time	By Device Model	1ms	0 ~ 65535	at any time	immediately
P0-75	Turn-off alarm speed	50	rpm	5 ~ 9999	at any time	immediately
P3-28	Internal forward rotation torque limit	By Device Model	%	0 ~ Motor overload factor	at any time	immediately
P3-29	Internal reverse rotation torque limit	By Device Model	%	0 ~ Motor overload factor	at any time	immediately
P3-38	Prevention of reverse rotation alarms; internal limit on forward rotation torque	By Device Model	%	0 ~ Motor overload factor	at any time	immediately
P3-39	Prevention of reverse rotation alarms; internal limit on reverse rotation torque	By Device Model	%	0 ~ Motor overload factor	at any time	immediately

Explain ：

1) This alarm is not detected when P0-74 or P0-75 is set to 0;
2) If this alarm occurs during normal servo operation, confirm the following:
   a) Monitor the torque of motor U0-02 and verify whether the torque limit settings for P3-28, P3-29 (P3-38/P3-39) are appropriate;
   b) Inspect the external mechanical structure and its installation;

3) The default alarm time for P0-74 stall condition is as follows by model:

Power Drive Model	P0-74 (/ms) Default Parameter
DS5□-20P1-PTA	2000
DS5□-20P2-PTA	3000
DS5□-20P4-PTA	3000
DS5□-20P7-PTA	5000
DS5□-415P0-PTA	20000
Other Models	0

P0-74 is set to 0, indicating the anti-clogging alarm is not enabled by default; users can configure it as needed.

3）The DS5K2 series parameters P3-38/P3-39 are solely used as reference values for blockage prevention rotation alarms, while P3-28/P3-29 represent the actual internal torque limits during motor operation.

5.7.2 Torque Limit

1. Internal Torque Limit

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-28	Internal forward rotation torque limit	By Device Model	%	0 – Motor overload factor	at any time	immediately
P3-29	Internal reverse rotation torque limit	By Device Model	%	0 – Motor overload factor	at any time	immediately
(1) If this set value is lower than the external torque limit, the final limit will be determined by this parameter's set value. (2) The setting value is expressed as a percentage of the motor's rated torque; for example, a motor designed for 3x overload operates at 300% of its rated torque by default, with the actual maximum output torque limited by the motor's overload factor.						

2. External torque limitation (activated via input signal)

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-30	Forward rotation and external torque	By Device	%	0 – Motor overload	at any time	immediately

	limitation	Model		factor		
P3-31	Reverse Side External Torque Limit	By Device Model	%	0 – Motor overload factor	at any time	immediately
The setting value is expressed as a percentage of the motor's rated torque; for example, a motor designed for 3x overload is factory-set to 300% of its rated torque.						

Parameter	Signal Name	Factory Settings	Meaning	Set Range	Revise	Come into force
P5-25	/P-CL	n.0000	Necessary conditions for using forward rotation with external torque limitation	Parameter range 0000 – 0014, allocated to other input interfaces via parameters P5–25.	at any time	immediately
P5-26	/N-CL	n.0000	Necessary conditions for applying reverse-side external torque limitations	Parameter range 0000 – 0014, allocated to other input interfaces via parameters P5–26.	at any time	immediately

3. Functional Relationship

Below is the functional relationship among internal torque limits, external torque limits, /P-CL, /N-CL, and T-REF.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-23	T-REF Function Allocation	0	-	0~3	servo bb	immediately

T-REF distribution	P-CL/N-CL state	Final value of forward rotation torque	Final reversal torque value
0	0	P3-28 Decision	P3-29 Decision
	1	The smaller of the internal forward rotation torque limit and the external side forward rotation torque limit	The smaller of the internal reverse torque limit and the external reverse-side torque limit
1	Not working	The smaller value between the internal forward rotation torque limit and the external analog torque	The smaller value between the internal reverse rotation torque limit and the external analog torque
3	0	P3-28 Decision	P3-29 Decision
	1	The smaller value between the internal forward rotation	The smaller value between the internal reverse rotation torque

		torque limit and the external analog torque	limit and the external analog torque

4. Output torque reaches the limit value

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-42	torque limitation /CLT	n.0000	All	The motor output torque reaches the limit values specified in P3-28/P3-29/P3-30/P3-31/P3-38/P3-39 for the output signal.	at any time	immediately
Default value: no assigned terminals. Parameter range: 0000–0014, allocated to the output interface via parameter P5-42. Setting to 0002 enables signal output from SO2 terminals.						

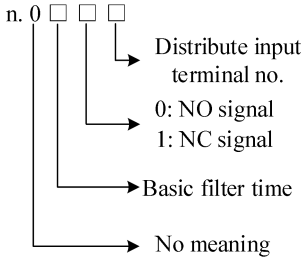
5.7.3 Speed Limitations

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-14	Positive maximum speed command limit	4000	rpm	0 ~ 10000	servo bb	immediately
P3-15	Reverse Maximum Speed Command Limit	4000	rpm	0 ~ 10000	servo bb	immediately
Note: The parameters set for P3-14 and P3-15 are valid in all modes.						

5.7.4 Input/Output Terminal Allocation

5.7.4.1 Input Terminal Allocation

1. Allocation of Input Signals

Parameter	Parameter Meaning	Set Value	Meaning
P5-20 ~ P5-36		n.0000	Not assigned to terminal input
		n.000x	Enter a normally open signal from the SIx terminal
		n.0010	Set the signal to always active
		n.001x	Enter a normally closed signal from the SIx terminal.

The basic filtering time refers to the filtering time of the input terminal.

2. Factory settings for input terminals

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

3. Filter time for input terminals

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-18	SI Filter Time Factor	1	Times	0 ~ 10000	at any time	immediately

The SI input filtering time is determined jointly by the IO parameter value and P5-18, as illustrated below:

Configure the SI1 terminal as the pulse deviation clear input and set the filter time to 30 ms.

The parameters are set as follows:

P5-34=n. 0 3 0 1
- P5-34.0
- P5-34.2

P5-34.0=1: Set the input terminal to SI1

P5-34.2=3: The basic filtering time is set to 3 ms

P5-18=10: Set the filtering time factor to 10 times

The total filtering time is P5-34.2 × P5-18 = 3 ms × 10 = 30 ms.

5.7.4.2 Output Terminal Allocation

1. Terminal Allocation for Output Signals

parameter	Parameter Meaning	set value	meaning
P5-37 ~ P5-53	n. 0 □ □ □ □: Distribute output terminal no. □: 0: NO signal 1: NC signal □: No meaning □: No meaning	n.0000	Not assigned to terminal output
		n.000x	The SOx terminal outputs a normally open signal.
		n.0010	Set the signal to always active
		n.001x	The SOx terminal outputs a normally closed signal.

2. Factory settings for output terminals

leading-out terminal	SO1	SO2	SO3
signal	/COIN	/ALM	/S-RDY

5.7.5 Description of Output Terminal Functions

5.7.5.1 Servo Ready Output (/S-RDY)

- relevant parameter

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-70	/S-RDY: Output Condition Selection	0	-	0~1	at any time	immediately

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-41	/S-RDY	n.0000	All	Server Ready Output	at any time	immediately
For details on hardware wiring, refer to Chapter 3.2.2. Parameter range P5-41: The parameter setting range is n.0000−0014, which is assigned to other input terminals via parameters. To obtain an SO_2 output signal, set P5-41 to n.0002/0012.						

1. Output Conditions for Servo Ready Signal

When P5-70 is set to 0: The drive has completed initialization and the servo has no alarm status/S-RDY is active;
When P5-70 is set to 1: enabled when the servo has no alarm status and S-RDY is active.

5.7.5.2 Rotation Detection Output (/TGON)

1. Signal Settings

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-40	/TGON	n.0000	All	Rotation Detection Output	at any time	immediately
It is an output signal indicating that the servo motor is rotating at a speed higher than the set value. 1. Default value for unallocated terminal output signals. Parameter range: 0000−0018, assigned to						

other output terminals via parameter P5−40. 2. This indicates that when the servo motor's rotational speed exceeds the set value of P5-03, it signifies that the servo is rotating.

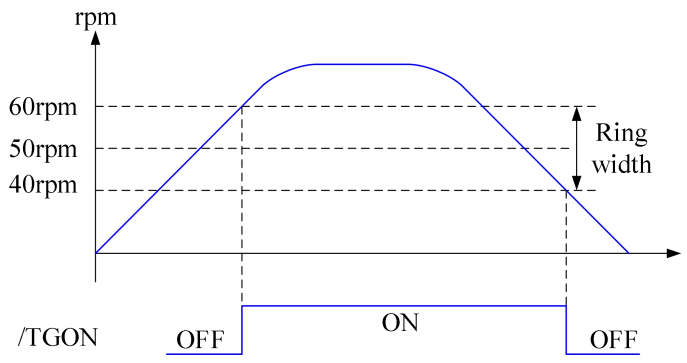
2. Relevant Parameters

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-03	Rotation Detection Speed/TGON	50	rpm	0 ~ 10000	at any time	immediately
Set the condition range for rotation detection output: if the servo motor's speed exceeds the P5-03 set value, it is determined that "the servo motor is rotating," and the rotation detection signal (/TGON) is output.						

The rotation detection exhibits a hysteresis loop at 10 rpm.

3. The Concept of Hysteresis Loop

The hysteresis loop is designed to prevent system oscillations caused by parameter fluctuations around a specific value. Once the hysteresis threshold is set, a fixed loop width is established: the system only activates when parameters exceed a certain value and deactivates when they fall below another threshold; this width determines the action interval. A narrow loop results in rapid and frequent responses, while a wide loop causes delayed responses. Note that rotation detection speed (P5-03), synchronous detection speed (P5-04), and arrival detection speed (P5-05) all incorporate a 10 rpm hysteresis range. For example, setting rotation detection speed P5-03 to 50 with the rotation detection/TGON output port at SO3.



5.7.5.3 Same-speed Detection (/V-CMP)

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-39	Same-speed detection/V-CMP	n.0000	3、4、7	Detection signal at the same speed	at any time	immediately
Default value: no assigned terminals. Parameter range: 0000−0014, assigned to the output interface via						

parameter P5-39. Setting to 0002 enables signal output from SO2 terminals.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-04	Signal width detected at the same speed	50	rpm	0 ~ 10000	at any time	immediately



By default, there is a hysteresis of 10 rpm; refer to Section 5.12.3 for the definition of hysteresis.

5.7.5.4 Warning Output (/ WARN)

Set an alarm output threshold; when the current speed exceeds the warning speed, output WARN.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P3-19	Positive Warning Speed	Motor-related	rpm	0 ~ 65535	servo bb	immediately
P3-20	Reverse Warning Speed	Motor-related	rpm	0 ~ 65535	servo bb	immediately

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-45	/WARN	n.0000	All	Warning Output	at any time	immediately
1. Default value for unallocated terminal output signals. Parameter range: 0000–0014, assigned to other output terminals via parameters P5–45. 2. When a warning occurs, the servo unit only outputs a warning signal and will not be forcibly turned off.						

5.7.5.5 Servo Alarm Output (/ALM)

1. Servo Alarm Output/ALM

Parameter	Signal Name	Setting	Meaning	Modification Scope
P5-47	Alarm Output /ALM	n.0002 (Default)	When a servo alarm occurs, conduction is established between SO2 and COM, generating an alarm signal.	The parameter range is 0000–0014, assigned to the output interface via parameters P5–47. Setting it to 0001
		n.0012	When the servo alarm occurs,	

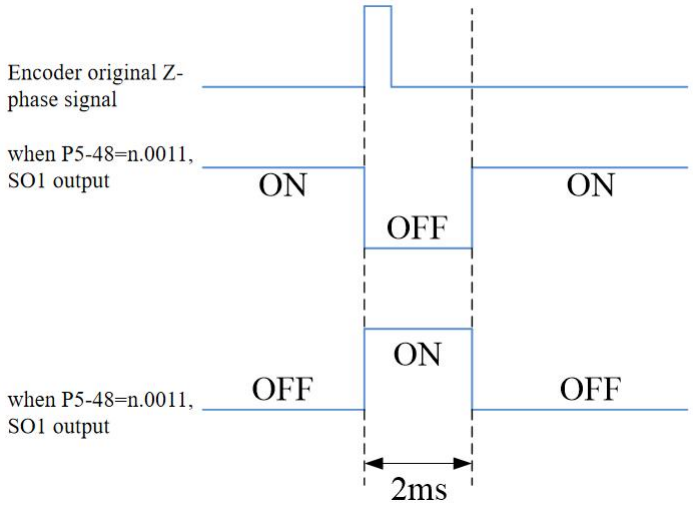
			the connection between SO2 and COM is disconnected.	indicates signal output from terminal SO1.

- When an alarm occurs, the servo unit is forcibly turned off, and the motor will move under external force (including gravity). To maintain motor position, use a motor equipped with a power failure brake (also called a lock-up brake) and apply the /BK signal. Refer to Section 5.2.5.
- No output terminals may be duplicated for the assigned functional parameters.

5.7.5.6 Encoder Z-phase Output (/Z)

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P5-48	Z-phase Output/Z	n.0000	-	0000 ~ 0018	at any time	immediately
P5-19	Z-phase output hold time	2	ms	1 ~ 65535	at any time	immediately

1. The /Z signal can be assigned to other output terminals via parameter P5-48.
2. The Z-axis signal is output as a single pulse with a default width of approximately 2 ms, which can be adjusted via parameter P5-19 and remains independent of the motor's rotational speed.



5.7.5.7 Custom Output Signals

Users can customize two output paths as needed, defined as SOx outputs when A> B or SOx outputs when A <B. A represents nine system-provided trigger conditions, while B is a user-defined comparison value selected from these conditions.

Custom Output 1

P5-10	Custom Output 1 Trigger Condition					
	Default Trigger Condition	Trigger Condition Settings	Unit	Applicable Mode	Revise	Come into force
	0	See table: Optional trigger conditions	With the selected trigger The conditions are related.	All Modes	at any time	immediately
P5-11	Value to compare with the trigger condition for Custom Output 1					
	Set Unit	Factory Settings	Set Range	Applicable Mode	Revise	Come into force
	With the selected trigger The conditions are related.	0	-32768~32767	All Modes	at any time	immediately

P5-12	Output when P5-10 ≥ P5-11; output when SOx has a value if P5-10 <P5-11.					
	Set Value	Function	Factory Value	Applicable Mode	Revise	Come into force
	0	When P5-10 ≥ P5-11, the SOx output is determined.	0	All Modes	at any time	immediately
	1	When P5-10 <P5-11, SOx output is generated.				
	2	When the absolute value of P5-10 is ≥ P5-11, SOx output occurs.				
	3	When the absolute value of P5-10 is ≤ P5-11, SOx output is activated.				

P5-13	Set Custom Output 1 Hysteresis Loop					
	Set Unit	Factory Settings	Set Range	Applicable Mode	Revise	Come into force
	Related to the selected trigger condition	0	0~65535	All Modes	at any time	immediately

P5-52	Custom Output 1 Port Settings			
	Signal Name	Factory Settings	Meaning	Revise
	Custom Output 1	n.0000	Default unallocated	Parameter range: 0000 – 0014,

			terminal output signal	assigned to other output terminals via parameters P5−52

Custom Output 2

P5-14	Custom Output 2 Trigger Condition					
	Default Trigger Condition	Trigger Condition Settings	Unit	Applicable Mode	Revise	Come into force
	0	See table: Optional trigger conditions	Related to the selected trigger condition	All Modes	at any time	immediately
P5-15	Value to compare with the trigger condition for Custom Output 2					
	Set Unit	Factory Settings	Set Range	Applicable Mode	Revise	Come into force
	Related to the selected trigger condition	0	-9999~9999	All Modes	at any time	immediately
P5-16	Output when P5-14 ≥ P5-15; or SOx output when P5-14 <P5-15.					
	Set value	Function	Factory Value	Applicable Mode	Revise	Come into force
	0	When P5-14 ≥ P5-15, SOx output is generated.	0	All Modes	at any time	immediately
	1	When P5-14 <P5-15, SOx output is generated.				
	2	When the absolute value of P5-14 is ≥ P5-15, SOx output occurs.				
	3	When the absolute value of P5-14 is ≤ P5-15, SOx output is generated.				
P5-17	Set Custom Output 2 Hysteresis Loop					
	Set Unit	Factory Settings	Set Range	Applicable Mode	Revise	Come into force
	Related to the selected trigger condition	0	-32768~32767	All Modes	at any time	immediately

P5-53	Custom Output 2: Output Port Configuration			
	Signal Name	Factory Settings	Meaning	Revise
	Custom Output 2	n.0000	Default unallocated terminal output signal	Parameter range: 0000 – 0014, assigned to other output terminals via parameter P5−53



The concept of hysteresis loop is referenced in 5.7.5.2.

Optional Trigger Conditions

Trigger Condition Code	Meaning	Unit
0	not have	-
203	Current Command	rated current %
205	Current Feedback	rated current %
301	Speed Instruction	rpm
302	rate feedback	rpm
308	jitter	rpm
4402	Position Instruction	1 Instruction
4404	position feedback	1 Instruction
1405	position deviation	1 Instruction
502	busbar voltage	V
503	Internal temperature of the drive	℃
506	Average Output Power	W
508	Average Thermal Power	W

5.7.5.8 Other SO Terminal Function Links

Terminal Name	Explain	Quick Link
/COIN-HD	Complete Positioning	5.3.1.2
/COIN	Location Determination Completed	5.3.1.2
/CLT	Torque Limit Detection	5.7.2
/VLT	Speed Limit Detection	5.5.1.2
/MRUN	Internal Location Mode Movement Has Begun	5.3.2.7
/V-RDY	Speed Arrival Signal	5.4.1.3

5.7.6 Input Terminal Functions

5.7.6.1 Proportional Motion Command (/P-CON)

Parameter	Signal Name	Type	Factory Settings	State	Meaning	Revise	Come into force
P5-21	Proportional Action/P-CON	import	n.0000	valid	Run in P-control mode	at any time	immediately
				invalid	Operate in PI control mode		
1. For the P-CON signal, select either PI (proportional-integral) or P (proportional) control as the speed control method. 2. Setting it to P control reduces motor rotation and minor vibrations caused by speed command drift, but simultaneously decreases servo rigidity during stop. 3. The /P-CON signal can be assigned to the input terminals via parameter P5-21.							

5.7.6.2 Alarm Reset (/ALM-RST)

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Come into force
P5-24	/ALM-RST	n.0002	All	Enter a normally open signal at terminal SI2	at any time	immediately
1. Parameter range: 0000–0014, allocated to other input terminals via parameters P5–24. 2. When an alarm occurs, determine the cause and resolve it, then clear the alarm by setting this signal to valid. 3. The /ALM-RST signal can be routed to other terminal inputs via this parameter. Since the alarm signal is critical for the safe operation of the servo system, the /ALM-RST signal should not be set to always active (n.0010).						

5.7.6.3 Other SI Terminal Function Links

Terminal Name	Explain	Quick Link
/S-ON	Server Enablement	5.2.2
/P-OT	Forward drive is prohibited	5.2.4
/N-OT	Reverse Drive Prohibited	5.2.4
/P-CL	Forward rotation and external torque limitation	5.7.2
/N-CL	Reverse Side External Torque Limit	5.7.2
/SPD-D	Internal Speed Direction	5.4.2

Terminal Name	Explain	Quick Link
/SPD-A	Internal Set Speed	5.4.2
	Position Mode Reference Origin Trigger	5.3.1.8
/SPD-B	Internal Set Speed	5.4.2
	Position Mode Reference Origin Trigger	5.3.1.8
/C-SEL	Control Method Selection	5.1.2
/ZCLAMP	Zero Clamping	5.4.1.2
/INHIBIT	Instruction Pulse Prevention	5.3.3.4
/PREFA	Internal Location Selection Signal	5.3.2.1
/PREFB	Internal Location Selection Signal	5.3.2.1
/PREFC	Internal Location Selection Signal	5.3.2.1
/PREFD	Internal Location Selection Signal	5.3.2.1

5.8 Encoder ABZ Phase Division Output

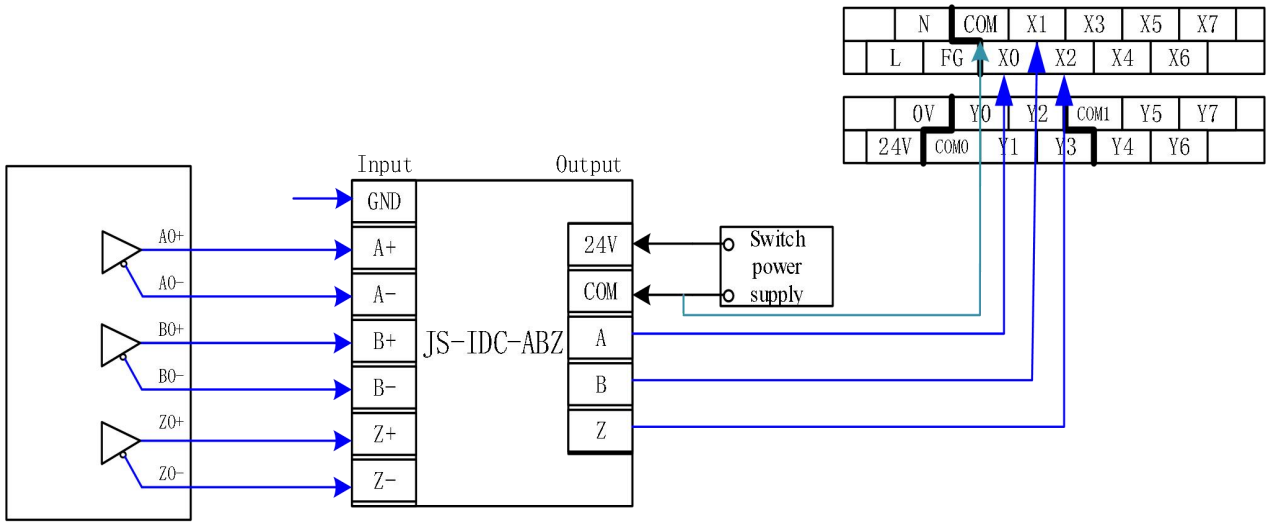
The servo drive generates a differential signal via a frequency-dividing output circuit and a differential driver, providing position signals for the host device or pulse signals for the driven servo unit to achieve precise synchronization between master and slave axes.

1. Encoder Frequency Division Output Specifications

Terminal Name	Terminal Pin Number [Port CN0]	Terminal Functions
OA+	35	Phase-A frequency-divided signal output
OA-	36	
OB+	37	B-phase frequency-divided signal output
OB-	38	
OZ+	39	Z-phase frequency-divided signal output
OZ-	40	

2. Circuit Diagram

The encoder frequency-divided output circuit generates a differential signal via a differential driver and, when used with the JS-IDC-ABZ differential board, provides closed-loop feedback signals for the host device in forming a position control system.



3. Number of feedback pulses per encoder revolution setting

<table>
<tr><td rowspan="3">P0-17</td><td colspan="6">Frequency Division Output Enable Switch (-supported in versions 4230 and above)</td></tr>
<tr><td>Set value</td><td>Function</td><td>Factory Value</td><td>Applicable Mode</td><td>Revise</td><td>Come into force</td></tr>
<tr><td>0
1</td><td>Turn off frequency division output
Enable frequency division output</td><td>1</td><td>All</td><td>servo bb</td><td>immediately</td></tr>
<tr><td rowspan="3">P0-18</td><td colspan="6">Set the number of feedback pulses per encoder revolution (low bit)</td></tr>
<tr><td>Set Unit</td><td>Factory Settings</td><td>Set Range</td><td>Applicable Mode</td><td>Modify Time</td><td>Effectiveness Time</td></tr>
<tr><td>1</td><td>2500</td><td>0~9999</td><td>All</td><td>servo bb</td><td>immediately</td></tr>
<tr><td rowspan="3">P0-19</td><td colspan="6">Set the number of feedback pulses per encoder revolution (high bit)</td></tr>
<tr><td>Set Unit</td><td>Factory Settings</td><td>Set Range</td><td>Applicable Mode</td><td>Modify Time</td><td>Effectiveness Time</td></tr>
<tr><td>10000</td><td>0</td><td>0~9999</td><td>All</td><td>servo bb</td><td>immediately</td></tr>
<tr><td rowspan="3">P0-20</td><td colspan="6">Encoder feedback pulse output frequency division (numerator)</td></tr>
<tr><td>Set Unit</td><td>Factory Settings</td><td>Set Range</td><td>Applicable Mode</td><td>Modify Time</td><td>Effectiveness Time</td></tr>
<tr><td>-</td><td>1</td><td>0~65535</td><td>All</td><td>servo bb</td><td>immediately</td></tr>
<tr><td rowspan="3">P0-21</td><td colspan="6">Encoder feedback pulse output frequency division (denominator)</td></tr>
<tr><td>Set Unit</td><td>Factory Settings</td><td>Set Range</td><td>Applicable Mode</td><td>Modify Time</td><td>Effectiveness Time</td></tr>
<tr><td>-</td><td>1</td><td>0~65535</td><td>All</td><td>servo bb</td><td>immediately</td></tr>
</table>

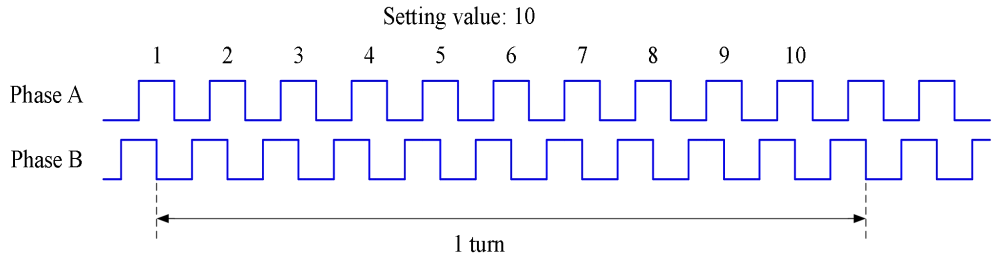
Explain ：

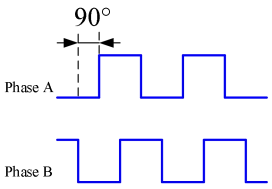
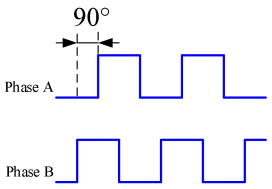
1) Pulse count per revolution: P0-19 × 10,000 + P0-18. The parameters P0-18 to P0-21 all relate to encoder feedback; P0-18 and P0-19 form one pair, while P0-20 and P0-21 form another. However, the priority of pulse count per revolution for P0-18 and P0-19 exceeds that of the feedback pulse output division (P0-20 and P0-21). Division settings for P0-20 and P0-21 only activate when both P0-18 and P0-19 are set to 0.

For instance, a magnetic absolute encoder motor (CN) requires 10,000 pulses per revolution for feedback. You can set P0-18 = 0000 and P0-19 = 0001, or configure the encoder's feedback division ratio as P0-20/P0-21 = required feedback pulses per revolution / encoder resolution = 10,000 / 524,288 = 625 / 32,768. In this case, set P0-18 = P0-19 = 0, P0-20 = 625, and P0-21 = 32,768.

2) Encoder feedback is output via port CN0. When using single-phase counting, the count value per motor revolution equals the set value; when using AB-phase counting, it equals four times the set value. The pulse receiver should employ AB-phase counting.

3) Assuming a feedback pulse count of 10 per cycle, the encoder's frequency division pulse outputs A-phase (PAO) and B-phase (PBO) signals as follows:



<table>
<tr><td rowspan="5">P0-87.0</td><td colspan="6">Encoder feedback output direction selection</td></tr>
<tr><td>Set value</td><td>Function</td><td>Factory Value</td><td>Applicable Mode</td><td>Revise</td><td>Come into force</td></tr>
<tr><td>0</td><td>Phase A leads phase B in terms of rotation direction.</td><td rowspan="2">0</td><td rowspan="2">All</td><td rowspan="2">servo OFF</td><td rowspan="2">immediately</td></tr>
<tr><td>1</td><td>Phase B leads phase A in terms of direction (positive rotation).</td></tr>
<tr><td colspan="3">The A-phase is advanced relative to the B-phase during forward rotation.</td><td colspan="3">During forward rotation, Phase A lags behind Phase B.</td></tr>
<tr><td colspan="3"> 
</td><td colspan="3"> 
</td></tr>
<tr><td rowspan="4">P0-87.1</td><td colspan="6">Differential feedback output in Z-phase mode</td></tr>
<tr><td>Set value</td><td>Function</td><td>Factory Value</td><td>Applicable Mode</td><td>Revise</td><td>Come into force</td></tr>
<tr><td>0</td><td>Do not output the Z-phase pulse</td><td rowspan="2">0</td><td rowspan="2">All</td><td rowspan="2">servo OFF</td><td rowspan="2">immediately</td></tr>
<tr><td>1</td><td>Output Z-phase pulse</td></tr>
<tr><td rowspan="3">P5-19</td><td colspan="6">Z-phase pulse width</td></tr>
<tr><td>Set Unit</td><td>Factory Settings</td><td>Set Range</td><td>Applicable Mode</td><td>Modify Time</td><td>Effectiveness Time</td></tr>
<tr><td>ms</td><td>2</td><td>1~65535</td><td>All</td><td>at any time</td><td>immediately</td></tr>
</table>

5.9 Weak Magnetic Control (Supported in versions 4230 and above)

5.9.1 Overview of Weak Magnetic Function

For servo-driven permanent magnet synchronous motors, weak magnetic control is a control method that operates the motor above its rated speed by reducing the motor's magnetic field, while complying with the inverter's maximum voltage and current limits. This approach expands the speed regulation range of permanent magnet synchronous motors.



When using the weak magnetic function, the motor speed must not exceed its maximum limit to prevent motor failure or personal or property damage.

5.9.2 Settings for Weak Magnetic Correlation Parameters

Servo weak magnetic control switch PE-01.3, 0 (default): Off – weak magnetic function disabled; 1: On – weak magnetic function enabled.

When enabling the weak magnetic function on the servo, you must match the correct motor parameters such as back electromotive force coefficient, Ld, and Lq. For specific usage conditions and parameter settings, please contact the original manufacturer's technical support.

Parameter	Parameter Name	Unit	Scope	Effectiveness Time	Default
PE-01.3	Weak Magnetic Control Switch	—	0-1	at any time	0
PE-80	Weak magnetic control gain Kv	Hz	10-1000	at any time	30
PE-81	Integrating time constant Ti for weak magnetic control	%	10-1000	at any time	16
PE-82	Weak magnetic control integrated limiting	%	0-200	at any time	60
PE-83	Voltage Command Limit Threshold	%	50-150	at any time	115
PE-84	IdRef amplitude limiting	%	50-150	at any time	95
PE-85	Main Loop Voltage Smoothing Filter Time	0.1ms	0-1000	at any time	20

6. CANopen Bus Communication (supported only in 22/32 power segments)

CANopen is a high-level protocol built upon the CAN (Control Local Area Network) serial bus system and the CAL (CAN Application Layer). It assumes that connected devices are equipped with hardware featuring a CAN transceiver compliant with ISO 11898 standards and a CAN controller.

The CANopen communication protocol CiA DS-301 supports both periodic and event-driven communication, effectively minimizing bus load while ensuring ultra-short response times. It delivers high communication performance at low baud rates, thereby reducing electromagnetic compatibility issues and lowering cable costs.

The CANopen device protocol defines a mechanism for direct access to servo parameters and enables time-critical process data communication.

6.1 Object Dictionary Area Allocation

CANopen communication primarily employs several operation modes to control various parameters of servo motors and enable additional auxiliary functions. For further details, refer to the CAN documentation published by the International Society of Automation Users and Manufacturers (www.can-cia.de).

CAL provides all network management services and packet transmission protocols, but does not specify the content of objects or the types of communicating entities (it only defines how, not what)—precisely where CANopen excels.

Developed based on CAL, CANopen utilizes a subset of CAL's communication and service protocols, offering an implementation solution for distributed control systems. It ensures interoperability among network nodes while allowing flexible functional expansion — ranging from simple to complex capabilities.

All objects of CANopen are configured within the object dictionary of each group using a 16-bit index configuration address represented in 4-digit hexadecimal format.

The object dictionaries specified in CiA402 for CoE (CANopen over EtherCAT) and those for the DS5K2 series servos are as follows:

The object dictionary specified in CiA402		DS5K2 Series Object Dictionary	
Index	Content	Index	Content
0000h ~ 0FFFh	Data Type Region	0000h ~ 0FFFh	Data Type Region
1000h ~ 1FFFh	COE Communication Area	1000h ~ 1FFFh	Data Type Region
2000h ~ 5FFFh	Manufacturer Custom Area	2000h ~ 2FFFh	Servo Parameter Region (Group P)
		3000h ~ 3FFFh	Servo Parameter Region (Group U)

		4000h ~ 4FFFh	Servo Parameter Region (Group F)
		5000h ~ 5FFFh	Keep
6000h ~ 9FFFh	Profile region	6000h ~ 6FFFh	Driver Profile Area
		7000h ~ 9FFFh	CiA402 Motion Control Device Sub-Protocol Area
A000h ~ FFFFh	Keep	A000h ~ FFFFh	Keep

6.1.1 Overview Table of Object Dictionary for CANopen Bus Communication Zones (DS301)

Index of matrix	Subindex	Object type	Name	Data type	Read/Write Capability	PDO Mapping
1000	-	VAR	Device type	UINT32	RO	NO
1001	-	VAR	Error register	UINT8	RO	NO
1003	-	ARRAY	Pre-defined Error Field	-	-	-
	01	VAR	Standard Error Field	UINT32	RO	NO
	02	VAR	Standard Error Field	UINT32	RO	NO
	03	VAR	Standard Error Field	UINT32	RO	NO
	04	VAR	Standard Error Field	UINT32	RO	NO
1005	-	VAR	COB-ID SYNC	UINT32	RW	NO
1006	-	VAR	Communication Cycle Period	UINT32	RW	NO
1007	-	VAR	Sync Windows Length	UINT32	RW	NO
1008	-	VAR	Manufacturer Device Name	STRING	-	-
1009	-	VAR	Manufacturer Hardware Version	STRING	-	-
100A	-	VAR	Manufacturer Software Version	STRING	-	-
100B	-	VAR	Device ID	UINT8	RW	NO
100C	-	VAR	Guard Time	UINT16	RW	NO
100D	-	VAR	Life Time Factor	UINT8	RW	NO
1010	-	ARRAY	Store Parameter Field	-	-	-
	01	VAR	Save All Parameters	UINT32	RW	NO
	02	VAR	Save Communication Parameters	UINT32	RW	NO
	03	VAR	Save APPlication Parameters	UINT32	RW	NO
1011	-	ARRAY	Restore Default Parameters	-	-	-
	01	VAR	Restore all Default	UINT32	RW	NO

Index of matrix	Subindex	Object type	Name	Data type	Read/Write Capability	PDO Mapping
			Parameters			
	02	VAR	Restore Communication Default Parameters	UINT32	RW	NO
	03	VAR	Restore APPlication Default Parameters	UINT32	RW	NO
1014	-	VAR	COB-ID EMCY	UINT32	RW	NO
1017	-	VAR	Producer Heartbeat Time	UINT16	RW	NO
1018	-	-	Identity Object	-	-	-
	01	VAR	Vendor ID	UINT32	RO	NO
	02	VAR	Product Code	UINT32	RO	NO
	03	VAR	Revision Number	UINT32	RO	NO
	04	VAR	Serial Number	UINT32	RO	NO
1400	-	RECORD	1. receive PDO parameter	-	-	-
	01	VAR	COB-ID used by PDO	UINT32	RW	NO
	02	VAR	transmission type	UINT8	RW	NO
1401	-	RECORD	2. receive PDO parameter	-	-	-
	01	VAR	COB-ID used by PDO	UINT32	RW	NO
	02	VAR	transmission type	UINT8	RW	NO
1402	-	RECORD	3. receive PDO parameter	-	-	-
	01	VAR	COB-ID used by PDO	UINT32	RW	NO
	02	VAR	transmission type	UINT8	RW	NO
1403	-	RECORD	4. receive PDO parameter	-	-	-
	01	VAR	COB-ID used by PDO	UINT32	RW	NO
	02	VAR	transmission type	UINT8	RW	NO
1600	-	RECORD	1. receive PDO maPPing	-	-	-
	01	VAR	1. maPPed object	UINT32	RW	NO
	02	VAR	2. maPPed object	UINT32	RW	NO
	03	VAR	3. maPPed object	UINT32	RW	NO
	04	VAR	4. maPPed object	UINT32	RW	NO
	05	VAR	5. maPPed object	UINT32	RW	NO
	06	VAR	6. maPPed object	UINT32	RW	NO
	07	VAR	7. maPPed object	UINT32	RW	NO
	08	VAR	8. maPPed object	UINT32	RW	NO
1601	-	RECORD	2. receive PDO maPPing	-	-	-
	01	VAR	1. maPPed object	UINT32	RW	NO
	02	VAR	2. maPPed object	UINT32	RW	NO
	03	VAR	3. maPPed object	UINT32	RW	NO
	04	VAR	4. maPPed object	UINT32	RW	NO
	05	VAR	5. maPPed object	UINT32	RW	NO
	06	VAR	6. maPPed object	UINT32	RW	NO
	07	VAR	7. maPPed object	UINT32	RW	NO
	08	VAR	8. maPPed object	UINT32	RW	NO

Index of matrix	Subindex	Object type	Name	Data type	Read/Write Capability	PDO Mapping
1602	-	RECORD	3. receive PDO maPPing	-	-	-
	01	VAR	1. maPPed object	UINT32	RW	NO
	02	VAR	2. maPPed object	UINT32	RW	NO
	03	VAR	3. maPPed object	UINT32	RW	NO
	04	VAR	4. maPPed object	UINT32	RW	NO
	05	VAR	5. maPPed object	UINT32	RW	NO
	06	VAR	6. maPPed object	UINT32	RW	NO
	07	VAR	7. maPPed object	UINT32	RW	NO
	08	VAR	8. maPPed object	UINT32	RW	NO
1603	-	RECORD	4. receive PDO maPPing	-	-	-
	01	VAR	1. maPPed object	UINT32	RW	NO
	02	VAR	2. maPPed object	UINT32	RW	NO
	03	VAR	3. maPPed object	UINT32	RW	NO
	04	VAR	4. maPPed object	UINT32	RW	NO
	05	VAR	5. maPPed object	UINT32	RW	NO
	06	VAR	6. maPPed object	UINT32	RW	NO
	07	VAR	7. maPPed object	UINT32	RW	NO
	08	VAR	8. maPPed object	UINT32	RW	NO
1800	-	RECORD	1. transmit PDO parameter	-	-	-
	01	VAR	COB-ID used by PDO	UINT32	RW	NO
	02	VAR	transmission type	UINT8	RW	NO
1801	-	RECORD	2. transmit PDO parameter	-	-	-
	01	VAR	COB-ID used by PDO	UINT32	RW	NO
	02	VAR	transmission type	UINT8	RW	NO
1802	-	RECORD	3. transmit PDO parameter	-	-	-
	01	VAR	COB-ID used by PDO	UINT32	RW	NO
	02	VAR	transmission type	UINT8	RW	NO
1803	-	RECORD	4. transmit PDO parameter	-	-	-
	01	VAR	COB-ID used by PDO	UINT32	RW	NO
	02	VAR	transmission type	UINT8	RW	NO
1A00	-	RECORD	1. transmit PDO maPPing	-	-	-
	01	VAR	1. maPPed object	UINT32	RW	NO
	02	VAR	2. maPPed object	UINT32	RW	NO
	03	VAR	3. maPPed object	UINT32	RW	NO
	04	VAR	4. maPPed object	UINT32	RW	NO
	05	VAR	5. maPPed object	UINT32	RW	NO
	06	VAR	6. maPPed object	UINT32	RW	NO
	07	VAR	7. maPPed object	UINT32	RW	NO
	08	VAR	8. maPPed object	UINT32	RW	NO
1A01	-	RECORD	2. transmit PDO maPPing	-	-	-
	01	VAR	1. maPPed object	UINT32	RW	NO
	02	VAR	2. maPPed object	UINT32	RW	NO

Index of matrix	Subindex	Object type	Name	Data type	Read/Write Capability	PDO Mapping
	03	VAR	3. maPPed object	UINT32	RW	NO
	04	VAR	4. maPPed object	UINT32	RW	NO
	05	VAR	5. maPPed object	UINT32	RW	NO
	06	VAR	6. maPPed object	UINT32	RW	NO
	07	VAR	7. maPPed object	UINT32	RW	NO
	08	VAR	8. maPPed object	UINT32	RW	NO
1A02	-	RECORD	3. transmit PDO maPPing	-	-	-
	01	VAR	1. maPPed object	UINT32	RW	NO
	02	VAR	2. maPPed object	UINT32	RW	NO
	03	VAR	3. maPPed object	UINT32	RW	NO
	04	VAR	4. maPPed object	UINT32	RW	NO
	05	VAR	5. maPPed object	UINT32	RW	NO
	06	VAR	6. maPPed object	UINT32	RW	NO
	07	VAR	7. maPPed object	UINT32	RW	NO
	08	VAR	8. maPPed object	UINT32	RW	NO
1A03	-	RECORD	4. transmit PDO maPPing	-	-	-
	01	VAR	1. maPPed object	UINT32	RW	NO
	02	VAR	2. maPPed object	UINT32	RW	NO
	03	VAR	3. maPPed object	UINT32	RW	NO
	04	VAR	4. maPPed object	UINT32	RW	NO
	05	VAR	5. maPPed object	UINT32	RW	NO
	06	VAR	6. maPPed object	UINT32	RW	NO
	07	VAR	7. maPPed object	UINT32	RW	NO
	08	VAR	8. maPPed object	UINT32	RW	NO
Note: Items marked with "-" in the table indicate that the object dictionary does not have the corresponding attribute.						

6.1.2 Overview Table of Custom Area Object dictionaries

The object dictionary in the custom zone corresponds one-to-one with the parameters of the servo driver's host computer. Only the parameters in Group U of this dictionary possess PDO mapping capability, enabling PDO reading; all other dictionaries support only SDO-based operations. The corresponding rules are as follows:

Object Dictionary Index	Corresponding drive parameters	
2000	P0 Group Parameters	P0-00
2001		P0-01
.....		.....
205F		P0-95
2100	Parameter Group P1	P1-00

Object Dictionary Index	Corresponding drive parameters	
2101		P1-01
.....		.....
2142		P1-66
2200	Group P2 Parameters	P2-00
2201		P2-01
.....		.....
2255		P2-85
2300	Group P3 Parameters	P3-00
2301		P3-01
.....		.....
232D		P3-45
2500	Group P5 Parameters	P5-00
2501		P5-01
.....		.....
2547		P5-71
2605	P6 Group Parameters	P6-05
2607		P6-07
2608		P6-08
260C		P6-12
2700	Group P7 Parameters	P7-00
2701		P7-01
.....		.....
271F		P7-31
2800	Group P8 Parameters	P8-00
2801		P8-01
.....		.....
2817		P8-23
3000	Group U0 Parameters	U0-00
3001		U0-01
.....		.....
3061		U0-97
3100	U1 Group Parameters	U1-00
3101		U1-01
.....		.....
311A		U1-26
3200	U2 Group Parameters	U2-00

Object Dictionary Index	Corresponding drive parameters	
3201		U2-01
.....		.....
3218		U2-24
3300	U3 Group Parameters	U3-00
3301		U3-01
3302		U3-02
3346		U3-70
4000	F0 Group Parameters	F0-00
4001		F0-01
4002		F0-02
4100	F1 Group Parameters	F1-00
4101		F1-01
4105		F1-05
4106		F1-06

6.1.3 List of Object dictionaries for the Sub-Protocol Area of Motion Control Equipment (CiA402)

Index of matrix	Subindex	Target type	Name	Data type	Read/Write Capability	PDO	Op-mode
6040h	00h	VAR	Controlword	U16	RW	YES	All
			Control Word. See 4.6.2.2 for details				
6041h	00h	VAR	Statusword	U16	RO	YES	All
			State Byte. See 4.6.2.3 for details				
605Ah	00h	VAR	Quickstop Option Code	I16	RW	NO	All
			Used to specify the action when the servo drive system receives an emergency stop command. The default value is 2; see Section 5.6.2.5 for details.				
605Bh	00h	VAR	Shutdown option code	I16	RW	NO	All
			Set the motor deceleration stop method for receiving PDS commands "Shutdown" and "Disable voltage". The default value is 0; see Section 5.6.2.5 for details.				
605Ch	00h	VAR	Disable operation option code	I16	RW	NO	All
			Set the motor deceleration stop method when receiving the PDS command "Disable operation". The default value is 1; see Section 5.6.2.5 for details.				
605Dh	00h	VAR	Halt option code	I16	RW	NO	All
			Set the motor deceleration stop method when receiving the "Halt"				

Index of matrix	Subindex	Target type	Name	Data type	Read/Write Capability	PDO	Op-mode
			command. The default value is 1; see 5.6.2.5 for details.				
605Eh	00h	VAR	Fault reaction option code	I16	RW	NO	All
			Set the motor stop method when an alarm occurs. The default value is 2; see Section 5.6.2.5 for details.				
6060h	00h	VAR	Modes of Operation	I8	RW	YES	All
			Used to set the control mode of the servo driver. See 5.6.2.4 for details				
6061h	00h	VAR	Modes of Operation Display	I8	RO	YES	All
			Displays the current control mode of the servo driver. See 5.6.2.4 for details				
6062h	00h	VAR	Position Demand Value	I32	RW	YES	PP,HM
			Output value of the position trajectory generator.				
6063h	00h	VAR	Position Actual Internal Value	I32	RO	YES	All
			The actual internal position information provided by the servo motor's feedback system constitutes the feedback for the position loop.				
6064h	00h	VAR	Position Actual Value	I32	RO	YES	All
			Actual position information from the servo motor feedback.				
606Bh	00h	VAR	Velocity Demand Value	I32	RO	YES	PV
			The output value of the speed trajectory generator serves as the input to the speed loop.				
606Ch	00h	VAR	Velocity Actual Value	I32	RO	YES	All
			The actual speed information provided by the servo motor's feedback system constitutes the feedback for the speed loop.				
6071h	00h	VAR	Target Torque	I16	RW	YES	TQ
			The user-defined torque input for the servo driver in TQ mode, measured in 0.1% of the rated torque, is valid only during this mode.				
6072h	00h	VAR	Max Torque	U16	RW	YES	All
			The maximum torque achievable by the servo drive system is 0.1% of the rated torque, with a default value of 3000 (equivalent to 300% of the rated torque).				
6073h	00h	VAR	Max Current	U16	RW	YES	All
			The maximum current a servo motor can withstand is 0.1% of its rated current, with a default value of 3000 (equivalent to 300% of the rated current).				
6074h	00h	VAR	Torque Demand Value	I16	RW	YES	All
			Torque command: input to the torque ring, measured in 0.1% of the rated torque.				
6075h	00h	VAR	Motor Rated Current	U32	RO	YES	All
			The system automatically determines the servo motor's rated current based on its parameters, typically requiring no user intervention; this				

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Target type</th><th>Name</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td></td><td></td><td></td><td colspan="5">value is expressed as 0.1% of the rated current.</td></tr>
<tr><td rowspan="2">6076h</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Motor Rated Torque</td><td>U32</td><td>RO</td><td>YES</td><td>All</td></tr>
<tr><td colspan="5">The system automatically determines the servo motor's rated torque based on its parameters, typically requiring no user intervention; it is expressed as 0.1% of the rated torque.</td></tr>
<tr><td rowspan="2">6077h</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Torque Actual Value</td><td>I16</td><td>RO</td><td>YES</td><td>All</td></tr>
<tr><td colspan="5">The actual torque of the servo motor, i.e., the feedback from the torque loop, is equal to 0.1% of the rated torque.</td></tr>
<tr><td rowspan="2">6078h</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Current Actual Value</td><td>I16</td><td>RO</td><td>YES</td><td>All</td></tr>
<tr><td colspan="5">The actual shaft current of a servo motor is 0.1% of the rated current.</td></tr>
<tr><td rowspan="2">6079h</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>DC Link Circuit Voltage</td><td>U32</td><td>RO</td><td>YES</td><td>All</td></tr>
<tr><td colspan="5">The DC bus voltage of the servo driver is 0.001 V.</td></tr>
<tr><td rowspan="2">607Ah</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Target Position</td><td>I32</td><td>RW</td><td>YES</td><td>PP</td></tr>
<tr><td colspan="5">The user's target position when the servo driver is in PP mode, measured in command units, is valid only in PP mode.</td></tr>
<tr><td rowspan="2">607Eh</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Polarity</td><td>U8</td><td>RW</td><td>YES</td><td>All</td></tr>
<tr><td colspan="5">User command polarity, which consists of 8 bits, as shown in the table below:
<table>
<tr><th>Bit7</th><th>Bit6</th><th>Bit5</th><th>Bit0-4</th></tr>
<tr><td>position polarity</td><td>velocity polarity</td><td>torque polarity</td><td>reserved</td></tr>
</table>
When BitX (X = 5, 6, 7) is 0, it indicates a forward instruction from the user.
When BitX (X = 5, 6, 7) is 1, it indicates that the user command is a negative instruction.</td></tr>
<tr><td rowspan="2">607Fh</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Max Profile Velocity</td><td>U32</td><td>RW</td><td>YES</td><td>PP,PV,HM</td></tr>
<tr><td colspan="5">The maximum operating speed of the servo motor, measured in command units per second, is valid for control modes other than TQ. The default value is 1000000 (0xF4240).</td></tr>
<tr><td rowspan="2">6080h</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Max Motor Speed</td><td>U32</td><td>RW</td><td>YES</td><td>ALL</td></tr>
<tr><td colspan="5">The maximum speed of a servo motor during operation, measured in revolutions per minute (r/min). The default value is 6000 (0x1770).</td></tr>
<tr><td rowspan="2">6081h</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Profile Velocity</td><td>U32</td><td>RW</td><td>YES</td><td>PP</td></tr>
<tr><td colspan="5">When performing position trajectory planing, the speed achieved upon completion of the motor acceleration process is measured in command units per second and applies exclusively in PP mode.</td></tr>
<tr><td rowspan="2">6083h</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Profile Acceleration</td><td>U32</td><td>RW</td><td>YES</td><td>PP,PV</td></tr>
<tr><td colspan="5">When performing position trajectory planing or velocity trajectory planing, the acceleration during motor acceleration is measured in command units/s² and applies only to PP mode and PV mode. The default value is 5000000.</td></tr>
</table>

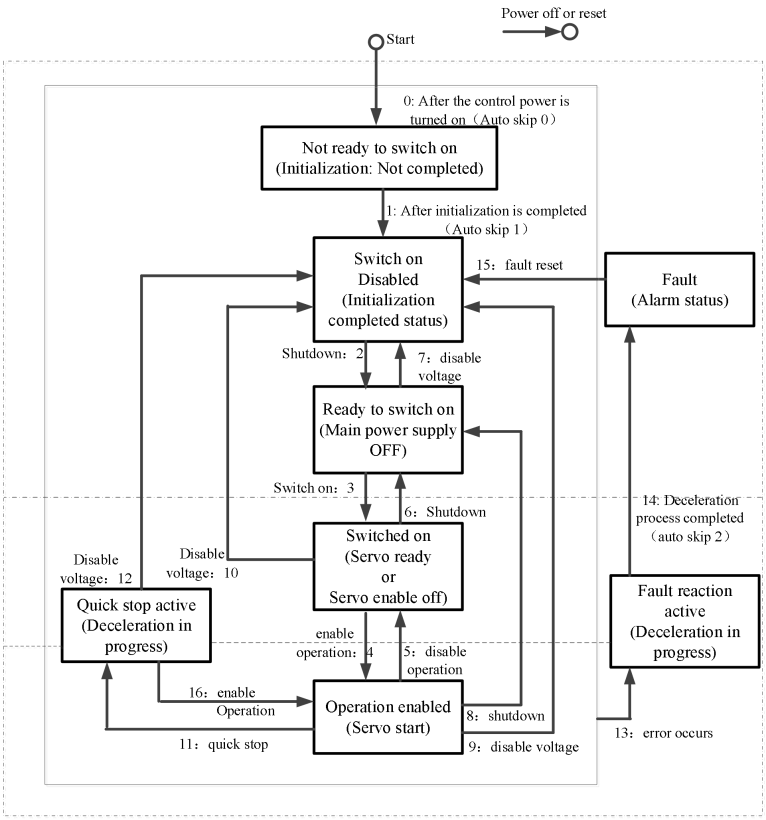
Index of matrix	Subindex	Target type	Name	Data type	Read/Write Capability	PDO	Op-mode
6084h	00h	VAR	Profile Deceleration	U32	RW	YES	PP,PV
			When performing position trajectory planing or velocity trajectory planing, the deceleration during motor reduction is measured in command units/s² and applies only to PP mode and PV mode. The default value is 5000000.				
6085h	00h	VAR	Quick Stop Declaration	U32	RW	YES	PP,PV,HM
			The deceleration rate for emergency stop when the servo drive system receives an emergency stop command, measured in command units/s², is valid in control modes other than TQ. The default value is 10000000.				
6087h	00h	VAR	Torque Slope	U32	RW	YES	TQ
			The torque variation rate used when changing the torque command in a servo drive system is measured in 0.1% of the rated torque per second and is valid only in TQ mode.				
6098h	00h	VAR	Homing Method	I8	RW	YES	HM
			Used to set the zero-setting method for the servo drive system, valid only in HM mode.				
6099h	00h	RECORD	Homing Speeds	-	-	-	HM
			It has two sub indexes, both of which are valid only in the HM mode.				
	01h	VAR	Speed during Search Switch	U32	RW	YES	HM
			The speed at which a servo motor searches for a Switch signal, measured in command units per second. The default value is 10000.				
	02h	VAR	Speed during Search Zero	U32	RW	YES	HM
			The speed of a servo motor when searching for the zero signal, measured in command units per second. The default value is 5000.				
609Ah	00h	VAR	Homing Acceleration	U32	RW	YES	HM
			The acceleration and deceleration values used by the servo motor during zero return movement are measured in command units/s² and apply only in HM mode. The default value is 20000.				
60C5h	00h	VAR	Max Acceleration	U32	RW	YES	PP,PV,HM
			The maximum allowable acceleration of a servo motor during acceleration, measured in command units/s², valid in PP, PV, and HM modes. The default value is 4294967295.				
60C6h	00h	VAR	Max Deceleration	U32	RW	YES	PP,PV,HM
			The maximum allowable deceleration of a servo motor during reduction, measured in command units/s², valid in PP, PV, and HM modes. The				

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Target type</th><th>Name</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td></td><td></td><td></td><td colspan="5">default value is 4294967295.</td></tr>
<tr><td rowspan="2">60F4h</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Following Error Actual Value</td><td>I32</td><td>RO</td><td>YES</td><td>PP,HM</td></tr>
<tr><td colspan="5">The position deviation of the servo drive system during position control, defined as 0x60F4 = 0x6062 − 0x6064, is valid in both PP and HM modes.</td></tr>
<tr><td rowspan="2">60FCh</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Position Demand Internal Value</td><td>I32</td><td>RO</td><td>YES</td><td>PP,HM</td></tr>
<tr><td colspan="5">Object dictionary 0x6062 is the result of motion polarity processing by object dictionary 0x607E (Polarity) and serves as the input to the position loop.</td></tr>
<tr><td rowspan="2">60FDh</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Digital Inputs</td><td>U32</td><td>RO</td><td>YES</td><td>All</td></tr>
<tr><td colspan="5">The functional signals assigned via host parameters P5-22 (POT), P5-23 (NOT), and P5-27 (SPD-D) respectively indicate the input states of POT, NOT, and SPD-D. Each signal has 32 bits, as shown in the table below:
<table>
<tr><th>Bit31~Bit3</th><th>Bit2</th><th>Bit1</th><th>Bit0</th></tr>
<tr><td>reserved</td><td>SPD-D</td><td>POT</td><td>NOT</td></tr>
</table></td></tr>
<tr><td rowspan="2">60FFh</td><td rowspan="2">00h</td><td rowspan="2">VAR</td><td>Target Velocity</td><td>I32</td><td>RW</td><td>YES</td><td>PV</td></tr>
<tr><td colspan="5">The user-defined target speed for the servo driver in PV mode, measured in command units per second, is valid exclusively during this mode.</td></tr>
</table>

6.2 CiA402 Motion Control Specifications

6.2.1 PDS (Power Drive Systems) Specifications

The core of the CiA402 motion control protocol is the PDS (Power Drive System) state machine, which defines and controls the states of the servo drive system as well as transitions between them. State transitions are governed by the 0x6040 Control Word, and the detailed transition relationships among these eight states are illustrated in the figure below:



After migrating to Operation enabled, increase the response time to above 100 ms and enter the action command.

The table below shows PDS state transition events (transition conditions) and actions performed during transitions.

During PDS migration, the state transition occurs simultaneously with the handshake process (using 6041h: Statusword to confirm state change before sending the next migration command).

PDS Conversion		Event	Movement
0	Auto skip 0	Automatically migrates after power-on or application-layer reset.	Automatically migrates after power-on or application-layer reset.
1	Auto skip 1	Automatically convert after initialization is complete.	Communication is established.
2	Shutdown	The scenario where the shutdown command is received.	Nothing special.
3	Switch on	When the power supply is ON, it receives a Switch on command.	Nothing special.
4	Enable operation	Conditions for receiving the Enable operation command.	The drive function is working properly. Additionally, all previous set-point data have been cleared.
5	Disable operation	Conditions for receiving the disable operation command.	The drive function is invalid.
6	Shutdown	When the power supply is ON, receiving a shutdown command. When the detected power supply is in OFF state.	Nothing special.
7	Disable voltage	When the disable voltage command is received.	Nothing special.

PDS Conversion		Event	Movement
		When the Quick Stop command is received.	
8	Shutdown	This occurs when the power supply is on and a shutdown command is received.	Drive function is invalid
9	Disable voltage	When the disable voltage command is received.	Drive function is invalid
10	Disable voltage	When the disable voltage command is received. When the Quick Stop command is received.	Nothing special.
11	Quick stop	When the Quick Stop command is received.	Run the Quick Stop function.
12	Disable voltage	The Quick Stop occurs when the selected code is set to 1, 2, or 3 and the Quick Stop action has been completed. This occurs when the Quick Stop selection code is set to 5, 6, or 7, and after the Quick Stop action has completed, upon receiving the Disable Voltage command. When the detected power supply is in OFF state.	The drive function is disabled.
13	Error occurs	Abnormal detection cases.	Execute the Fault Reaction function.
14	Auto skip 2	After completing the anomaly detection and reduction processing, automatic migration will occur.	Drive function is invalid
15	Fault reset	The situation where a fault reset instruction is received after the cause of the anomaly has been eliminated.	No fault factors were detected; the fault status has been reset.
16	Enable operation	The Quick Stop function is activated when the selected code values are 5, 6, or 7 upon receiving the Enable Operation command.	Optimize the driving function.

6.2.2 Controlword (6040h)

Commands for PDS state transitions and control of the slave unit (servo driver) are configured using the 6040h control word.

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Name</th><th>Scope</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td rowspan="2">6040h</td><td rowspan="2">00h</td><td>Controlword</td><td>0~65535</td><td>U16</td><td>RW</td><td>RxPDO</td><td>All</td></tr>
<tr><td colspan="6">Set control commands for servo drivers such as PDS state transitions.
bit information
<table>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td></tr>
<tr><td colspan="7">r</td><td>h</td></tr>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>fr</td><td colspan="3">oms</td><td>eo</td><td>qs</td><td>ev</td><td>so</td></tr>
</table>
r = reserved (not mapped) fr = fault reset
oms = operation mode specific eo = enable operation
(Control mode-dependent bit) qs = Quick Stop
h = halt ev = enable voltage
so = switch on</td></tr>
</table>

Command	Bits of the controlword					PDS change
	bit7	bit3	bit2	bit1	bit0	
	Fault reset	Enable operation	Quick stop	Enable voltage	Switch on	
Shutdown	0	-	1	1	0	2，6，8
Switch on	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3+4
Enable operation	0	1	1	1	1	4，16
Disable voltage	0	-	-	0	-	7，9，10，12
Quick stop	0	-	0	1	-	7，10，11
Disable operation	0	0	1	1	1	5
Fault reset	0->1	-	-	-	-	13



- The bit logic of the Quick Stop instruction is valid when set to 0.
- Note that you need to perform other bit logic operations and their inverses.

bit8 (halt) :

- At 1:00, the motor is decelerated and paused using the 605Dh (halt selection code).
- After pausing, return to 0 and resume the action.
- However, under the HM control mode, even if you return to state 0 after executing an interrupt operation, the device cannot be reopened.

Bit6-4 (operation mode specific):

The following shows changes to the OMS bits inherent to the control mode (Op-mode). (For details, refer to the chapter on the associated objects for each control mode.)

Op-mode	Bit6	Bit5	Bit4
PP	absolute /relative	change set immediately	new set-point
PV	-	-	-
TQ	-	-	-
HM	-	-	start homing

6.2.3 Statusword（6041h）

State confirmation of the station (servo driver) is performed using control word 6041h.

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Name</th><th>Scope</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td rowspan="2">6041h</td><td rowspan="2">00h</td><td>Statusword</td><td>0~65535</td><td>U16</td><td>RO</td><td>TxPDO</td><td>All</td></tr>
<tr><td colspan="6">Displays the status of the servo driver.
bit information
<table>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td></tr>
<tr><td colspan="2">r</td><td colspan="2">oms</td><td>ila</td><td>tr</td><td>rm</td><td>r</td></tr>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>r</td><td>sod</td><td>qs</td><td>ve</td><td>f</td><td>oe</td><td>so</td><td>rtso</td></tr>
</table>
r = reserved (not mapped) sod = switch on disabled
oms = operation mode specific qs = quick stop
(Control mode dependent bit) ve = voltage-enabled
ila = internal limit active f = fault
tr= target reached oe = operation enabled
rm = remote so = switched on
rtso = ready to switch on</td></tr>
</table>

Bit 6, 5, 3-0 (Switch On Disabled/Quick Stop/Fault/Operation Enabled/Switched On/Ready to Switch On): This bit determines the PDS status. The following lists the states and their corresponding bits.

StatusWord	PDS State
xxxx xxxx x0xx 0000 b	Not ready to turn on; initialization is incomplete
xxxx xxxx x1xx 0000 b	Turn on disabled – Initialization completed status

StatusWord	PDS State
xxxx xxxx x01x 0001 b	Ready to turn on – Initialization complete
xxxx xxxx x01x 0011 b	Turn on Servo Enable/Disable/Servo Preparation
xxxx xxxx x01x 0111 b	Operation enabled: Servo enable turned on
xxxx xxxx x00x 0111 b	Quick Stop Active: Stop immediately
xxxx xxxx x0xx 1111 b	Fault Reaction Active: Abnormality (Alarm) Detection
xxxx xxxx x0xx 1000 b	Malfunction/Abnormality (Alarm) Status

The PDS state machine of DS5K2 series servos can be monitored via U0-99; detailed meanings are listed in the table below:

U0-99	Description
0x01	Not ready to turn on; initialization is incomplete
0x02	Turn on disabled – Initialization completed status
0x04	Ready to turn on – Initialization complete
0x08	Turn on Servo Enable/Disable/Servo Preparation
0x10	Operation enabled: Servo enable turned on
0x20	Quick Stop Active: Stop immediately
0x40	Fault Reaction Active: Abnormality (Alarm) Detection
0x80	Malfunction/Abnormality (Alarm) Status

bit4 (voltage-enabled): When set to 1, it indicates that the power supply voltage is applied to PDS.
Bit 5 (Quick Stop): A value of 0 indicates that the PDS has received a quick stop request. The quick stop bit logic is valid when set to 0. Note that other bit logic states require opposite actions.
bit11 (Internal Limit Active): Subject to internal restrictions.
Bit 13 and 12 (operation mode-specific): These bits indicate changes inherent to the control mode's OMS configuration. (For details, refer to the chapter on the corresponding objects for each control mode.)

Op-mode	Bit13	Bit12
PP	-	set-point acknowledge
PV	-	-
TQ	-	-
HM	homing error	homing attained

6.2.4 Control Mode Settings

1、Modes of operation（6060h）

The control mode is set using 6060h (Modes of Operation).

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Name</th><th>Scope</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td rowspan="2">6060h</td><td rowspan="2">00h</td><td>Mode of operation</td><td>-128~127</td><td>I8</td><td>RW</td><td>RxPDO</td><td>All</td></tr>
<tr><td colspan="6">Set the control mode of the servo driver.
The non-corresponding control mode setting is disabled.
<table>
<tr><th>bit</th><th>Mode of operation</th><th>abbreviation</th><th>corresponding</th></tr>
<tr><td>-128~ -1</td><td>Reserved</td><td>-</td><td>-</td></tr>
<tr><td>0</td><td>No mode changed/No mode assigned
(No control mode change / No control mode assignment)</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>Profile Position Mode</td><td>PP</td><td>YES</td></tr>
<tr><td>3</td><td>Profile Velocity Mode</td><td>PV</td><td>YES</td></tr>
<tr><td>4</td><td>Torque Profile Mode (Profile Torque Control Mode)</td><td>TQ</td><td>YES</td></tr>
<tr><td>6</td><td>Homing Mode (Original Point Reset Position Mode)</td><td>HM</td><td>YES</td></tr>
<tr><td>7~127</td><td>Reserved</td><td>-</td><td>-</td></tr>
</table></td></tr>
</table>

Since 6060h (Modes of Operation) defaults to (No mode change/no mode assigned), please set the desired control mode value after powering on the device.
In the initial state, 6060h=0 (No mode assigned). After switching to a supported control mode (PP, PV, TQ, HM), resetting 6060h=0 again as "No mode changed" prevents the control mode switch from being executed (the previous control mode remains unchanged).

2、Modes of operation display（6061h）

The confirmation of the control mode inside the servo driver is performed according to 6061h (Modes of Operation Display). After setting 6060h (Modes of Operation), verify whether the specified action can be executed by performing a test.

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Name</th><th>Scope</th><th>Data type</th><th>Read/ Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td rowspan="2">6061h</td><td rowspan="2">00h</td><td>Mode of operation display</td><td>-128~127</td><td>I8</td><td>RO</td><td>TxPDO</td><td>All</td></tr>
<tr><td colspan="6">Represents the current control mode.
<table>
<tr><th>bit</th><th>Mode of operation</th><th>abbreviation</th><th>corresponding</th></tr>
<tr><td>-128~ -1</td><td>Reserved</td><td>-</td><td>-</td></tr>
<tr><td>0</td><td>No mode changed/No mode assigned
(No control mode change / No control mode assignment)</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>Profile Position Mode</td><td>PP</td><td>YES</td></tr>
<tr><td>3</td><td>Profile Velocity Mode</td><td>PV</td><td>YES</td></tr>
<tr><td>4</td><td>Torque Profile Mode (Profile Torque Control Mode)</td><td>TQ</td><td>YES</td></tr>
<tr><td>6</td><td>Homing Mode (Original Point Reset Position Mode)</td><td>HM</td><td>YES</td></tr>
<tr><td>7~127</td><td>Reserved</td><td>-</td><td>-</td></tr>
</table></td></tr>
</table>

6.2.5 Select Code (Set Reduction Stop Time)

PDS is a motor deceleration and stop mechanism activated in the Operation-enabled state (servo enable-on state), designed to trigger shutdown when a main power failure or alarm occurs.

The deceleration functions defined by CoE (CiA402) – including dynamic brake stop, free-run stop, and instant stop – will be used in combination.

- List of PDS Selection Codes

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode
605Ah	00h	Quick stop option code	0-7	I16	RW	NO	All
605Bh	00h	Shutdown option code	0-1	I16	RW	NO	All
605Ch	00h	Disable operation option code	0-1	I16	RW	NO	All
605Dh	00h	Halt option code	1-3	I16	RW	NO	All
605Eh	00h	Fault reaction option code	0-2	I16	RW	NO	All

- List of Other Related Objects

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode
6084h	00h	Profile deceleration	0 - 4294967295	U32	RW	RxPDO	All
6085h	00h	Quick stop deceleration	0 - 4294967295	U32	RW	RxPDO	All
6087h	00h	Torque slope	0 - 4294967295	U32	RW	RxPDO	All
609Ah	00h	Homing acceleration	0 - 4294967295	U32	RW	RxPDO	All
60C6h	00h	Max deceleration	0 - 4294967295	U32	RW	RxPDO	All

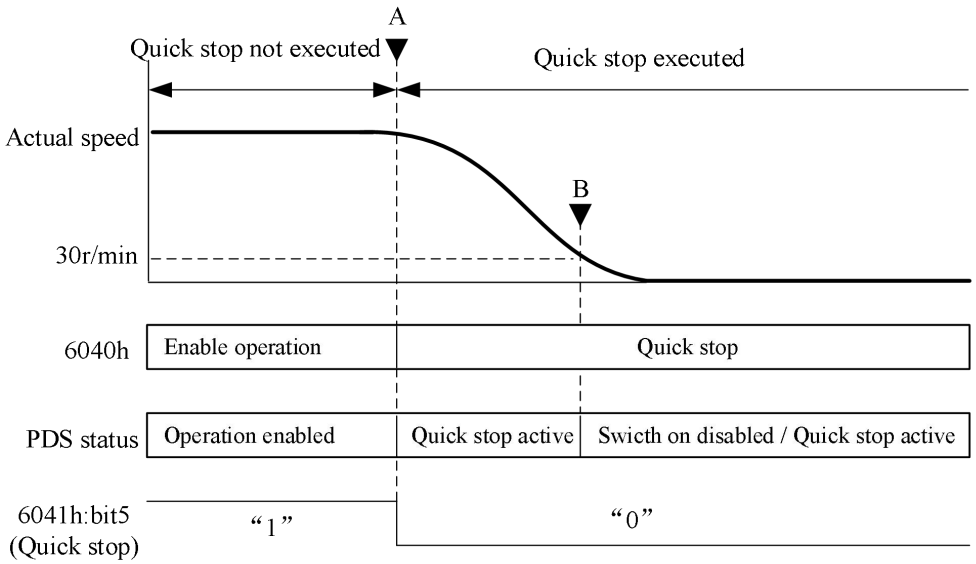
1、Quick stop option code(605Ah)

Set the motor deceleration and stop method when the PDS command "Quick Stop" is received.

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Name</th><th>Scope</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td rowspan="11">605Ah</td><td rowspan="11">00h</td><td>Quick stop option code</td><td>0-7</td><td>I16</td><td>RW</td><td>NO</td><td>All</td></tr>
<tr><td colspan="6">Set the timing for Quick Stop. Varies depending on the control mode definition. Prohibition is set for values other than those listed below.
<table>
<tr><th>numeric value</th><th>definition</th></tr>
<tr><td>0</td><td>Stop immediately; migrate PDS status to Switch on disabled</td></tr>
<tr><td rowspan="3">1</td><td>The control mode is PP/PV: After the motor stops via 0x6084 (Profile Deceleration), the PDS state transitions to Switch On Disabled.</td></tr>
<tr><td>Control mode is HM: After the motor stops via 0x609A (Homing Acceleration), the PDS status transitions to Switch on disabled.</td></tr>
<tr><td>Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Switch on disabled.</td></tr>
<tr><td rowspan="2">2</td><td>The control mode is PP, PV, or HM: After the motor stops via 0x6085 (Quick Stop Declaration), the PDS status transitions to Switch On Disabled.</td></tr>
<tr><td>Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Switch on disabled.</td></tr>
<tr><td rowspan="2">3</td><td>Control modes: PP, PV, HM. After the motor stops via 0x60C6 (Maximum Deceleration), the PDS state transitions to Switch On Disabled.</td></tr>
<tr><td>Control mode is TQ: After the motor stops at torque 0, the PDS state transitions to Switch on disabled.</td></tr>
<tr><td>5</td><td>Control mode is PP/PV: After the motor stops via 0x6084 (Profile</td></tr>
</table></td></tr>
</table>

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode
		Deceleration), the PDS status transitions to Quick Stop Active.					
		Control mode is HM: After the motor stops via 0x609A (Homing Acceleration), the PDS status transitions to Quick Stop Active.					
		Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Quick Stop Active.					
		6 The control mode is PP, PV, or HM: After the motor stops via 0x6085 (Quick Stop Declaration), the PDS status transitions to Quick Stop Active.					
		Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Quick Stop Active.					
		7 Control modes: PP, PV, HM. After the motor stops via 0x60C6 (Maximum Deceleration), the PDS status transitions to Quick Stop Active.					
		Control mode is TQ: After the motor stops at torque 0, the PDS status transitions to Quick Stop Active.					

Example of using the Quick Stop command to slow down and halt movement:
If 6040h:bit2 (Control Word: Quick Stop) changes from 1 to 0, deceleration begins and the system stops.
The PDS status during deceleration changes to Quick Stop Active.
After stopping, the PDS status becomes Switch on disabled or Quick stop active.



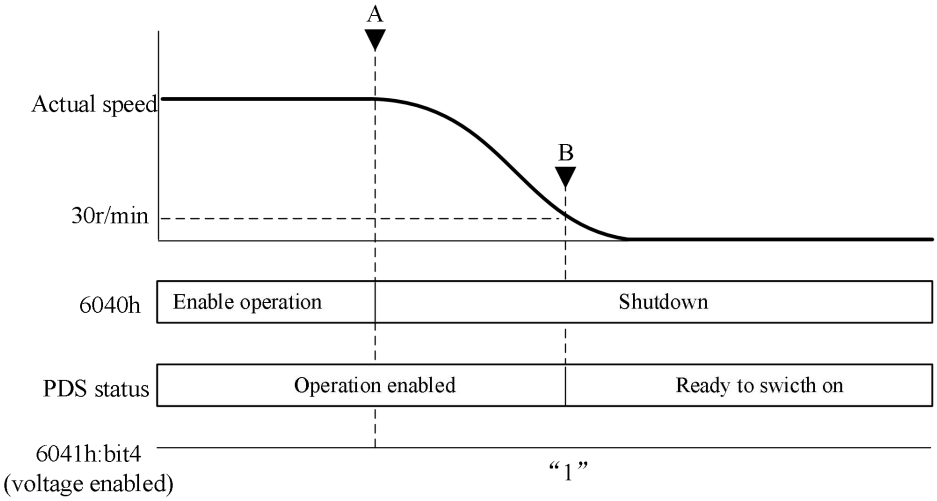
2、Shutdown option code(605Bh)

Set the motor deceleration and stop method when receiving the PDS commands „Shutdown "and Disable

voltage".

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Name</th><th>Scope</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td rowspan="2">605Bh</td><td rowspan="2">00h</td><td>Shutdown option code</td><td>0-1</td><td>I16</td><td>RW</td><td>NO</td><td>All</td></tr>
<tr><td colspan="6">Set the timing for "Shutdown" and "Disable voltage". Varies depending on the control mode definition.
Prohibition is set for values other than those listed below.
(1) When the PDS command "Shutdown" is received
<table>
<tr><th>numeric value</th><th>definition</th></tr>
<tr><td>0</td><td>Stop immediately and migrate the PDS status to Ready to switch on.</td></tr>
<tr><td rowspan="3">1</td><td>The control mode is PP/PV: After the motor stops via 0x6084 (Profile deceleration), the PDS status transitions to Ready to switch on.</td></tr>
<tr><td>Control mode is HM: After the motor stops via 0x609Ah (Homing acceleration), the PDS status transitions to Ready to switch on.</td></tr>
<tr><td>Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Ready to switch on.</td></tr>
</table>
(2) When the PDS command "Disable voltage" is received
<table>
<tr><th>numeric value</th><th>definition</th></tr>
<tr><td>0</td><td>Stop immediately; the PDS status will migrate to Switch on disabled.</td></tr>
<tr><td rowspan="3">1</td><td>The control mode is PP/PV: After the motor stops via 0x6084 (Profile deceleration), the PDS status transitions to Switch on disabled.</td></tr>
<tr><td>Control mode is HM: After the motor stops via 0x609Ah (Homing acceleration), the PDS status transitions to Switch on disabled.</td></tr>
<tr><td>Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Switch on disabled.</td></tr>
</table></td></tr>
</table>

Example of a deceleration and stop action triggered by a shutdown command:
If the PDS command "Shutdown" is received, begin decelerating and stop.
The PDS state during deceleration remains Operation enabled.
After stopping, the PDS status is Ready to switch on.





At 6041 hours: bit4 (Status word: voltage enabled) remains unchanged at 1.

3、Disable operation option code(605Ch)

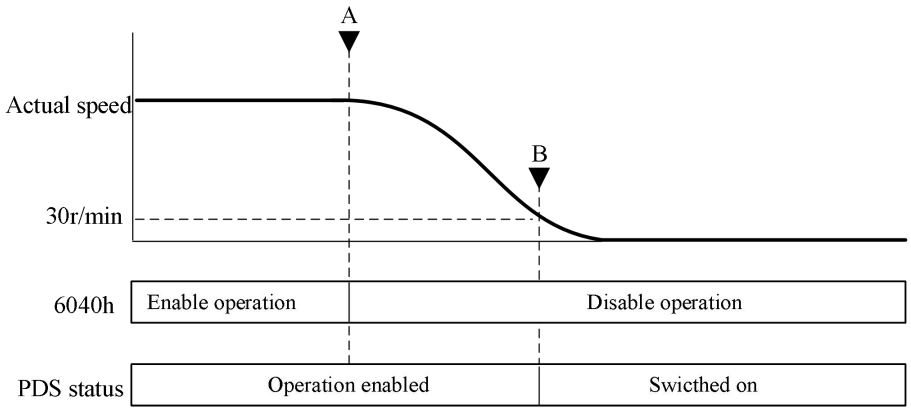
Set the motor deceleration and stop method when receiving the PDS command "Disable operation".

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode
605Ch	00h	Disable operation option code	0-1	I16	RW	NO	All

Set the timing for "Disable operation". Varisies depending on the control mode definition.
Prohibition is set for values other than those listed below.

numeric value	definition
0	Stop immediately and migrate the PDS status to Switch on.
1	The control mode is PP/PV: After the motor stops via 0x6084 (Profile deceleration), the PDS status transitions to Switch on.
	Control mode is HM: After the motor stops via 0x609Ah (Homing acceleration), the PDS status transitions to Switch on.
	Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Switch on.

An example of slowing down or stopping an action using the Disable Operation command.
If the PDS command "Disable operation" is received, start decelerating and stop.
The PDS state during deceleration remains Operation enabled.
After stopping, the PDS status bit is switched to On.



4、Halt option code(605Dh)

Set the motor deceleration and stop method when bit 8 (Halt) of 6040h (Control Word) is set to 1.

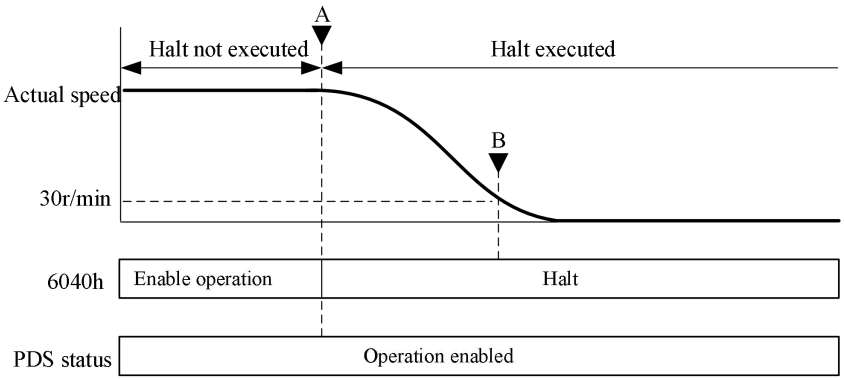
<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Name</th><th>Scope</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td rowspan="8">605Dh</td><td rowspan="8">00h</td><td>Halt option code</td><td>1-3</td><td>I16</td><td>RW</td><td>NO</td><td>All</td></tr>
<tr><td colspan="6">Set the timing for the Halt action. Varies depending on the control mode definition.
Prohibition is set for values other than those listed below.
<table>
<tr><th>numeric value</th><th>definition</th></tr>
<tr><td rowspan="3">1</td><td>The control mode is PP/PV: After the motor stops via 0x6084 (Profile Deceleration), the PDS status transitions to Operation enabled.</td></tr>
<tr><td>Control mode is HM: After the motor stops via 0x609A (Homing Acceleration), the PDS status transitions to Operation enabled.</td></tr>
<tr><td>Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Operation enabled.</td></tr>
<tr><td rowspan="2">2</td><td>Control modes are PP, PV, and HM: After the motor stops via 0x6085 (Quick Stop Declaration), the PDS status transitions to Operation enabled.</td></tr>
<tr><td>The control mode is CST. For TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Operation enabled.</td></tr>
<tr><td rowspan="2">3</td><td>Control modes: PP, PV, HM. After the motor stops via 0x60C6 (Maximum Deceleration), the PDS status transitions to Operation enabled.</td></tr>
<tr><td>Control mode is TQ: After the motor stops at torque 0, the PDS status transitions to Operation enabled.</td></tr>
</table></td></tr>
</table>

Examples of deceleration and stopping actions based on the Halt function

If 6040h:bit8 (Control Word: halt) changes from 0 to 1, the speed decreases and then stops.

The PDS state during deceleration remains Operation enabled.

After stopping, the PDS status remains Operation enabled.



5、Fault reaction option code(605Eh)

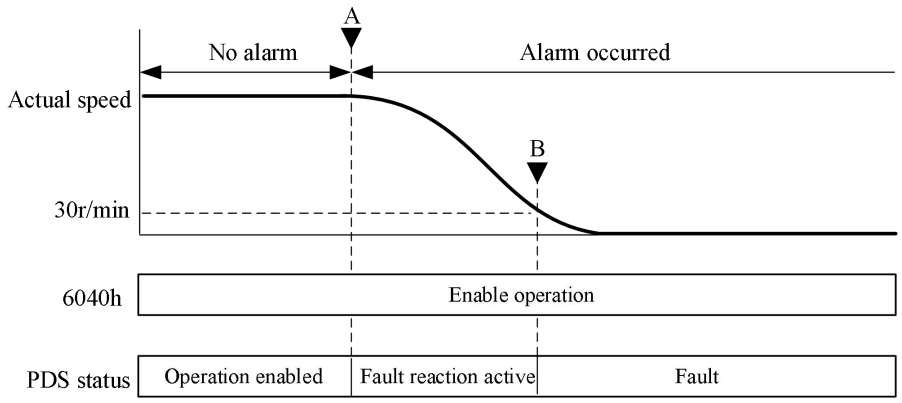
Set the motor stop method when an alarm occurs.

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode
605Eh	00h	Fault reaction option code	0-2	I16	RW	NO	All

Set the timing when an alarm occurs. Varies depending on the control mode definition.
Prohibition is set outside the specified range.

numeric value	definition
0	Stop immediately; the PDS status migrates to Fault.
1	The control mode is PP/PV: After the motor stops via 0x6084 (Profile deceleration), the PDS status transitions to Fault.
	Control mode is HM: After the motor stops via 0x609Ah (Homing acceleration), the PDS status transitions to Fault.
	Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Fault.
2	Control mode: PP, PV, HM. After the motor stops via the 6085h (Quick Stop Deceleration) function, the system switches to Fault mode.
	Control mode is TQ: After the motor stops via 0x6087 (Torque Slope), the PDS status transitions to Fault.

An example of the deceleration and stop action triggered by an alarm
If an alarm occurs, start decelerating and stop.
During deceleration, the PDS status is Fault Reaction Active.
The PDS status after stopping is Fault.



6.3 CIA402 Motion Control Modes

6.3.1 PP pattern

PP (Profile Position Control Mode) is a positioning control method that specifies target position, target speed, acceleration/deceleration rates, etc., and generates corresponding position commands within the servo driver for execution.

1. Associated Parameters

PP Control Mode Association Object (Command/Setting Category)

Register	Explain	Unit
RXPDO[0x6040]	control word	-
RXPDO[0x6060]	Set to 1	-
RXPDO[0x607A]	Location Given	Command Unit
RXPDO[0x6072]	maximum torque	0.1%
RXPDO[0x607F]	Maximum Internal Speed	Command Unit/Unit
RXPDO[0x6081]	Internal speed is set	Command Unit/Unit
RXPDO[0x6083]	Internal Acceleration	Unit of instruction /s²
RXPDO[0x6084]	Internal deceleration	Unit of instruction /s²
RXPDO[0x60C5]	maximal acceleration	Unit of instruction /s²
RXPDO[0x60C6]	maximum deceleration	Unit of instruction /s²

- The value of 6081h (profile velocity) is constrained by 607Fh (maximum profile velocity).
- The change in the 607Fh (Maximum Profile Velocity) setting during operation does not reflect in the actual motion.

PP Control Mode Association Object (Command/Monitoring Category)

Register	Explain	Unit
TXPDO[0x6041]	status word	-
TXPDO[0x6061]	Pattern Query	
TXPDO[0x6063]	Internal Actual Location	Command Unit
TXPDO[0x6064]	Position Feedback (Actual Motor Position)	Command Unit
TXPDO[0x606C]	rate feedback	Command Unit/Unit
TXPDO[0x6077]	Actual Torque	0.1%
TXPDO[0x60F4]	Actual Following Error Value	Command Unit

2. Control Word (6040h) <Function of PP Control Mode>

<table>
<tr><th>Index of matrix</th><th>Subindex</th><th>Name</th><th>Scope</th><th>Data type</th><th>Read/Write Capability</th><th>PDO</th><th>Op-mode</th></tr>
<tr><td rowspan="2">6040h</td><td rowspan="2">00h</td><td>Controlword</td><td>0~65535</td><td>U16</td><td>RW</td><td>RxPDO</td><td>All</td></tr>
<tr><td colspan="7">Set control commands for servo drivers such as PDS state transitions.
bit information
<table>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td></tr>
<tr><td colspan="7">r</td><td>h</td></tr>
<tr><td>7</td><td>6</td><td colspan="3">5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="2">fr</td><td colspan="4">oms</td><td rowspan="2">eo</td><td rowspan="2">qs</td><td rowspan="2">ev</td><td rowspan="2">so</td></tr>
<tr><td>Abs/rel</td><td colspan="2">Change set immediately</td><td>New set point</td></tr>
</table>
r = reserved (not mapped) fr = fault reset r = reserved (not mapped) fr = fault reset
oms = operation mode specific eo = enable operation
(Control mode-dependent bit) qs = Quick Stop (Control mode-dependent bit) qs = Quick Stop
h = halt ev = enable voltage
h = halt ev = enable voltage
so = switch on</td></tr>
</table>

Bit4-6（operation mode specific）：

Bit	Name	Price	Description
4	new set-point	0→1	The positioning action starts when the set value is updated. Obtain new position determination tasks (e.g., 607Ah (Target position), 6081h (Profile velocity), etc.).
5	change set immediately	0	Complete the ongoing positioning action.
		1	Stop the current positioning action and immediately start the downward positioning action

6	absolute/ relative	0	607 Ah (Target position) is treated as an absolute position.
		1	607 Ah (Target position) is treated as a relative position.

Do not change acceleration or deceleration during motor operation (*).
If the acceleration or deceleration mode changes, set bit 4 (new set-point) from 0 to 1 after the motor stops.

（*1）6083h（Profile acceleration）

6084h（Profile deceleration）

60C5h（Max acceleration）

60C6h（Max deceleration）

3. Status Word (6041h) <Function of Control Mode>

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode
6041h	00h	Statusword	0~65535	U16	RO	TxPDO	All

Displays the status of the servo driver.
bit information

15	14	13	12	11	10	9	8
r			oms set- point acknowledge	ila	oms Target Reached	rm	r
7	6	5	4	3	2	1	0
w	sod	qs	ve	f	oe	so	rsto

r = reserved (not mapped) w = warning
sod = switch on disabled
oms = operation mode specific qs = quick stop
(Control mode dependent bit) ve = voltage-enabled
ila = internal limit active f = fault
oe = operation enabled
rm = remote so = switched on
rtso = ready to switch on

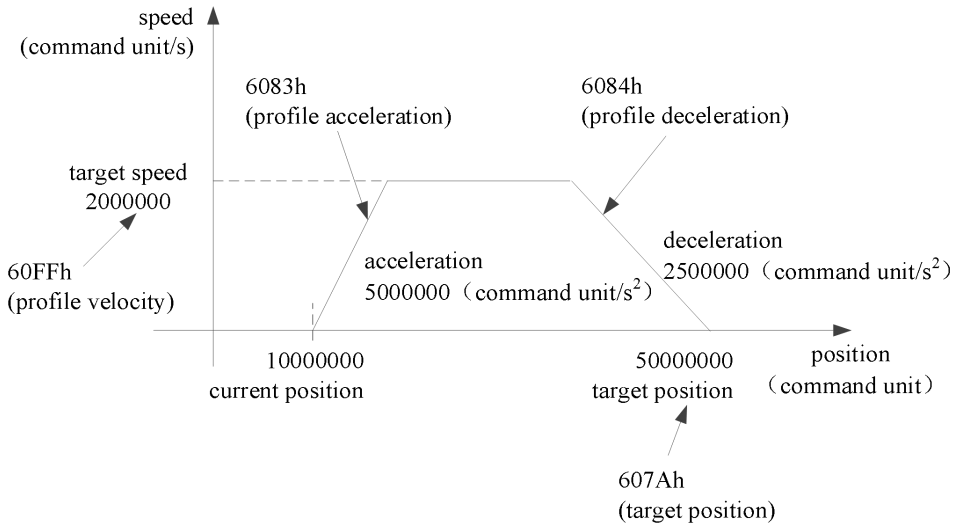
bit12,10（operation mode specific）：

Bit	Name	Price	Description
10	target reached	0	hold=0 (normal): Positioning not completed halt=1 (based on the halt time): During shaft deceleration
		1	Hold=0 (Normal): Positioning completed

			halt=1 (based on the halt time): Axis stopped (axis speed = 0)
12	set-point acknowledge	0	The new setpoint is 0, and the buffer is empty after completing the current target-position operation (in execution).
		1	The new positioning task writes data into the buffer, which is not empty.

4. Description of the PP Control Mode Operations

The schematic diagrams illustrating the working principles of object dictionaries 0x607A,0x6081,0x6083, and 0x6084 are shown below:



The relative or absolute mode can be determined by bit 6 of the 6040h control word (absolute/relative).

Action 1: Basic set-point

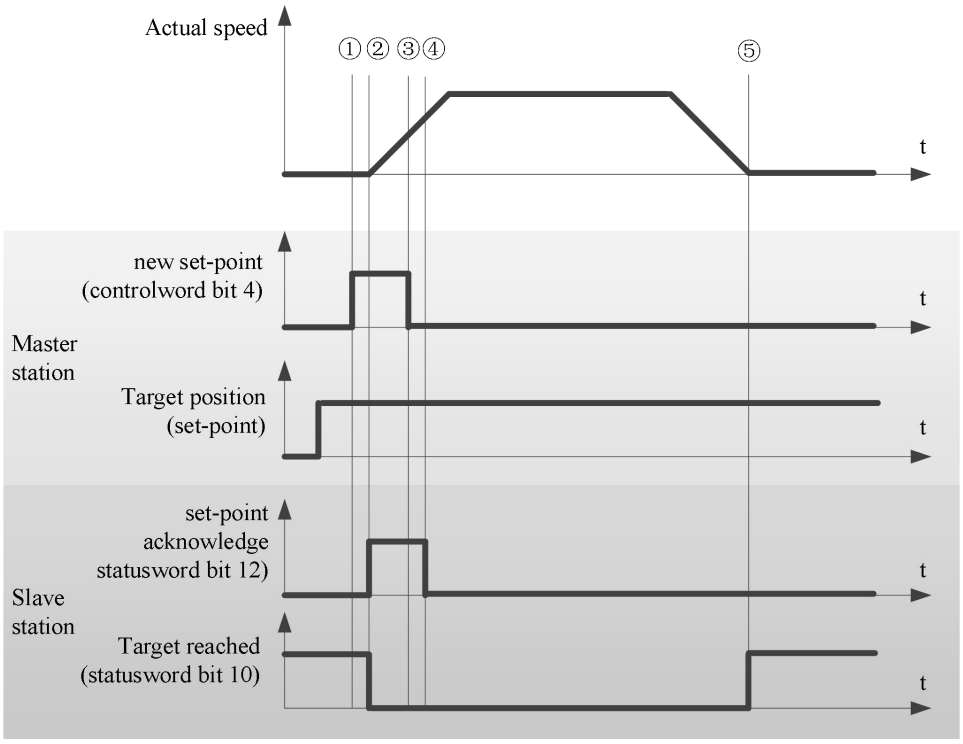
① On the main station, after setting the value of 607 Ah (Target position), set bit 4 (new set-point) of 6040 h (Control word) from 0 to 1. Also, configure 6081 h (Profile velocity).
The motor does not operate when the profile velocity (6081h) is zero.

② Upon arrival at the station, confirm the rising edge (0→1) of bit 4 (new set-point) in 6040h (Control Word), and initiate positioning based on 607Ah (Target Position). At this point, bit 12 (set-point acknowledge) in 6041h (State Word) transitions from 0 to 1.

③ At the master station, confirm that bit 12 (set-point acknowledge) of 6041h has changed from 0 to 1, and that bit 4 (new set-point) of 6040h has returned to 0.

④ At the slave station, confirm that bit 4 of 6040h (Control Word) – representing the new set-point – is set to 0, and that bit 12 of 6041h (Status Word) – indicating set-point acknowledgment – has also been set to 0.

⑤ Upon reaching the target location, bit 10 (target reached) of 6041h changes from 0 to 1.



< Set-point example >

Action 2: Change in action data without buffering: single set-point

When bit 5 (Change Set Immediately) of Control Word 6040h is set to 1, if changes have been made to the positioning data during the operation, the current positioning action is interrupted and the next positioning action begins immediately.

① On the master station, verify that bit 12 (set-point acknowledge) of 6041h is set to 0; after modifying the value of 607Ah (Target position), set bit 4 (new set-point) of 6040h from 0 to 1.

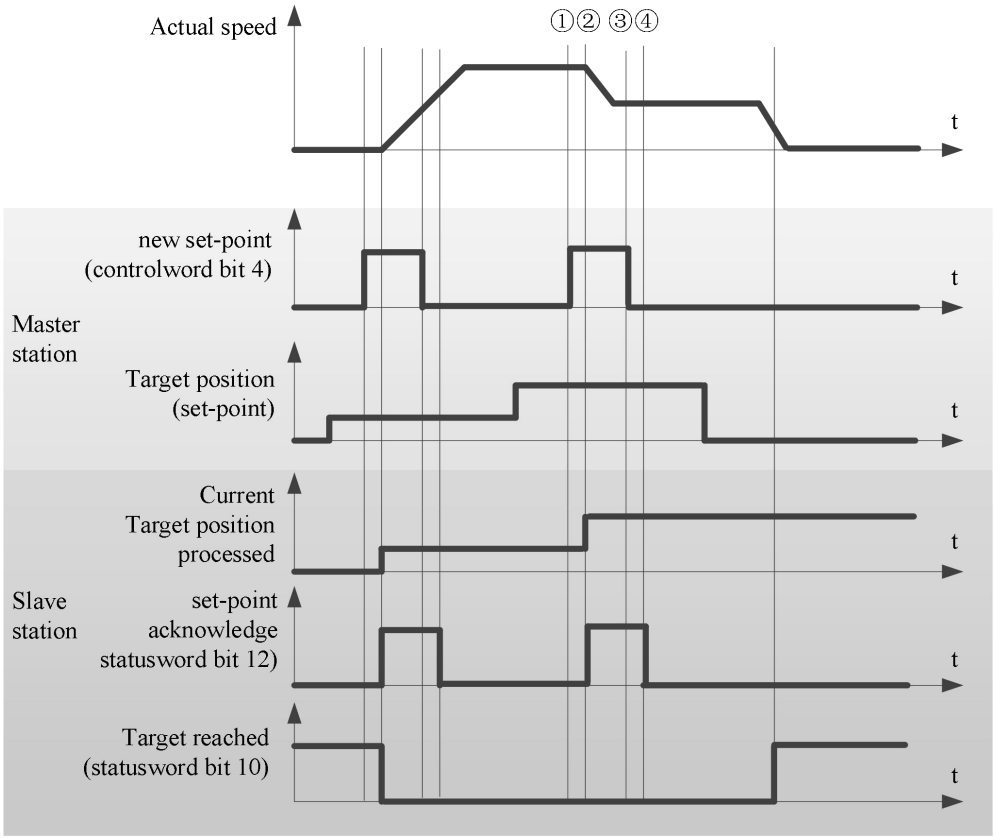
At this point, do not change the acceleration or deceleration.

② Upon arrival at the station, verify that bit 4 of 6040h (Control Word) – representing the new set-point – transitions from 0 to 1 on its rising edge; immediately update 607Ah (Target Position) and 6081h (Profile Velocity) as the new target position and internal execution speed. Concurrently, set bit 12 of 6041h (Status Word) from 0 to 1 to indicate set-point acknowledgment.

③ At the master station, confirm that bit 12 (set-point acknowledge) of 6041h has changed from 0 to 1, and that bit 4 (new set-point) of 6040h has returned to 0.

④ At the slave station, verify that bit 4 of 6040h (Control Word) – representing the new set-point – is

set to 0, and that bit 12 of 6041h (Status Word) – indicating set-point acknowledgment – is also set to 0.



< handshaking procedure for the single set-point method >

6.3.2 PV pattern

PV (Profile Speed Control Mode) is a speed control mode that specifies target speeds, acceleration/deceleration rates, and generates position commands for execution within the servo driver.

1. Associated Parameters

PV Control Mode Association Object (Command/Setting Category)

Register	Explain	Unit
RXPDO[0x6040]	control word	-
RXPDO[0x6060]	Set to 3	-
RXPDO[0x60FF]	Speed Given	Command Unit/Unit
RXPDO[0x6072]	maximum torque	0.1%
RXPDO[0x607F]	Maximum Internal Speed	Command Unit/Unit
RXPDO[0x6080]	Maximum Motor Speed	r/min
RXPDO[0x6083]	Internal Acceleration	Unit of instruction /s²
RXPDO[0x6084]	Internal deceleration	Unit of instruction /s²

Register	Explain	Unit
RXPDO[0x60C5]	maximal acceleration	Unit of instruction /s²
RXPDO[0x60C6]	maximum deceleration	Unit of instruction /s²

PV Control Mode Association Object (Command/Monitoring Category)

Register	Explain	Unit
TXPDO[0x6041]	status word	-
TXPDO[0x6061]	Pattern Query	-
TXPDO[0x6063]	Internal Actual Location	Command Unit
TXPDO[0x6064]	Position Feedback (Actual Motor Position)	Command Unit
TXPDO[0x606C]	rate feedback	Command Unit/Unit
TXPDO[0x6077]	Actual Torque	0.1%

2. Control Word (6040h) <Function of PV Control Mode>

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode
6040h	00h	Controlword	0~65535	U16	RW	RxPDO	All

Set control commands for servo drivers such as PDS state transitions.

bit information

15	14	13	12	11	10	9	8
r							h
7	6	5	4	3	2	1	0
fr	oms			eo	qs	ev	so
	r	r	r				

r = reserved (not mapped) fr = fault reset

oms = operation mode specific eo = enable operation

(Control mode-dependent bit) qs = Quick Stop

h = halt ev = enable voltage

so = switch on

PV mode does not use the OMS bit.

3. Control Word (6041h) <Function of PV Control Mode>

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode
6041h	00h	Statusword	0~65535	U16	RO	TxPDO	All

Displays the status of the servo driver.

bit information

15	14	13	12	11	10	9	8
r		oms		ila	oms	rm	r

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	Op-mode

		r	r		Targetreached		
7	6	5	4	3	2	1	0
w	sod	qs	ve	f	oe	so	rsto

r = reserved (not mapped) w = warning
sod = switch on disabled
oms = operation mode specific qs = quick stop
(Control mode dependent bit) ve = voltage-enabled
ila = internal limit active f = fault
oe = operation enabled
rm = remote so = switched on
rtso = ready to switch on

bit10（target reached（Velocity reached））：

The difference between the sum of 60FFh (target velocity) and 60B1h (velocity offset) and 606Ch (actual velocity value) falls within the range specified by 606Dh (velocity window). If, after the duration set by 606Eh (velocity window time), bit 10 of 6041h (status word) becomes 1, the condition is satisfied.

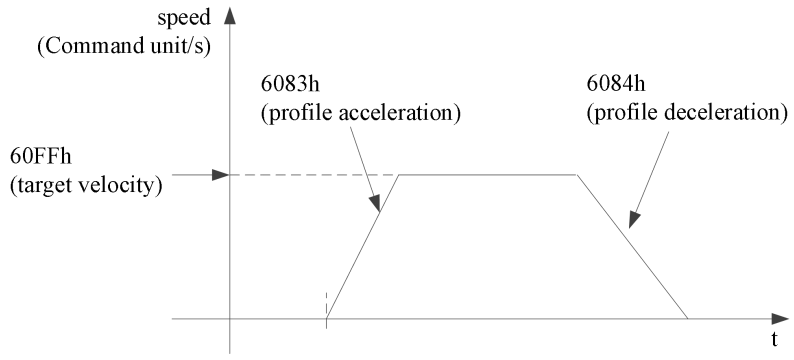
Bit	Name	Price	Description
10	Target reached	0	hold=0 (normal mode): Speed control not completed halt=1 (based on the halt time): During shaft deceleration
		1	Hold = 0 (normal mode): Speed control completed halt=1 (based on the halt time): Axis stopped (axis speed = 0)

4. Description of the operation for the PV control mode

The PV control mode generates speed commands based on the following parameters:

Target Velocity（60FFh） Profile acceleration（6083h） Profile deceleration（6084h）

Enable motor operation by setting object parameter 6060h to 3, and configure the target speed (60FFh), acceleration/deceleration parameters (6083h and 6084h), rotational speed (6080h), and torque limit (6072h). The target speed is set at 60FFh, with maximum speed capped at 6080h and maximum torque capped at 6072h. Upon enabling motor operation, the motor shall operate according to the preset values.



6.3.3 TQ pattern

TQ (Profile Torque Control Mode) is a torque control mode that specifies target torque, acceleration, and deceleration values, with the servo driver generating position commands accordingly before initiating operation.

1. Associated Parameters

- TQ Control Mode Association Object (Command/Setting Category)

Register	Explain	Unit
RXPDO[0x6040]	control word	-
RXPDO[0x6060]	Set to 4	-
RXPDO[0x6071]	Given target torque	0.1%
RXPDO[0x6072]	maximum torque	0.1%
RXPDO[0x6080]	Maximum Motor Speed	r/min
RXPDO[0x6087]	Set Torque Slope	0.1%/s

- Torque Category

Index of matrix	Subindex	Name	Unit	Scope	Data type	Read/Write Capability	PDO	OP-mode
6087h	00h	Torque slope	0.1 %/s	0~ 4294967295	U32	RW	RxPDO	TQ cst
		Set the parameter value to provide a biasing torque command. If set to 0, internal processing uses operation 1.						

- TQ Control Mode Association Object (Command/Monitoring Type)

Register	Explain	Unit
TXPDO[0x6041]	status word	-
TXPDO[0x6061]	Pattern Query	-
TXPDO[0x6064]	Position Feedback (Actual Motor Position)	Command Unit
TXPDO[0x606C]	rate feedback	Command Unit/Unit
TXPDO[0x6077]	Actual Torque	0.1%

2. Control Word (6040h) <Functions of the TQ Control Mode>

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	OP-mode
6040h	00h	Controlword	0~65535	U16	RW	RxPDO	All
		Set control commands for servo drivers such as PDS state transitions. bit information					

15	14	13	12	11	10	9	8
r							h

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	OP-mode

7	6	5	4	3	2	1	0
fr	oms			eo	qs	ev	so
	r	r	r				

r = reserved (not mapped) fr = fault reset
oms = operation mode specific eo = enable operation
(Control mode-dependent bit) qs = Quick Stop
h = halt ev = enable voltag
so = switch on

TQ mode does not use the OMS bit.

3. Status Word (6041h) <Functions of the Control Mode>

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	OP-mode
6041h	00h	Statusword	0~65535	U16	RO	TxPDO	All

Displays the status of the servo driver.
bit information

15	14	13	12	11	10	9	8
r		oms		ila	oms	rm	r
		r	r		Targetreached		
7	6	5	4	3	2	1	0
w	sod	qs	ve	f	oe	so	rsto

r = reserved (not mapped) w = warning
sod = switch on disabled
oms = operation mode specific qs = quick stop
(Control mode dependent bit) ve = voltage-enabled
ila = internal limit active f = fault
oe = operation enabled
rm = remote so = switched on
rtso = ready to switch on

bit13,12,10（operation mode specific）：

Bit	name	price	description
10	target reached	0	Hold value = 0 (normal condition): The torque demand (6074 h) has not reached the target torque level. halt=1 (based on the halt time): During shaft deceleration
		1	Hold value = 0 (normal operating condition): The torque demand (6074 h) reaches the target torque level. halt=1 (based on the halt time): Axis stopped (axis speed = 0)
12	reserved	-	unused
13	reserved	-	unused

4. Description of the actions in the TQ control mode

The TQ control mode generates torque commands based on the following parameters:

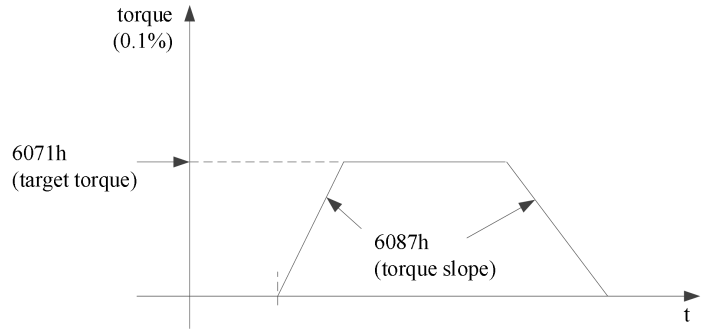
Target torque（6071h）

Torque slope（6087h）

The target torque is 6071 h, with a torque slope of 6087 h. The maximum rotational speed is limited by 6080 h, while the maximum torque is constrained by the minimum values among 6072 h, 231 Ch (P3-28), and 231 Dh (P3-29).

operating steps ：

1. Turn off the motor, set object parameter 6060 to 4, and configure target torque (6071 h), maximum motor speed (6080 h), and maximum torque (6072 h).
2. Start the motor to activate it; the motor shall increase its output torque according to the preset torque curve until reaching the set value, without exceeding the maximum set speed.



6.3.4 HM pattern

The HM mode (also known as the return-to-origin mode) is a position control mode that specifies various action speeds, generates position commands within the servo driver, and executes zero-return operations. This mode requires the coordinated use of external signals (POT, NOT, SPD-D).

1. Associated Parameters

- HM Control Mode Association Object (Command/Setting Category)

Register	Explain
RXPDO[0x6040]	Control word: Change the control word to restore to the original position
RXPDO[0x6060]	Set to 6 when the motor is not enabled
RXPDO[0x607F]	Maximum Internal Speed
RXPDO[0x60C5]	maximal acceleration
RXPDO[0x60C6]	maximum deceleration
RXPDO[0x6098]	Return to Origin Method
RXPDO[0x6099]	Return to Origin Speed
RXPDO[0x609A]	Return to Origin Acceleration

- HM Control Mode Association Object (Command/Monitoring Type)

Register	Explain
TXPDO[0x6041]	status word
TXPDO[0x6061]	Pattern Query
TXPDO[0x6063]	Internal Actual Location
TXPDO[0x6064]	Position Feedback (Actual Motor Position)
TXPDO[0x606C]	rate feedback
TXPDO[0x6077]	Actual Torque

2. Control Word (6040h) <Functions of HM Control Mode>

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	OP-mode
6040h	00h	Controlword	0~65535	U16	RW	RxPDO	All

Set control commands for servo drivers such as PDS state transitions.

bit information

15	14	13	12	11	10	9	8
r							h
7	6	5		4	3	2	1	0
fr	oms				eo	qs	ev	so
	r	r		sh				

r = reserved (not mapped) fr = fault reset

oms = operation mode specific eo = enable operation

(Control mode-dependent bit) qs = Quick Stop

h = halt ev = enable voltage

sh = start homing so = switch on

bit6-4（operation mode specific）：

Bit	Name	Price	Description
4	start homing	0→1	Start the reset process
5	reserved	-	Invalid Information
6	reserved	-	Invalid Information

3. Status Word (6041h) <Functions of HM Control Mode>

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	OP-mode
6041h	00h	Statusword	0~65535	U16	RO	TxPDO	All

Displays the status of the servo driver.

bit information

Index of matrix	Subindex	Name	Scope	Data type	Read/Write Capability	PDO	OP-mode

15	14	13	12	11	10	9	8
r		oms		ila	oms	rm	r
		r	r		Targetreached		
7	6	5	4	3	2	1	0
w	sod	qs	ve	f	oe	so	rsto

r = reserved (not mapped) w = warning
sod = switch on disabled
oms = operation mode specific qs = quick stop
(Control mode dependent bit) ve = voltage-enabled
ila = internal limit active f = fault
oe = operation enabled
rm = remote so = switched on
rtso = ready to switch on

bit10，12-13（operation mode specific）：

Bit	Name	Price	Description
10	target reached	0	Performing a reset operation
		1	Zeroing operation completed
12	homing attained	0	Return-to-zero operation not completed
		1	The reset operation was successfully completed.
13	homing error	0	The reset operation proceeded normally without any abnormalities.
		1	The reset operation is abnormal.

The reset operation has the following states:

Bit13	Bit12	Bit10	definition
0	0	0	Return-to-zero operation is in progress
0	0	1	The reset operation has not yet started or has been interrupted.
0	1	0	The reset operation has completed, but it did not reach the target position.
0	1	1	The reset operation has completed and successfully reached the target position.
1	0	0	Abnormal reset operation detected; the operation is still ongoing
1	0	1	Abnormal reset operation detected; stopped



After the CANopen bus reset is completed (in incremental mode when P0-79 = 1), the value in object dictionary 0x6063 will be 0, with possible minor deviations.

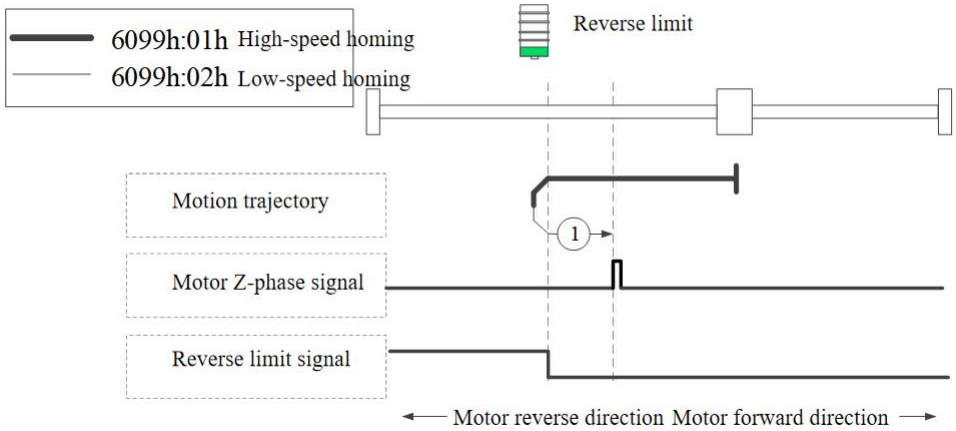
4. Original Point Return Method (6098h)

The DS5K2 series servo supports the following origin return modes: 1−14,17−30,33,34,35, and 37.

■ Method 1 (6098h = 1):

When using Method 1 of this origin restoration approach, if the reverse limit switch is in the non-triggered state, the initial movement direction is left. The origin position corresponds to the first Z-phase pulse located to the right of the position where the negative limit switch becomes invalid.

Mechanical Origin: Motor Z Signal
Reduction Point: Reverse Overtravel Switch



Use a negative limit switch in conjunction with the motor's Z-axis signal to restore the original position.

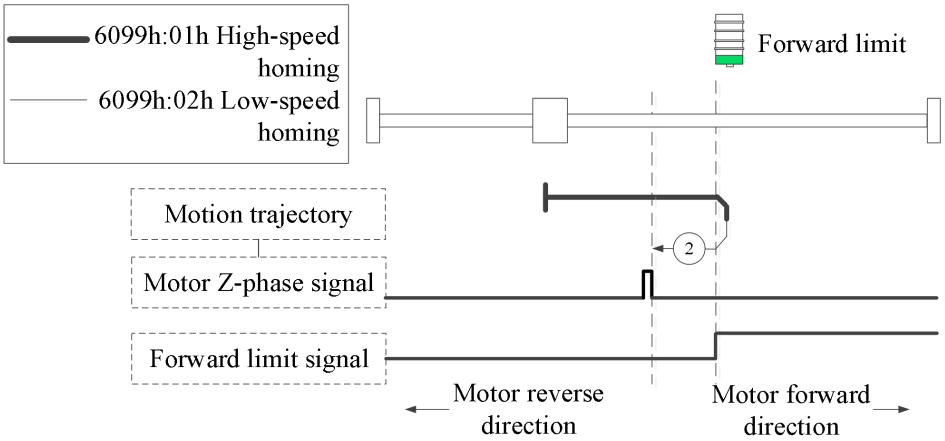
- 6098h=1 Action Description:

The reverse limit is invalid: When initiating return to origin, start the reverse zeroing at high speed (6099h:01h). Upon encountering the rising edge of the reverse limit (NOT), decelerate and change direction, then proceed with low-speed forward movement at 6099h:02h. Upon reaching the falling edge of the reverse limit, stop at the first motor Z signal.

■ Method 2 (6098h = 2):

When using Method 2, if the forward limit switch remains inactive, the initial movement direction is to the right. The origin position is determined at the first Z-phase pulse on the left side of the position where the forward limit switch becomes inactive.

Mechanical Origin: Motor Z Signal
Reduction Point: Forward Overtravel Switch



Use a positive limit switch in conjunction with the motor's Z-axis signal to return to the original position.

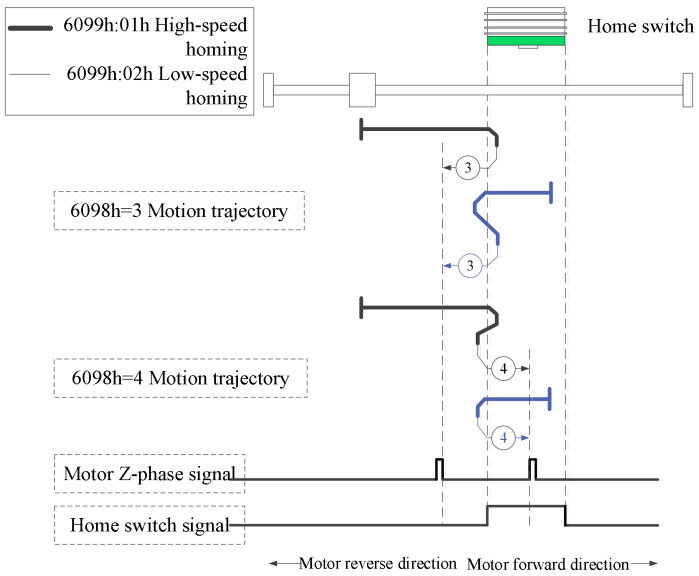
- 6098h=2 Action Description:

  The forward limit is invalid: When starting the return process, begin the forward zero return at high speed (6099h:01h). Upon encountering the rising edge of the forward limit (POT), decelerate and reverse direction, then proceed with low-speed reverse operation at 6099h:02h. Upon detecting the falling edge of the forward limit, halt the motor upon receiving the first Z signal.

■ Method 3 (6098h=3), Method 4 (6098h=4):

When using Method 3 or 4, the initial movement direction depends on the state of the origin switch. The origin position is either on the reverse-side side of the origin switch or at the initially detected Z-phase position during forward rotation.

Mechanical Origin: Motor Z Signal
Reduction Point: Origin Switch



Use the origin switch and the motor's Z-axis signal to return to the original position.

- 6098h=3 Action Description:

  ① When the origin switch is in the invalid state: During initial return, initiate forward zeroing at high speed (6099h:01h); upon detecting the rising edge of the origin switch, decelerate and reverse direction, then operate backward at the original speed (6099h:02h); upon detecting the falling edge of the origin switch, halt at the first motor Z signal.

  ② The origin switch is in the active state: When initiating return to zero, start the reverse movement at high speed (6099h:01h). Upon detecting the falling edge of the origin switch, reverse direction; identify the rising edge, decelerate, then reverse direction again, and proceed in reverse at the original speed (6099h:02h). Upon encountering the falling edge of the origin switch, stop the motor upon receiving the first Z-axis signal.

- 6098h = 4 Action Description:

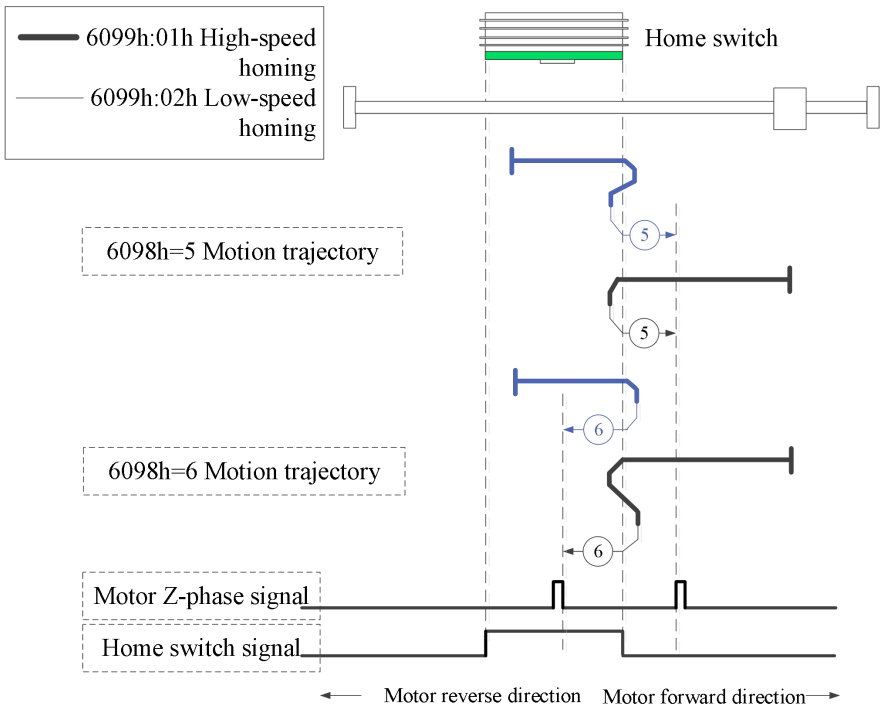
  ① When the origin switch is in the invalid state: Initiate return to zero at high speed (6099h:01h) in forward direction; upon detecting the rising edge of the origin switch, reverse direction and locate its falling edge before decelerating and reversing again. Then proceed forward at the original return speed (6099h:02h); upon encountering the rising edge of the origin switch, stop when detecting the first Z-axis signal from the motor.

  ② The origin switch is in the active state: When initiating return to zero, start the reverse return at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then proceed forward at the return speed of 6099h:02h; upon detecting the rising edge of the origin switch, identify the first motor Z signal and stop operation.

■ Method 5 (6098h=5), Method 6 (6098h=6):

When using Method 5 or 6, the initial movement direction depends on the state of the origin switch. The origin position is either on the reverse-side side of the origin switch or at the initially detected Z-phase position during forward rotation.

Mechanical Origin: Motor Z Signal
Reduction Point: Origin Switch



Use the origin switch and the motor's Z-axis signal to return to the original position.

- 6098h=5 Action Description:

  ① When the origin switch is in the invalid state: During initial return, initiate reverse zeroing at high speed (6099h:01h); upon detecting the rising edge of the origin switch, decelerate and reverse direction, then proceed forward at the original return speed (6099h:02h); upon detecting the falling edge of the origin switch, halt operation at the first motor Z signal.

  ② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and wait for its rising edge before decelerating and reversing again. Continue forward operation at the original return speed (6099h:02h); upon encountering the falling edge of the origin switch, stop when the first motor Z signal is detected.

- 6098h = 6 Action Description:

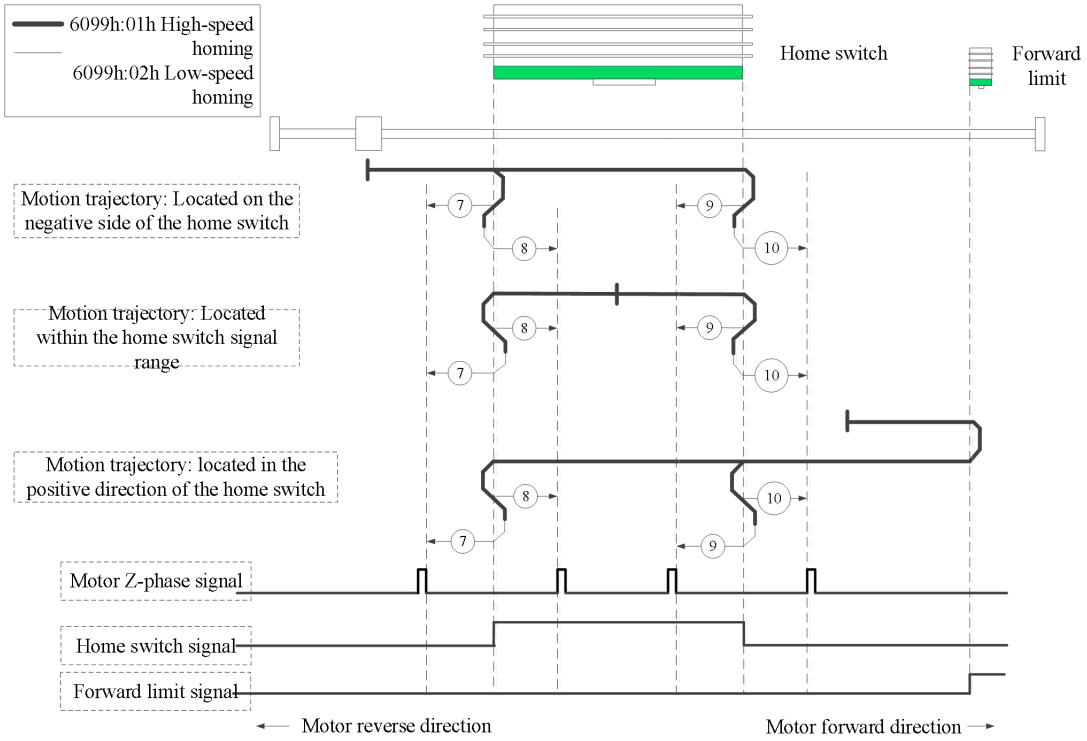
  ① When the origin switch is in the invalid state: Initiate reverse return at high speed (6099h:01h). Upon detecting the rising edge of the origin switch, reverse direction; identify its falling edge, decelerate, then reverse direction again. Operate in reverse at the original return speed (6099h:02h). Upon encountering the rising edge of the origin switch, stop the motor upon receiving the first Z-axis signal.

  ② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then operate backward at the return speed of 6099h:02h; upon detecting the rising edge of the origin switch, halt at the first motor Z signal.

■ Method 7−14 (6098h = 7−14):

All configurations from 7 to 14 utilize the origin switch and Z-phase signal.
For Modes 7 and 8, the initial motion direction is negative if the origin switch is activated at the start of movement.
For Modes 9 and 10, the initialization direction is positive if the origin switch is already activated at the start of operation.
For Modes 11 and 12, the initialization direction is positive if the origin switch is already activated at the start of operation.
For Modes 13 and 14, the initialization direction of the action is negative if the origin switch is already activated at the start of the action.
The final position returning to the origin is the Z-phase signal near either the rising or falling edge of the origin switch.

Mechanical Origin: Motor Z Signal
Reduction Point: Origin Switch



Use the origin switch, forward limit signal, and the motor's Z-axis reference signal to return to the original position.

- 6098h=7 Action Description:

① Located in the negative direction of the origin switch: When initiating return to zero, start forward movement at high speed (6099 h: 01 h); upon encountering the rising edge of the origin switch, decelerate and reverse direction, then operate backward at the return speed of 6099 h: 02 h; upon reaching the falling edge of the origin switch, detect the first Z-axis signal from the motor and stop operation.

② The origin switch is in the active state: When initiating return to zero, start the reverse movement at high speed (6099h:01h). Upon detecting the falling edge of the origin switch, reverse direction; identify

the rising edge, decelerate, then reverse direction again, and proceed in reverse at the original speed (6099h:02h). Upon encountering the falling edge of the origin switch, stop the motor upon receiving the first Z-axis signal.

③ Positioning relative to the origin switch in forward direction: Upon initiating return to zero, commence forward movement at high speed (6099h:01h). Upon reaching the forward limit, automatically reverse direction and continue running at high speed. When the origin switch reaches its rising edge, proceed forward until encountering its falling edge; then reverse direction, locate the next rising edge of the origin switch, decelerate, and reverse direction again, operating backward at the original return speed (6099h:02h). Upon reaching the origin switch's falling edge, stop based on the first motor Z signal.

- 6098h=8 Action Description:

① Positioned in the negative direction relative to the origin switch: Upon initiating return to zero, proceed forward at high speed (6099h:01h) until reaching the rising edge of the origin switch; then reverse direction and search for its falling edge before decelerating and reversing again. Continue forward at the original return speed (6099h:02h), stopping when the first motor Z signal is detected upon encountering the origin switch's rising edge.

② The origin switch is in the active state: When initiating return to zero, start the reverse return at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then proceed forward at the return speed of 6099h:02h; upon detecting the rising edge of the origin switch, identify the first motor Z signal and stop operation.

③ Positioning at the origin switch in forward direction: Upon initiating return to zero, begin a forward movement at high speed (6099h:01h); upon reaching the forward limit, automatically reverse direction and continue running at high speed; after detecting the rising edge of the origin switch, proceed forward until encountering its falling edge, then decelerate and reverse direction, continuing forward at the original return speed (6099h:02h); upon detecting the rising edge of the origin switch again, stop at the first motor Z signal.

- 6098h=9 Action Description:

① Positioned in the negative direction relative to the origin switch: Upon initiating return to zero, proceed forward at high speed (6099h:01h); upon encountering the rising edge of the origin switch, continue moving forward until reaching its falling edge, then decelerate and reverse direction, operating backward at the return speed of 6099h:02h; upon encountering the rising edge again, stop at the first motor Z signal.

② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then operate backward at the return speed of 6099h:02h; upon detecting the rising edge of the origin switch, halt at the first motor Z signal.

③ Positioning at the origin switch in forward direction: Upon initiating return to zero, start forward movement at high speed (6099h:01h); upon reaching the forward limit, automatically reverse direction and continue at high speed; upon detecting the rising edge of the origin switch, reverse direction again, locate the falling edge of the origin switch, decelerate, then reverse direction once more, operating backward at the original return speed (6099h:02h); upon detecting the rising edge of the origin switch, stop when the first motor Z signal is detected.

- 6098h = 10 Action Description:

① Positioned in the negative direction relative to the origin switch: Upon initiating return to zero, proceed forward at high speed (6099h:01h) until reaching the rising edge of the origin switch; then continue forward until encountering its falling edge, reverse direction, locate the next rising edge, decelerate, reverse again, and resume forward operation at the original return speed (6099h:02h); upon reaching the falling edge of the origin switch, stop when detecting the first motor Z signal.

② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and wait for its rising edge before decelerating and reversing again. Continue forward operation at the original return speed (6099h:02h); upon encountering the falling edge of the origin switch, stop when the first motor Z signal is detected.

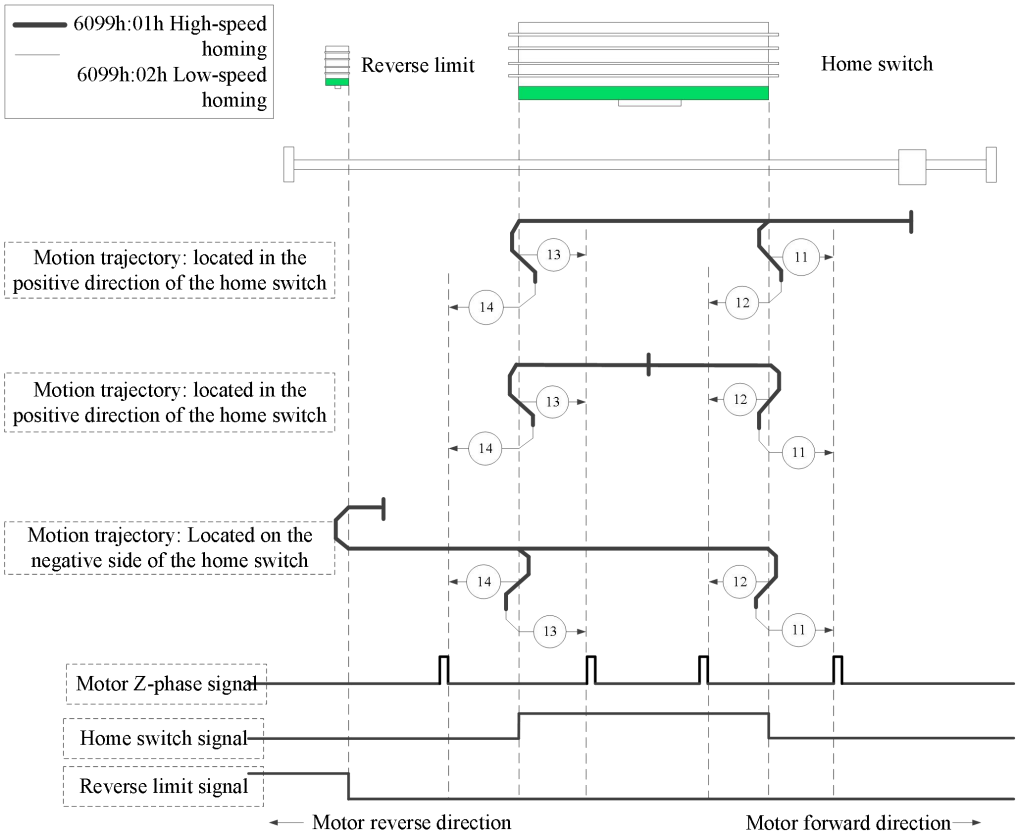
③ Positioned in the forward direction of the origin switch: Upon initiating return to zero, start forward movement at high speed (6099h:01h); upon reaching the forward limit, automatically reverse direction and continue at high speed; upon detecting the rising edge of the origin switch, decelerate and reverse direction, then proceed forward at the return speed of 6099h:02h; upon detecting the falling edge of the origin switch, halt at the first motor Z signal.

④ Located in the negative direction of the origin switch: Upon initiating return to zero, start reverse movement at high speed (6099h:01h); upon reaching the reverse limit, automatically switch direction and continue running at high speed; upon detecting the rising edge of the origin switch, proceed forward until encountering its falling edge, then reverse direction, locate the next rising edge, decelerate, switch direction again, and proceed forward at the original return speed (6099h:02h); upon detecting the falling edge of the origin switch, stop at the first motor Z signal.

⑤ The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and wait for its rising edge before decelerating and reversing again. Continue forward operation at the original return speed (6099h:02h), then stop when encountering the falling edge of the origin switch and detect the first Z-axis signal from the motor.

⑥ Positioning at the origin switch in forward direction: When initiating return to zero, start the reverse return at high speed (6099h:01h); upon encountering the rising edge of the origin switch, decelerate and reverse direction, then proceed forward at the return speed of 6099h:02h; upon reaching the falling edge

of the origin switch, detect the first motor Z signal and stop operation.



Use the origin switch, reverse limit signal, and motor Z-axis reference signal to return to the original position.

- 6098h = 11 Action Description:

① Located in the negative direction of the origin switch: Upon initiating return to zero, start reverse movement at high speed (6099h:01h); upon reaching the reverse limit, automatically switch direction and continue running at high speed; upon detecting the rising edge of the origin switch, proceed forward until encountering its falling edge, then reverse direction, locate the next rising edge, decelerate, switch direction again, and proceed forward at the original return speed (6099h:02h); upon detecting the falling edge of the origin switch, stop at the first motor Z signal.

② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and wait for its rising edge before decelerating and reversing again. Continue forward operation at the original return speed (6099h:02h); upon encountering the falling edge of the origin switch, stop when the first motor Z signal is detected.

③ Positioning at the origin switch in forward direction: Upon initiating return to zero, begin reverse movement at high speed (6099h:01h); upon detecting the rising edge of the origin switch, decelerate and reverse direction, then proceed forward at the return speed of 6099h:02h; upon detecting the falling edge of the origin switch, halt at the first motor Z signal.

- 6098h = 12 Action Description:

① Located in the negative direction of the origin switch: Upon returning to the starting position, initiate reverse zero return at high speed (6099h:01h); upon reaching the reverse limit, automatically switch direction and continue running at high speed; upon detecting the rising edge of the origin switch, proceed forward until encountering its falling edge, then decelerate and reverse direction, operating in reverse at the original return speed (6099h:02h); upon detecting the rising edge again, halt the motor at the first Z-axis signal.

② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then operate backward at the return speed of 6099h:02h; upon detecting the rising edge of the origin switch, halt at the first motor Z signal.

③ Positioning at the origin switch in forward direction: Upon initiating return to zero, start reverse movement at high speed (6099h:01h). Upon detecting the rising edge of the origin switch, reverse direction; identify the falling edge, decelerate, then reverse again. Continue operating in reverse at the original return speed (6099h:02h), and upon encountering the rising edge of the origin switch, stop when the first motor Z signal is detected.

- 6098h = 13 Action Description:

① Located in the negative direction of the origin switch: Upon initiating return to zero, start the reverse movement at high speed (6099h:01h); upon reaching the reverse limit, automatically switch direction and continue running at high speed; upon detecting the rising edge of the origin switch, reverse direction, locate its falling edge, decelerate, then switch direction again, and proceed forward at the original return speed (6099h:02h); upon detecting the rising edge of the origin switch, stop when the first motor Z signal is detected.

② The origin switch is in the active state: When initiating return to zero, start the reverse return at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then proceed forward at the return speed of 6099h:02h; upon detecting the rising edge of the origin switch, identify the first motor Z signal and stop operation.

③ Positioning along the positive direction of the origin switch: Upon initiating return to zero, begin reverse movement at high speed (6099h:01h); upon detecting the rising edge of the origin switch, continue forward until reaching its falling edge, then decelerate and reverse direction, proceeding forward at the original return speed (6099h:02h); upon encountering the rising edge again, stop at the first motor Z signal.

- 6098h = 14 Action Description:

① Located in the negative direction of the origin switch: Upon starting return, begin reverse zeroing at high speed (6099h:01h); upon reaching the reverse limit, automatically switch direction and continue running at high speed; upon detecting the rising edge of the origin switch, decelerate and reverse direction, operating backward at the original return speed (6099h:02h); upon detecting the falling edge of the origin

switch, halt at the first motor Z signal.

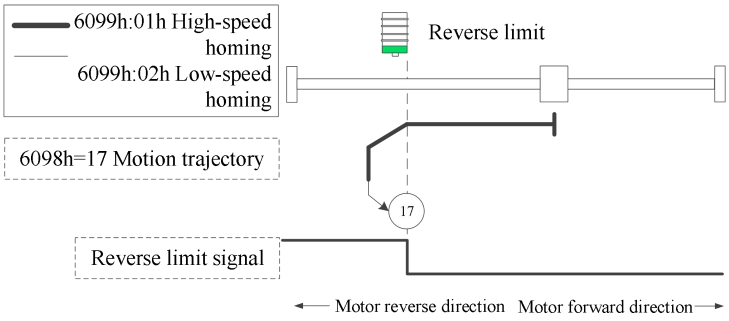
② The origin switch is in the active state: When initiating return to zero, start the reverse movement at high speed (6099h:01h). Upon detecting the falling edge of the origin switch, reverse direction; identify the rising edge, decelerate, then reverse direction again, and proceed in reverse at the original speed (6099h:02h). Upon encountering the falling edge of the origin switch, stop the motor upon receiving the first Z-axis signal.

③ Positioning along the positive direction of the origin switch: Upon initiating return to zero, start reverse movement at high speed (6099h:01h); upon detecting the rising edge of the origin switch, continue forward until reaching its falling edge, then reverse direction. Search for the next rising edge of the origin switch, decelerate, and reverse again; proceed in reverse at the original speed (6099h:02h). Upon encountering the falling edge of the origin switch, stop when the first motor Z signal is detected.

■ Method (6098h=17):

This method is similar to Method 1.
The key difference is that the origin detection position is not determined by the motor's Z-axis signal, but rather by the position change of the reverse limit switch (see figure below).
When the reverse limit (NOT) is not assigned, Homing error = 1.

Mechanical Origin: Reverse Limit Switch
Reduction Point: Reverse Limit Switch



Use the reverse limit signal to return to the original position.

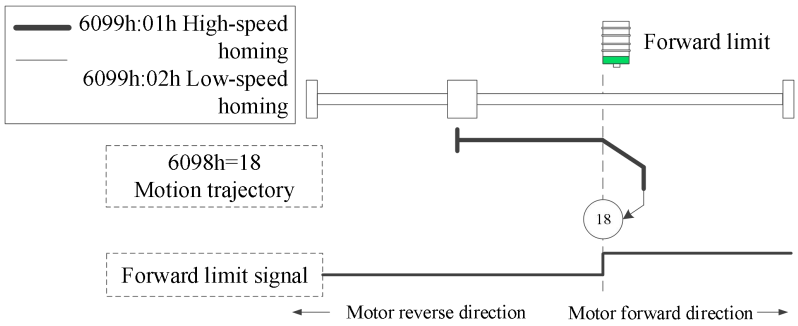
● 6098h = 17 Action Description:

The reverse limit is invalid: When starting the return process, begin the reverse zero return at high speed (6099h:01h). Upon encountering the rising edge of the reverse limit (NOT), change direction and decelerate to low-speed forward operation (6099h:02h); stop upon reaching the falling edge of the reverse limit.

■ Method (6098h=18):

This method is similar to Method 2.
The key difference is that the origin detection position is not determined by the motor's Z-axis signal, but rather by the position change of the forward limit switch (see figure below).
When the positive limit (POT) is not assigned, Homing error = 1.

Mechanical Origin: Forward Limit Switch
Reduction Point: Forward Limit Switch



Use the forward limit signal to return to the original position.

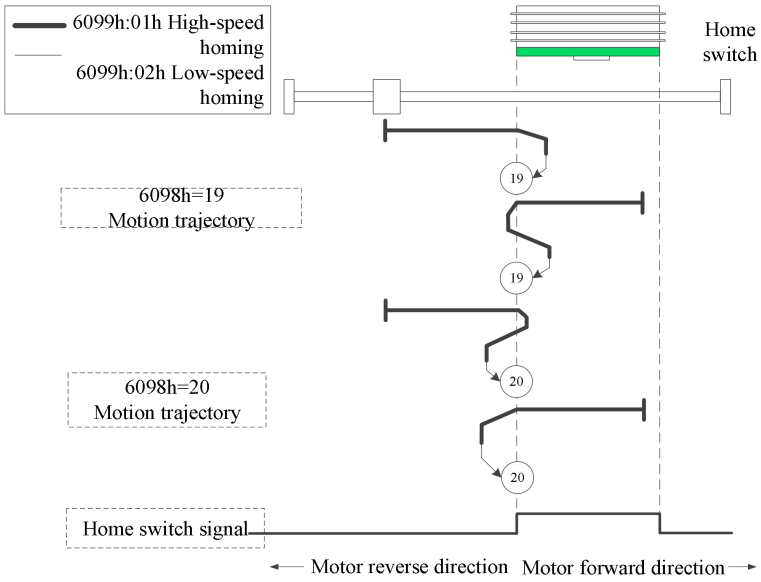
- 6098h = 18 Action Description:

The forward limit is invalid: When starting the return process, begin the forward zero return at high speed (6099h:01h). Upon encountering the rising edge of the forward limit (POT), reverse direction and decelerate to perform the low-speed reverse return at 6099h:02h; stop upon reaching the falling edge of the forward limit.

■ Method (6098h=19,6098h=20):

This method is similar to Methods 3 and 4.
The difference is that the origin detection position is not the motor's Z-axis signal but rather the position where the origin switch changes (see figure below).
When HOME is not allocated, Homing error = 1.

Mechanical Origin: Origin Switch
Reduction Point: Origin Switch



Use the origin switch signal to return to the original state.

- 6098h = 19 Action Description:

① When the origin switch is in the invalid state: During initial return, initiate forward zeroing at high

speed (6099h:01h); upon detecting the rising edge of the origin switch signal, reverse direction and decelerate to execute reverse operation at 6099h:02h; stop immediately upon receiving the falling edge of the origin switch signal.

② The origin switch is in the active state: When initiating return to zero, start the reverse movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction; identify the rising edge of the origin switch and reverse direction again; decelerate and operate in reverse at the original return speed (6099h:02h); stop operation upon encountering the falling edge of the origin switch.

- 6098h = 20 Action Description:

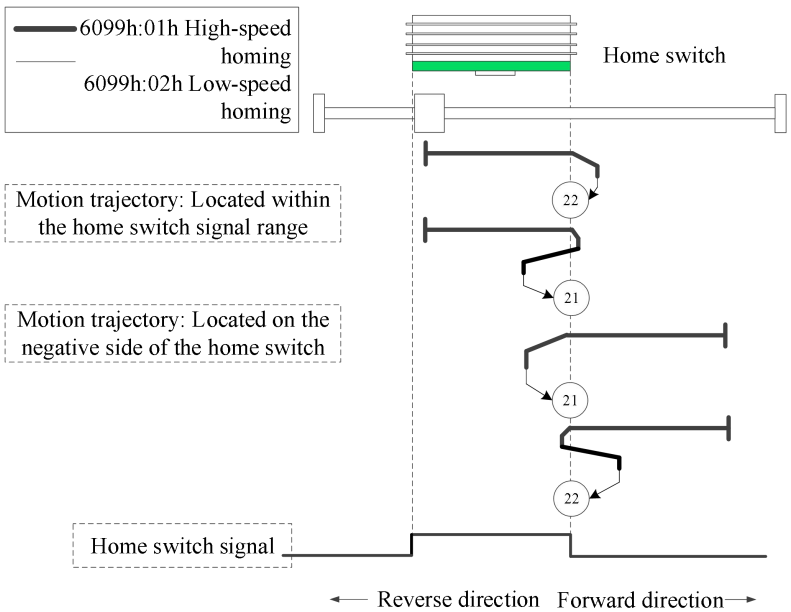
① When the origin switch is in the invalid state: During initial return, initiate forward zero return at high speed (6099h:01h). Upon detecting the rising edge of the origin switch, reverse direction; locate its falling edge and reverse again, then decelerate while operating forward at the original return speed (6099h:02h), stopping upon encountering the rising edge of the origin switch.

② The origin switch is in the active state: When initiating return to origin, start reverse zeroing at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and decelerate, then proceed forward at the original return speed (6099h:02h), stopping upon reaching the rising edge of the origin switch.

■ Method (6098h=21,6098h=22):

This method is similar to Methods 5 and 6 for restoration.
The difference is that the origin detection position is not the motor's Z-axis signal but rather the position where the origin switch changes (see figure below).
When the origin signal is not assigned, Homing error = 1.

Mechanical Origin: Origin Switch
Reduction Point: Origin Switch



Use the origin switch signal to return to the original state.

- 6098h = 21 Action Description:

  ① When the origin switch is in the invalid state: During initial return, initiate reverse zeroing at high speed (6099h:01h); upon detecting the rising edge of the origin switch, reverse direction and decelerate to operate forward at the return speed of 6099h:02h; stop operation upon detecting the falling edge of the origin switch.

  ② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and locate its rising edge before reversing again while decelerating. Continue forward operation at the original return speed (6099h:02h), stopping upon encountering the falling edge of the origin switch.

- 6098h = 22 Action Description:

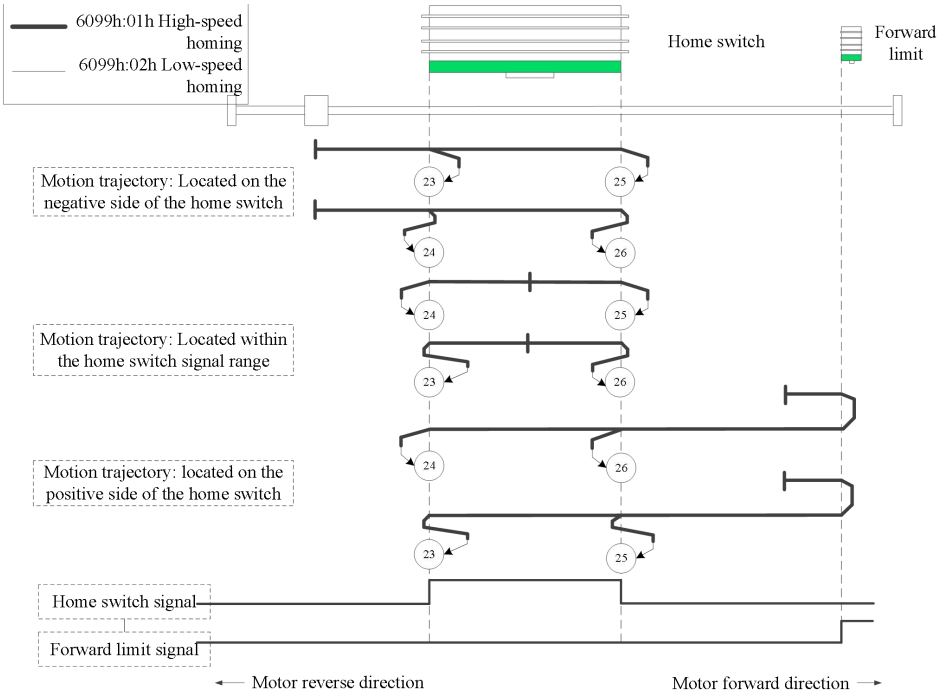
  ① The origin switch is in the invalid state: When initiating return to origin, start reverse zeroing at high speed (6099h:01h). Upon detecting the rising edge of the origin switch, reverse direction; locate its falling edge and reverse direction again. Slow down and operate in reverse at the original return speed (6099h:02h), stopping upon encountering the rising edge of the origin switch.

  ② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and decelerate, then operate in reverse at the return speed of 6099h:02h; stop operation upon detecting the rising edge of the origin switch.

■ Method (6098h = 23,24,25,26):

This method is similar to the original methods 7, 8, 9, and 10.
The difference is that the origin detection position is not the motor's Z-axis signal but rather the position where the origin switch changes (see figure below).
When the origin signal and forward limit signal are not assigned, Homing error = 1.

Mechanical Origin: Origin Switch
Reduction Point: Origin Switch



Use the origin switch signal and the forward limit signal to return to the original position.

- 6098h = 23 Action Description:

① Located in the negative direction of the origin switch: When initiating return to zero, start forward movement at high speed (6099h:01h); upon encountering the rising edge of the origin switch, decelerate and reverse direction, then operate backward at the return speed of 6099h:02h; stop upon reaching the falling edge of the origin switch.

② The origin switch is in the active state: When initiating return to zero, start the reverse movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction; identify the rising edge of the origin switch, decelerate, then reverse direction again; proceed in reverse at the original return speed (6099h:02h), and stop upon encountering the falling edge of the origin switch.

③ Operating in the forward direction relative to the origin switch: Upon initiating return to zero, start the forward movement at high speed (6099h:01h); upon reaching the forward limit, automatically reverse direction and continue running at high speed; upon detecting the rising edge of the origin switch, proceed forward until encountering its falling edge, then reverse direction, locate the next rising edge, decelerate, reverse direction again, and operate in reverse at the original return speed (6099h:02h); stop upon reaching the falling edge of the origin switch.

- 6098h = 24 Action Description:

① Located in the negative direction of the origin switch: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the rising edge of the origin switch, reverse direction; locate the falling edge of the origin switch, decelerate, then reverse direction again; proceed forward at the original return speed (6099h:02h), and stop upon encountering the rising edge of the origin switch.

② The origin switch is in the active state: When initiating return to origin, start reverse zeroing at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then proceed forward at the original return speed (6099h:02h); stop operation upon detecting the rising edge of the origin switch.

③ Positioning at the origin switch in forward direction: Upon initiating return to zero, start forward movement at high speed (6099h:01h); upon reaching the forward limit, automatically reverse direction and continue running at high speed; upon detecting the rising edge of the origin switch, proceed forward until encountering its falling edge, then decelerate and reverse direction, continuing forward at the original return speed (6099h:02h); stop upon detecting the rising edge of the origin switch.

- 6098h = 25 Action Description:

① Located in the negative direction of the origin switch: When initiating return to zero, start forward movement at high speed (6099h:01h); upon encountering the rising edge of the origin switch, continue forward until reaching its falling edge, then decelerate and reverse direction, operating backward at the return speed of 6099h:02h; stop upon encountering the rising edge of the origin switch.

② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then operate backward at the return speed of 6099h:02h; stop upon detecting the rising edge of the origin switch.

③ Positioned in the forward direction of the origin switch: Upon initiating return to zero, start forward movement at high speed (6099h:01h); upon reaching the forward limit, automatically reverse direction and continue at high speed; upon detecting the rising edge of the origin switch, reverse direction again, locate its falling edge, decelerate, then reverse direction once more, operating backward at the original return speed (6099h:02h); stop upon encountering the rising edge of the origin switch.

- 6098h = 26 Action Description:

① Located in the negative direction relative to the origin switch: When initiating return to zero, start forward movement at high speed (6099h:01h); upon encountering the rising edge of the origin switch, continue forward until reaching its falling edge, then reverse direction; locate the next rising edge of the origin switch, decelerate, reverse again, and proceed forward at the original return speed (6099h:02h); stop upon encountering the falling edge of the origin switch.

② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and search for its rising edge, then decelerate and reverse again; proceed forward at the original return speed (6099h:02h), stopping upon encountering the falling edge of the origin switch.

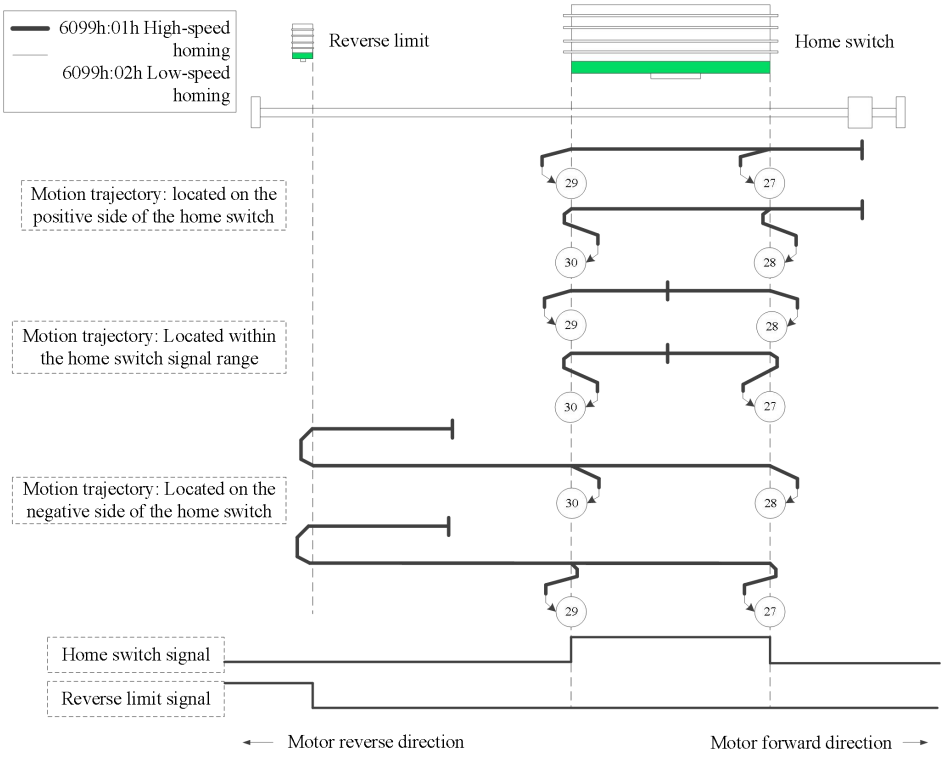
③ Positioned in the forward direction of the origin switch: Upon initiating return to zero, it starts

forward movement at high speed (6099h:01h); upon reaching the forward limit, it automatically reverses direction and continues running at high speed; upon detecting the rising edge of the origin switch, it decelerates and reverses direction, then proceeds forward at the return speed of 6099h:02h; it stops upon detecting the falling edge of the origin switch.

■ Method (6098h = 27,28,29,30):

This method is similar to the original methods 11,12,13, and 14.
The difference is that the origin detection position is not the motor's Z-axis signal but rather the position where the origin switch changes (see figure below).
When the origin switch and negative limit are not assigned, Homing error = 1.

Mechanical Origin: Origin Switch
Reduction Point: Origin Switch



Use the origin switch signal and the reverse limit signal to return to the original position.

● 6098h = 27 Action Description:

① Located in the negative direction of the origin switch: Upon initiating return to zero, it starts reverse movement at high speed (6099h:01h); upon reaching the reverse limit, it automatically switches direction and continues running at high speed; after detecting the rising edge of the origin switch, it moves forward until encountering its falling edge, then reverses direction, searches for the next rising edge, decelerates, switches direction again, and proceeds forward at the original return speed (6099h:02h); it stops upon reaching the falling edge of the origin switch.

② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction and search for

its rising edge, then decelerate and reverse again; proceed forward at the original return speed (6099h:02h), stopping upon encountering the falling edge of the origin switch.

③ Positioned in the forward direction of the origin switch: Upon initiating return to zero, start the reverse movement at high speed (6099h:01h); upon encountering the rising edge of the origin switch, decelerate and reverse direction, then proceed forward at the return speed of 6099h:02h; stop upon reaching the falling edge of the origin switch.

- 6098h = 28 Action Description:

① Located in the negative direction of the origin switch: Upon starting return, begin reverse zeroing at high speed (6099h:01h); upon reaching the reverse limit, automatically switch direction and continue running at high speed; upon encountering the rising edge of the origin switch, proceed forward until reaching its falling edge, then decelerate and reverse direction, operating backward at the original return speed (6099h:02h); stop upon encountering the rising edge of the origin switch.

② The origin switch is in the active state: When initiating return to zero, start forward movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then operate backward at the return speed of 6099h:02h; stop upon detecting the rising edge of the origin switch.

③ Positioning at the origin switch in forward direction: Upon initiating return to zero, start reverse movement at high speed (6099h:01h); upon detecting the rising edge of the origin switch, reverse direction; locate the falling edge of the origin switch, decelerate, then reverse direction again; proceed in reverse at the original return speed (6099h:02h), and stop upon encountering the rising edge of the origin switch.

- 6098h = 29 Action Description:

① Located in the negative direction of the origin switch: Upon initiating return to zero, it starts reverse movement at high speed (6099h:01h); upon reaching the reverse limit, it automatically switches direction and continues at high speed; upon detecting the rising edge of the origin switch, it reverses direction, searches for its falling edge, decelerates, then reverses direction again, proceeding forward at the original return speed (6099h:02h); upon encountering the rising edge of the origin switch, it stops.

② The origin switch is in the active state: When initiating return to origin, start reverse zeroing at high speed (6099h:01h); upon detecting the falling edge of the origin switch, decelerate and reverse direction, then proceed forward at the original return speed (6099h:02h); stop operation upon detecting the rising edge of the origin switch.

③ Positioning at the origin switch in forward direction: Upon initiating return to zero, start the reverse movement at high speed (6099h:01h); upon encountering the rising edge of the origin switch, continue forward until reaching its falling edge, then decelerate and reverse direction, proceeding forward at the original return speed (6099h:02h), and stop upon encountering the rising edge of the origin switch.

- 6098h=30 Action Description:

① Located in the negative direction of the origin switch: Upon initiating return to zero, it begins reverse movement at high speed (6099h:01h); upon reaching the reverse limit, it automatically switches direction and continues running at high speed; upon detecting the rising edge of the origin switch, it decelerates and reverses direction, operating backward at the return speed of 6099h:02h; upon detecting the falling edge of the origin switch, it stops.

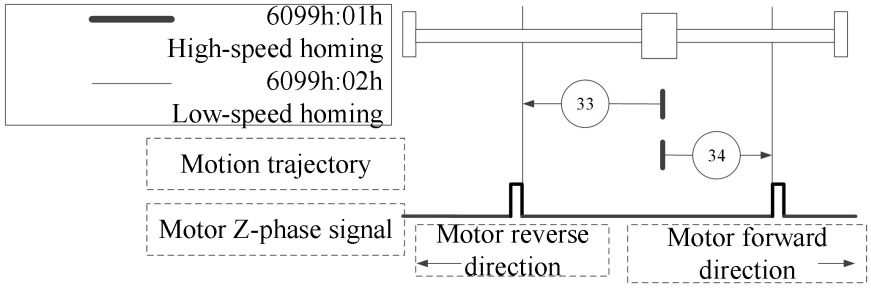
② The origin switch is in the active state: When initiating return to zero, start the reverse movement at high speed (6099h:01h); upon detecting the falling edge of the origin switch, reverse direction; identify the rising edge of the origin switch, decelerate, then reverse direction again; proceed in reverse at the original return speed (6099h:02h), and stop upon encountering the falling edge of the origin switch.

③ Positioning in the forward direction of the origin switch: Upon initiating return to zero, start the reverse movement at high speed (6099h:01h). Upon detecting the rising edge of the origin switch, continue forward until reaching its falling edge; then reverse direction. Search for the next rising edge of the origin switch, decelerate, and reverse again. Operate in reverse at the original return speed (6099h:02h), stopping upon encountering the falling edge of the origin switch.

■ Method (6098h=33,34):

Using Method 33 or 34, the direction back to the origin is negative or positive, respectively. The original position is located at the Z-axis near the selected direction.

Mechanical Origin: Motor Z Signal
Reduction Point: None



The origin is on the Z-positive sign.

- 6098h = 33 Action Description:

When starting the reverse operation, run in reverse at a speed of 6099 h:02h and stop when encountering the first Z signal from the motor.

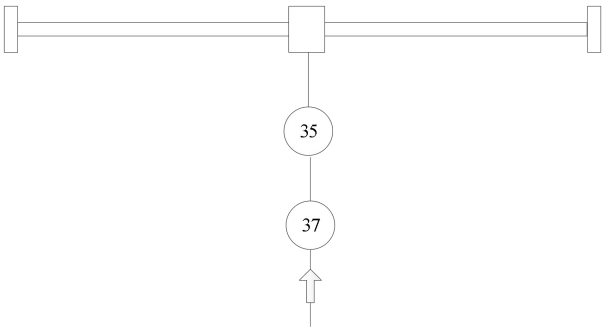
- 6098h = 34 Action Description:

During the return to origin, the system operated forward at a speed of 6099 h:02h until encountering the first motor Z signal, which triggered a shutdown.

■ Method 35 (6098h = 35), Method 37 (6098h = 37):

In the original 35/37 mode, after triggering the origin reset action, the current position becomes the origin.

Mechanical Origin: Trigger Position



All restoration methods require activation by a restoration action command to take effect.

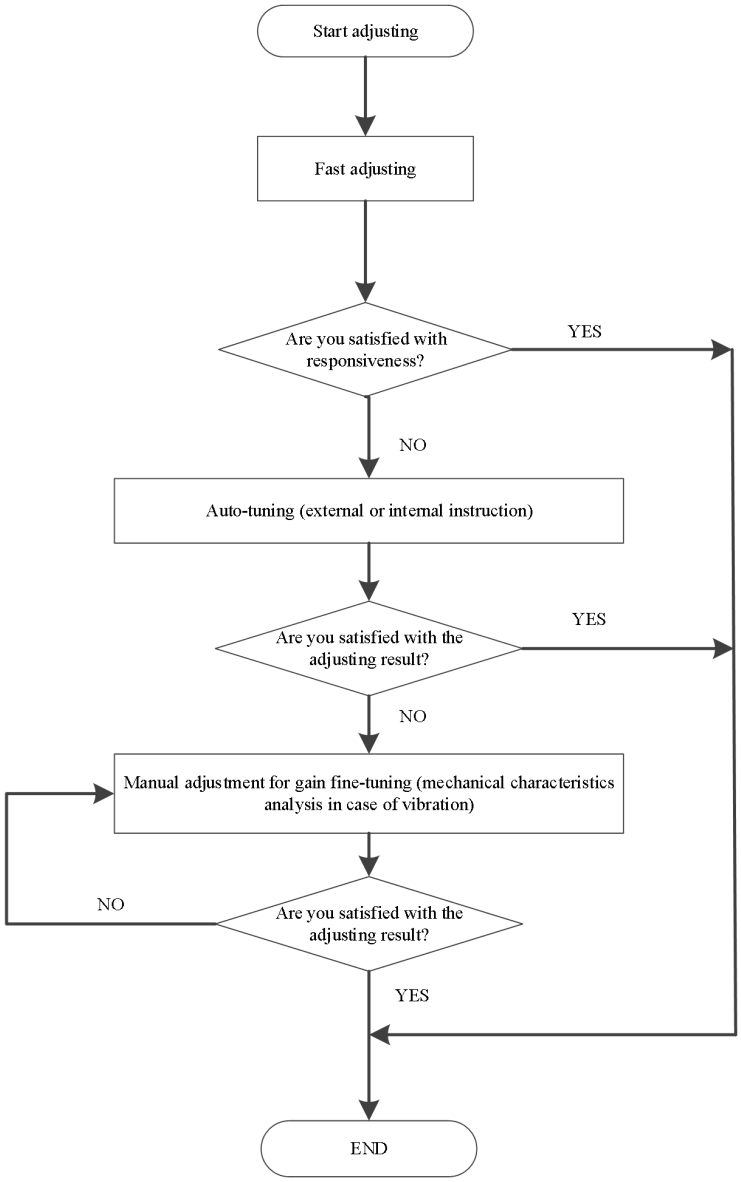
7. Adjustment of Servo Gain

7.1 Overview of Servo Gain Adjustment

7.1.1 Overview and Process

A servo driver requires a motor that operates as quickly and accurately as possible to follow commands from the host computer or internal settings. To meet this requirement, the servo gain must be properly adjusted.

The factory default servo gain is set to self-tuning mode, but different machines have varying requirements for servo responsiveness. The following diagram shows the basic gain adjustment procedure; adjust it according to your machine's current status and operating conditions.



7.1.2 Differences Between Various Adjustments

Adjustment methods include adaptive and self-adjusting approaches, each with independent control algorithms and parameters. The self-adjusting mode comprises three functions: rapid adjustment, automatic adjustment, and manual adjustment—these share the same underlying principle but differ in implementation; refer to the corresponding sections for details.

Adjustment Method	Classify	Controlling parameter	Rigidity	Reactive mode	Key Relevant Control Parameters
self-adaption	Auto adaptation	P2-01.0=1	Middle	150 ms level	P2-05 Adaptive Speed Loop Gain P2-10 Adaptive Speed Loop Integration P2-11 Adaptive Position Loop Gain P2-07 Adaptive Inertia Ratio P2-08 Adaptive Speed Observer Gain P2-12 Adaptive Stability Maximum Inertia Ratio
Self-Calibration	rapid adjustment	P2-01.0=0	High	10–50 ms range	P0-07 First Inertial Ratio P1-00 Speed Loop Gain P1-01 Speed Loop Integral P1-02 Position Ring Gain P2-35 Torque command filtering time constant 1 P2-49 Model Ring Gain
	self-correcting		High	10 ms level	
	Manual Adjustment		High	Determines by parameters	

7.2 Estimation of Rotational Inertia

7.2.1 Overview

Rotational inertia estimation is a function that automatically calculates the load's rotational inertia within the driver during operation (via forward and reverse rotation).
The moment of inertia ratio (the ratio of load moment of inertia to motor rotor moment of inertia) serves as the reference parameter for gain adjustment and should be set to the correct value whenever possible.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P0-07	First Inertia Ratio	200	%	0 ~ 50000	at any time	immediately

7.2.2 Precautions

When inertia cannot be determined

- Mechanical systems can only operate in one direction.

Scenarios where inertia estimation is prone to failure

- The load's rotational inertia is too large;
- The operating range is narrow, with a stroke of up to 0.5 revolutions;
- The rotational inertia varies significantly during operation.
- The mechanical rigidity is low, resulting in vibration when estimating inertia.

Key considerations for inertia estimation

- Since rotation is allowed in both directions within the specified movement range, confirm the movement range or direction, and ensure the load operates within a safe travel distance.
- If jitter occurs when calculating inertia using default parameters, it indicates that the current load inertia is too high. Under heavy loads, set the initial inertia to approximately twice the current value and run again.
- The maximum identification limit for the drive's inertia ratio is 500 times (parameter upper limit: 50,000). If the estimated inertia ratio equals 50,000, it indicates the limit has been reached and the ratio cannot be used. Replace with a motor featuring a larger rotor inertia.

Other Notes

- Inertia switching is not supported; the second inertia ratio is invalid.

7.2.3 Operating Tools

The tools for estimating load moment of inertia are the driver panel and the XINJE Servo host software.

Operation Tools	Restriction Item
Drive Panel	All firmware versions support F0-07
XINJE Servo Master Computer Software	All versions of the host software support it.

The driver firmware version can be viewed via U2-07.

7.2.4 Operating Steps

1. Steps for Estimating Inertia of the Drive Panel

1. Parameter Configuration

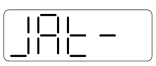
Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P2-15	Inertia Configuration Stroke	100	0.01 turn	1 ~ 300	at any time	immediately
P2-17	Inertia identification and the maximum speed determined through internal command-based self-adjustment	/	rpm	0 ~ 65535	at any time	immediately
P2-18	Initial inertia ratio for inertia identification	500	%	1 ~ 20000	at any time	immediately

The recommended P2-17 parameter is 500 rpm or higher; an instruction speed that is too low may result in inaccurate inertia ratio identification. By default, it is set to one-third of the rated speed and is calculated automatically based on the motor's rated speed parameters.

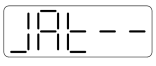
2. Inertia identification implementation

Before performing inertia identification, use the F1-00 point movement function to confirm the servo rotation direction. The initial operating direction is determined by INC or DEC at the start of inertia identification.

The servo enters the BB state and displays parameter F0-07:



Press and hold the ENTER key to enable the servo; the panel displays:



Press and hold the INC key for forward operation or the DEC key for reverse operation (choose one). The display will show:

perhaps 

The operation begins under the condition P0-05=0 (initial forward direction): a short press on INC initiates first forward rotation followed by reverse rotation; a short press on DEC initiates first reverse rotation followed by forward rotation. If inertia identification succeeds, the system displays the load inertia ratio after several cycles of forward/reverse operation and writes it automatically to P0-07; if identification fails, an error code is displayed. A short press on the STA/ESC key terminates the panel's inertia identification process.

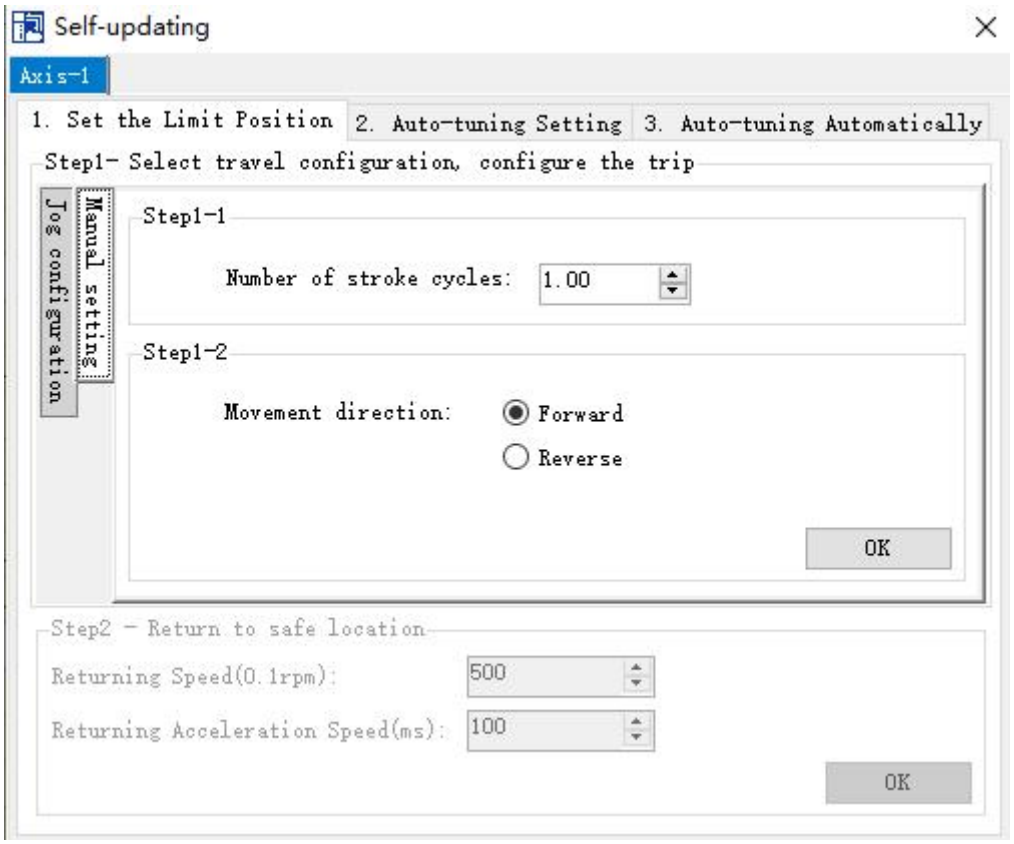
- Panel Inertia Identification Error Alarm

Error code	Meaning	Possible Reasons and Solutions
Err-1	Motor torque saturation	① The initial inertia is too small; in adaptive mode, switch to high-inertia mode (P2-03.3=1); in self-set mode, set the initial inertia value for inertia identification (P2-18) to twice the current value. ② The maximum speed is too high (P2-17), but it should not fall below 500 rpm; an excessively low set speed may lead to inaccurate inertia ratio identification. ③ The torque limit is too low (P3-28/29).
Err-2	The calculated inertia value has an excessively large numerical error.	① The maximum speed limit is set too low (P2-17), but it should not fall below 500 rpm; excessively low target speeds may lead to inaccurate inertia ratio identification. ② The estimated inertia stroke is too small. It is recommended that the minimum inertia stroke for P2-15 configuration be no less than 50 units (0.5 revolution); an insufficient stroke will result in inaccurate determination of the actuated inertia. ③ Excessive institutional friction; ④ Out-of-range occurrence
Err-3	Error in calculating the drive's internal stroke	① The estimated inertia travel is too small. It is recommended that the minimum inertia travel for P2-15 configuration be no less than 50 units (0.5 revolution); an insufficient travel will result in inaccurate determination of the actuated inertia.
Err-4	Location integration feature was used	①During torque-inertia identification, the system should operate in PI control mode; however, it has been switched to P control. Check whether the Proportional Action Command (P5-21) is

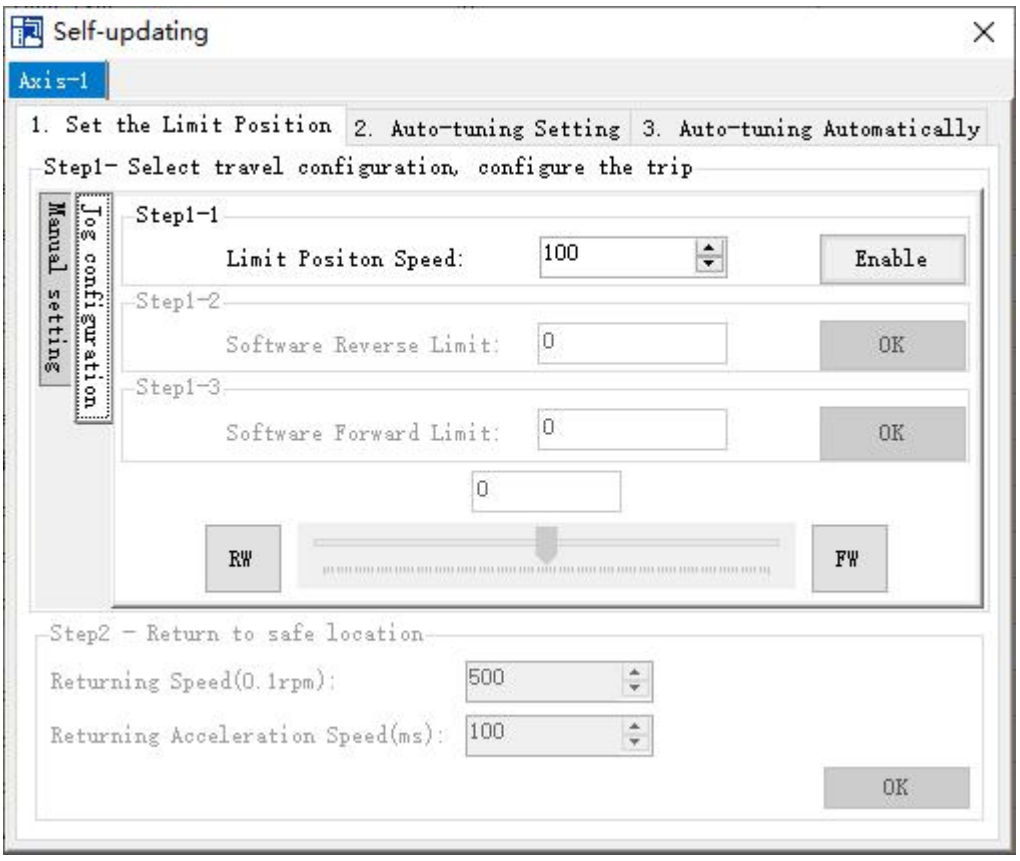
Error code	Meaning	Possible Reasons and Solutions
		enabled. When this function is activated, it will automatically switch to P/PI control, triggering Alarm Err-4 during inertia compensation execution. ② The load connected to the motor exhibits excessive deviation from its inertia, preventing the driver from accurately estimating the inertia. It is recommended to replace the motor with one featuring proper inertia matching, or manually increase P0-07 (when inertia identification is not feasible). ③ Empty-shaft estimated inertia. Inertia identification should be performed under load. ④ Incorrect phase sequence of the power lines. Check the phase sequence and wiring of the power lines.
Err-5	Uncontrollable vibrations occur during the inertia identification process.	An un-handleable vibration occurred
Err-6	The drive is not in BB mode currently	① The enable option is already turned on. Set P5-20 to 0 first; ② The driver alarm will appear. Press ESC to exit the configuration interface and check for any alarms.
Err-7	An alarm was triggered in the driver during the inertia identification process.	The drive has an alarm function. Press the ESC key to exit the calibration interface and view the alarm code. Resolve the alarm first before proceeding with inertia estimation.

II. XINJE Servo Inertial Estimation Steps

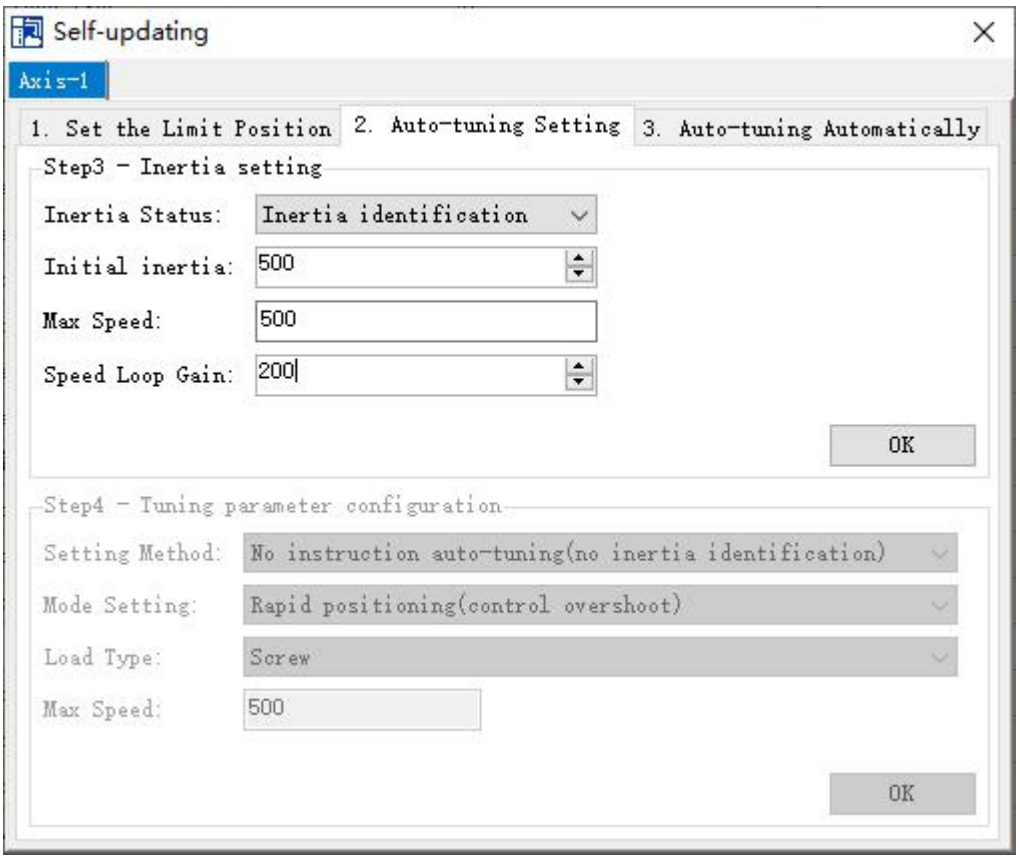
1. On the XINJE Servo main menu screen, click [Gain Adjustment];



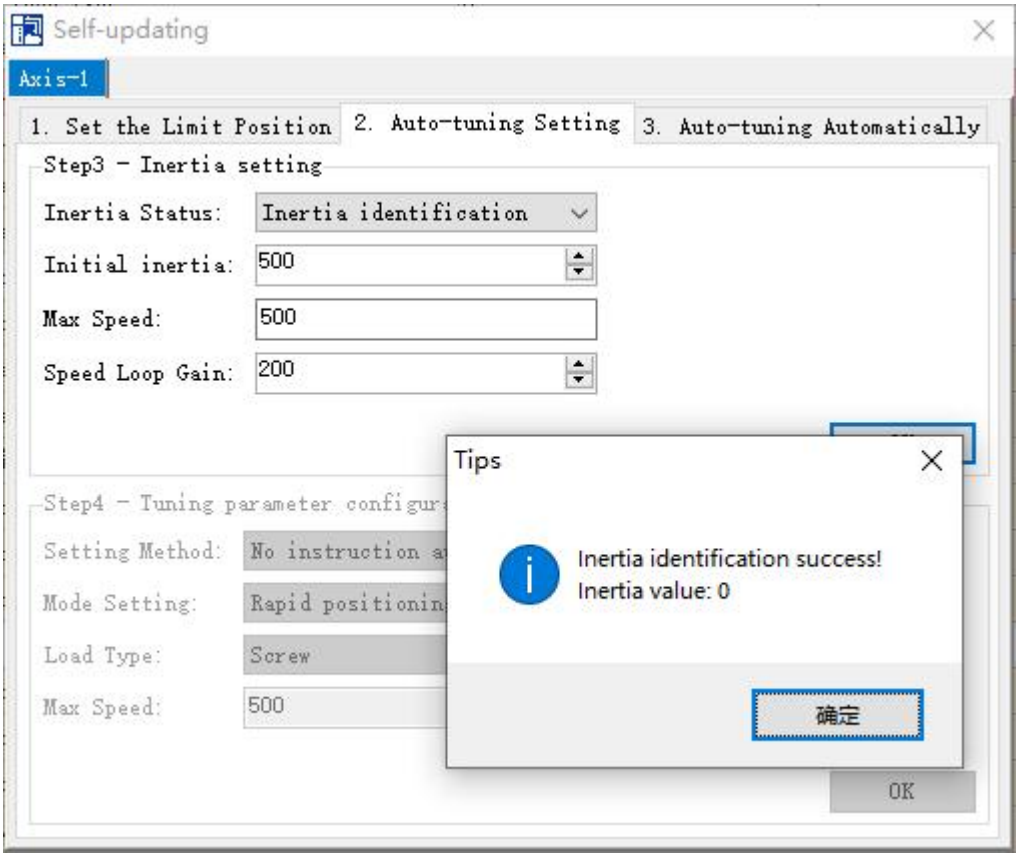
2. Select [Dynamic Configuration] or [Manual Setting] to configure the inertia estimation travel distance;



3. Configure the settings interface;


Self-updating
Axis-1
1. Set the Limit Position
2. Auto-tuning Setting
3. Auto-tuning Automatically
Step3 - Inertia setting
Inertia Status:
Inertia identification
Initial inertia:
500
Max Speed:
500
Speed Loop Gain:
200
OK
Step4 - Tuning parameter configuration
Setting Method:
No instruction auto-tuning(no inertia identification)
Mode Setting:
Rapid positioning(control overshoot)
Load Type:
Screw
Max Speed:
500
OK

4. Click [Confirm] to start estimating inertia.



- If you close the self-calibration interface directly at this point, the driver will only configure the inertia ratio parameters.
- For detailed instructions on using XINJE Servo's estimated inertia, refer to the XINJE Servo help documentation.

7.3 Quick Adjustment

7.3.1 Overview

To perform rapid adjustment, first set the load moment of inertia. Mismatched moments of inertia will trigger an oscillation alarm. The gain parameters for rapid adjustment operate in self-tuning mode.

7.3.2 Quick Adjustment Steps

1. Determine the load inertia using either the drive panel or the XINJE Servo host software, referring to Section 7.2 on rotational inertia estimation;
2. Set the required rigidity level P0-04.



P2-01.0 is the rightmost digit of the P2-01 parameter, as shown below:

P2-01=n. 0 0 1 0
↳ P2-01.0

7.3.3 Rigid Level Corresponding to Gain Parameters

The stiffness level should be set based on actual load conditions; the higher the P0-04 value, the greater the servo gain. If vibration occurs during stiffness level increase, further increases should be avoided; however, if vibration is eliminated through vibration suppression, additional increases may be attempted. The following are recommended stiffness levels for different loads for reference only.
Supports three rigid level types selected via P6-00.0:

1) P6-00.0 = 0: Standard mode [Default]:

Rigidity grade P0-04, associated with four parameters: P1-00, P1-01, P1-02, and P2-35;

2) P6-00.0 = 1: Positioning mode, also known as Soft Mode:

While ensuring responsiveness, gain switching is employed to minimize overshoot at the end of positioning. The rigidity level is P0-04, involving seven parameters: P1-00, P1-01, P1-02, P2-35, P1-05, P1-06, and P1-07, with gain switching forcibly enabled for these parameters; P1-14 = 0x00A1.

3) P6-00.0 = 2: Rapid positioning mode:

Enable the model loop and disturbance observer Dob with rigidity level P0-04, associating five parameters: P1-00, P1-01, P1-02, P2-35, and P2-49. Force binding for P2-00.0 and P2-41 of the disturbance observer Dob, as well as P2-47.0 and P2-49 of the model loop.

- Standard Mode Rigid Grade Table (P6-00.0=0)

Rigidity Level P0-04	Speed Loop Gain P1-00	Speed loop integral time constant P1-01	Position Loop Gain P1-02	Torque command filtering time constant 1 P2-35
0	15	50000	24	1326
1	20	39789	32	995
2	25	31831	40	796
3	30	26526	48	663
4	35	22736	56	568
5	45	17684	72	442
6	60	13263	96	332
7	75	10610	120	265
8	90	8842	144	221
9	110	7234	176	181
10	140	5684	224	142
11	180	4421	288	111
12	250	3183	400	80
13	300	2653	480	66
14	350	2274	560	57
15	400	1989	640	50
16	500	1592	800	40
17	600	1326	960	33
18	750	1061	1200	27
19	900	884	1440	22
20	1150	692	1840	17
21	1400	568	2240	14
22	1700	468	2720	12
23	2100	379	3360	9
24	2500	318	4000	8
25	2800	284	4480	7
26	3100	257	4960	6
27	3400	234	5440	6
28	3700	215	5920	5
29	4000	199	6400	5
30	4500	177	7200	5
31	5000	159	8000	5
32	5500	145	8800	3
33	6000	133	9600	3
34	6500	123	10400	3
35	7000	114	11200	0
36	7500	106	12000	0
37	8000	100	12800	0
38	8500	94	13600	0
39	9000	88	14400	0
40	9500	84	15200	0

Rigidity Level P0-04	Speed Loop Gain P1-00	Speed loop integral time constant P1-01	Position Loop Gain P1-02	Torque command filtering time constant 1 P2-35
41	10000	80	16000	0

- Rigidity Level Table for Positioning Mode (P6-00.0=1)

Rigidity Grade P0-04	Speed Loop Gain P1-00	Speed loop integral time constant P1-01	Position Loop Gain P1-02	Torque command filtering time constant 1 P2-35	Second Speed Loop Gain P1-05	Second speed loop integral time constant P1-06	Second Position Ring Gain P1-07
0	15	50000	24	1326	15	51200	40
1	20	39789	32	995	20	51200	48
2	25	31831	40	796	25	51200	56
3	30	26526	48	663	30	51200	72
4	35	22736	56	568	35	51200	96
5	45	17684	72	442	45	51200	120
6	60	13263	96	332	60	51200	144
7	75	10610	120	265	75	51200	176
8	90	8842	144	221	90	51200	224
9	110	7234	176	181	110	51200	288
10	140	5684	224	142	140	51200	400
11	180	4421	288	111	180	51200	480
12	250	3183	400	80	250	51200	560
13	300	2653	480	66	300	51200	640
14	350	2274	560	57	350	51200	800
15	400	1989	640	50	400	51200	960
16	500	1592	800	40	500	51200	1200
17	600	1326	960	33	600	51200	1440
18	750	1061	1200	27	750	51200	1840
19	900	884	1440	22	900	51200	2240
20	1150	692	1840	17	1150	51200	2720
21	1400	568	2240	14	1400	51200	3360
22	1700	468	2720	12	1700	51200	4000
23	2100	379	3360	9	2100	51200	4480
24	2500	318	4000	8	2500	51200	4960
25	2800	284	4480	7	2800	51200	5440
26	3100	257	4960	6	3100	51200	5920
27	3400	234	5440	6	3400	51200	6400
28	3700	215	5920	5	3700	51200	7200
29	4000	199	6400	5	4000	51200	8000
30	4500	177	7200	5	4500	51200	8000
31	5000	160	8000	5	5000	51200	8000

Rigidity Grade P0-04	Speed Loop Gain P1-00	Speed loop integral time constant P1-01	Position Loop Gain P1-02	Torque command filtering time constant 1 P2-35	Second Speed Loop Gain P1-05	Second speed loop integral time constant P1-06	Second Position Ring Gain P1-07
32	5500	145	8800	3	5500	51200	8000
33	6000	133	9600	3	6000	51200	8000
34	6500	123	10400	3	6500	51200	8000
35	7000	114	11200	0	7000	51200	8000
36	7500	106	12000	0	7500	51200	8000
37	8000	100	12800	0	8000	51200	8000
38	8500	94	13600	0	8500	51200	8000
39	9000	88	14400	0	9000	51200	8000
40	9500	84	15200	0	9500	51200	8000
41	10000	80	16000	0	10000	51200	8000

- Quick Location Mode Rigid Level Table (P6-00.0=2)

Rigidity Level P0-04	Speed Loop Gain P1-00	Speed loop integral time constant P1-01	Position Loop Gain P1-02	Torque command filtering time constant P2-35	Model Ring Gain P2-49
0	71	50000	24	20	24
1	80	39789	32	20	32
2	89	31831	40	20	40
3	100	26526	48	20	48
4	112	22736	56	20	56
5	125	17684	72	20	72
6	140	13263	96	20	96
7	157	10610	120	20	120
8	176	8842	144	20	144
9	198	7234	176	20	176
10	221	5684	224	20	224
11	248	4421	288	20	288
12	278	3183	400	20	400
13	311	2653	480	20	480
14	349	2274	560	20	560
15	390	1989	640	20	640
16	437	1592	800	20	800
17	490	1326	960	20	960
18	549	1061	1200	20	1200
19	615	884	1440	20	1440
20	689	692	1840	20	1840
21	771	568	2240	20	2240
22	864	468	2720	20	2720
23	968	379	3360	20	3360

Rigidity Level P0-04	Speed Loop Gain P1-00	Speed loop integral time constant P1-01	Position Loop Gain P1-02	Torque command filtering time constant P2-35	Model Ring Gain P2-49
24	1084	318	4000	8	4000
25	1214	284	4480	7	4480
26	1360	257	4960	6	4960
27	1523	234	5440	6	5440
28	1705	215	5920	5	5920
29	1910	199	6400	5	6400
30	2139	177	7200	5	7200
31	2396	160	8000	5	8000
32	2684	145	8800	3	-
33	3006	133	9600	3	-
34	3367	211	10400	3	-
35	3771	189	11200	0	-
36	4223	168	12000	0	-
37	4730	150	12800	0	-
38	5298	134	13600	0	-
39	5934	107	14400	0	-
40	6646	95	15200	0	-
41	6646	95	16000	0	-

7.3.4 Precautions

- In Quick Adjustment Mode, all gain parameters corresponding to the rigidity level can be independently fine-tuned.
- To ensure stability, the model ring gain is kept low at low stiffness levels; this parameter can be increased separately when high response is required.
- When rapid adjustment causes vibration, modify the torque command filter P2-35; if ineffective, perform mechanical characteristic analysis and set the relevant notch parameters (refer to Section 7.7 Vibration Suppression).
- The Quick Adjustment mode defaults to a rigid level. If the gain does not meet mechanical requirements, adjust it gradually upward or downward.

7.4 Automatic Adjustment

7.4.1 Overview

Automatic adjustment is divided into internal command-based self-adjustment and external command-based self-adjustment.

Automatic adjustment (internal command self-setting) refers to a function where the servo unit operates automatically (performing reciprocating movements in both forward and reverse directions) without commands from the higher-level device, adjusting its operation based on mechanical characteristics during runtime.

Automatic adjustment (external command self-setting) is a function that automatically optimizes parameters based on operational commands from the upper-level device.

The automatic adjustment items are as follows:

- Load rotational inertia
- Gain Parameters (Speed Loop, Position Loop, Model Loop Gain)
- Filter (passband filter, torque command filter)

7.4.2 Precautions

When unable to configure

- Mechanical systems can only operate in one direction.

Scenarios where calibration is prone to failure

- The load's rotational inertia is too large;
- The rotational inertia varies significantly during operation.
- Low mechanical rigidity causes vibration during operation, resulting in failed detection and positioning.
- The operating range is limited to within 0.5 revolutions.

Preparations before calibration

- Use Position Mode;
- The drive is in BB mode;
- The drive has no alarm;
- The number of pulses per revolution of the servo motor must be properly matched to the required positioning width.

7.4.3 Operating Tools

Both internal command self-setting and external command self-setting can be performed via the driver panel and the XINJE Servo host software.

Calibration Mode	Operation Tools	Restriction Item
Internal commands are set after calibration. External commands are set after the initial configuration.	XINJE Servo Master Computer Software	All versions of the host software support it.
	Drive Panel	The driver firmware requires version 3700 or higher

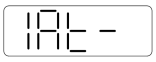
The driver firmware version can be viewed via U2-07.

7.4.4 Internal Instructions for Self-Setting Operation Steps

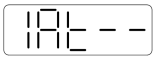
1. Self-Calibration Steps for the Drive Panel

1. Perform inertia identification by following the driver panel inertia estimation procedure outlined in Step 7.2.4 of the rotational inertia estimation section.

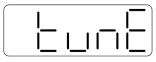
2. Enter parameter F0-09 and display "iat-";



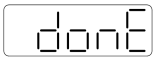
3. Press and hold the ENTER key; the panel will display "iat--", indicating that the servo is enabled.



4. Shortly press INC or DEC; the panel displays "tune" and flashes, entering the calibration state.



5. The driver automatically sends pulse commands internally to operate; upon successful calibration, it displays "done" and flashes.



6. Press and hold the STA/ESC key to exit internal command auto-setting.

During the calibration process, pressing STA/ESC briefly at any time will terminate the operation and apply the gain parameters at that moment. If calibration fails, always initialize the driver before attempting it again.

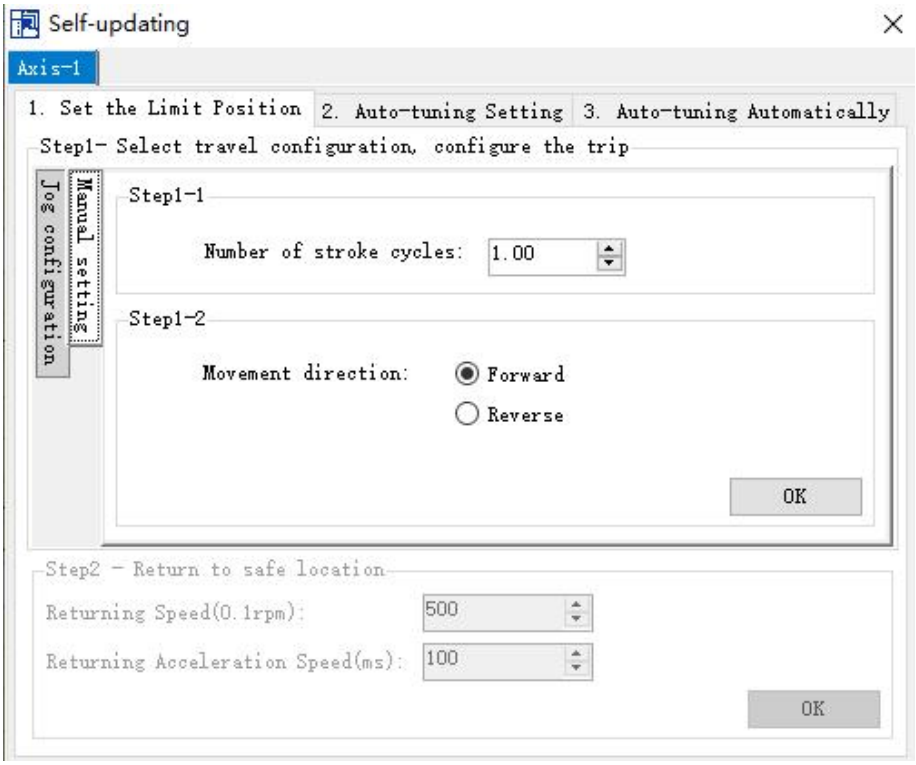
Error alarm on the self-calibration process panel

Error code	Meaning	Possible Reasons
Err-1	Search for optimal gain failed	The moment of inertia ratio is too high; the mechanism rigidity is too low
Err-2	Over-range/alarm occurred during the self-tuning process	Ensure the journey does not exceed limits or trigger alarms before auto-resetting
Err-6	The drive is not in the "bb" state when	Confirm the current status of the drive

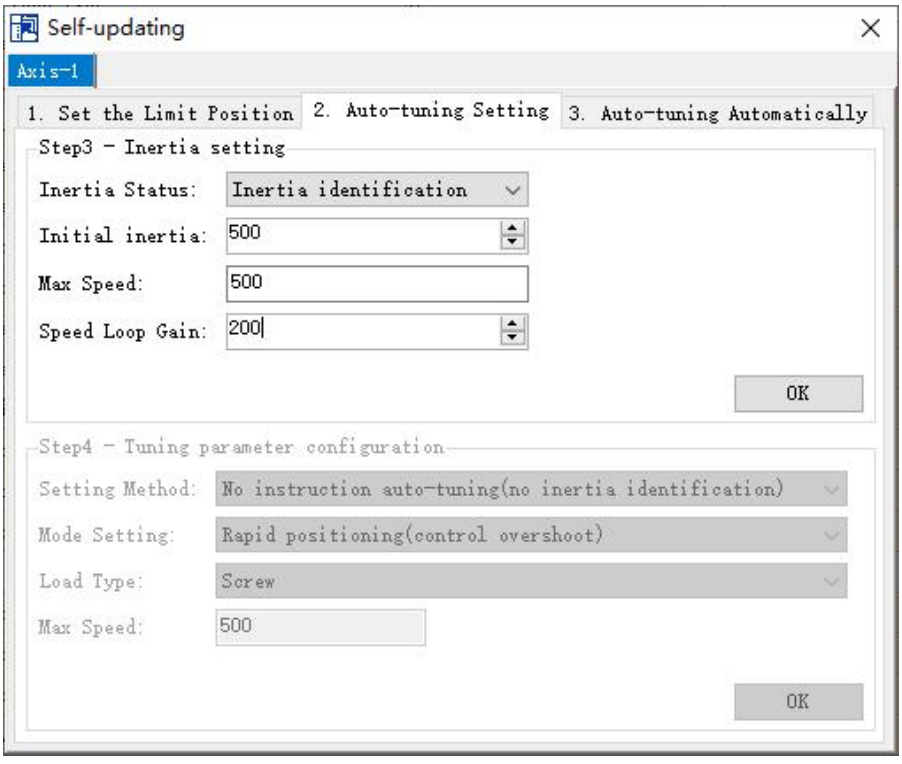
	performing the operation.	
Err-7	An alarm occurred in the driver during the calibration process.	The drive has an alarm.

II. XINJE Servo Self-Calibration Steps

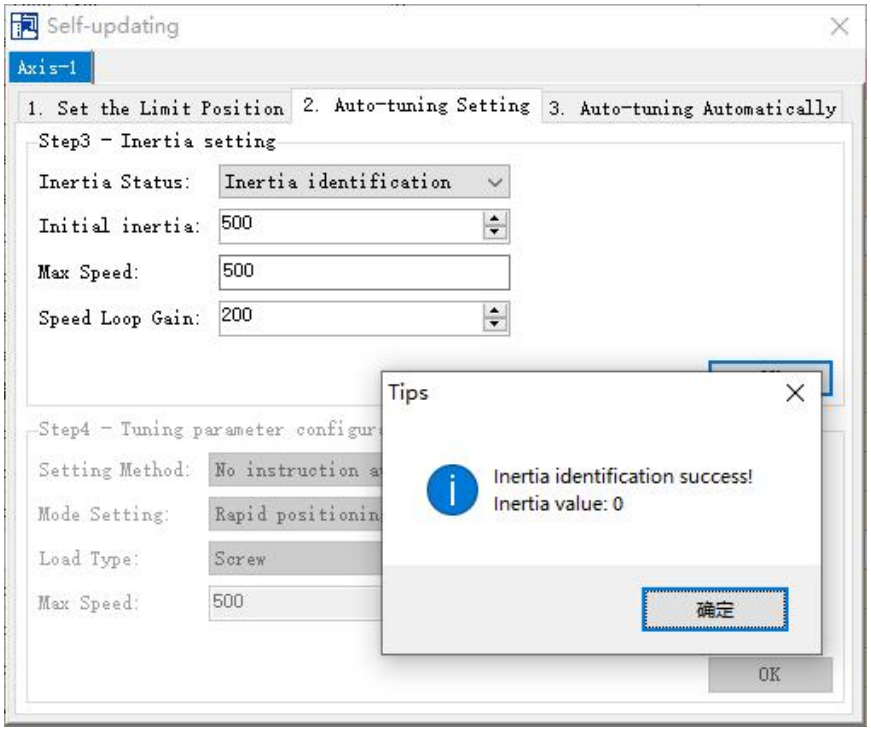
1. On the XINJE Servo main menu screen, click [Gain Adjustment];
2. Select [Dynamic Configuration] or [Manual Setting] to configure the inertia estimation travel distance;



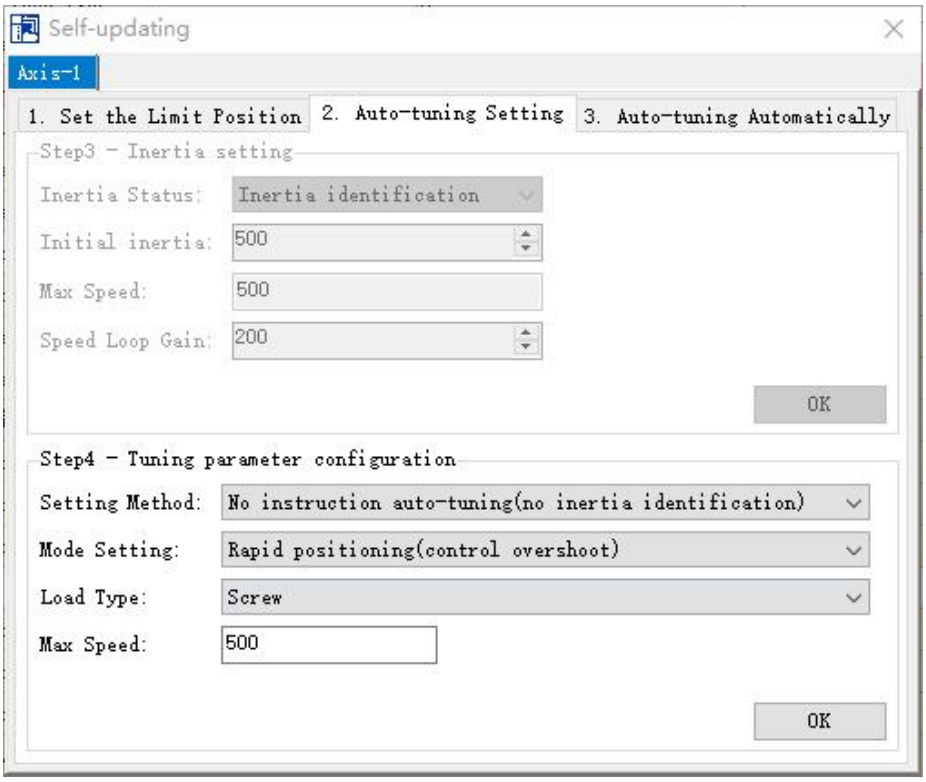
3. Configure the settings interface;



4. Click [Confirm] to start calculating the inertia;



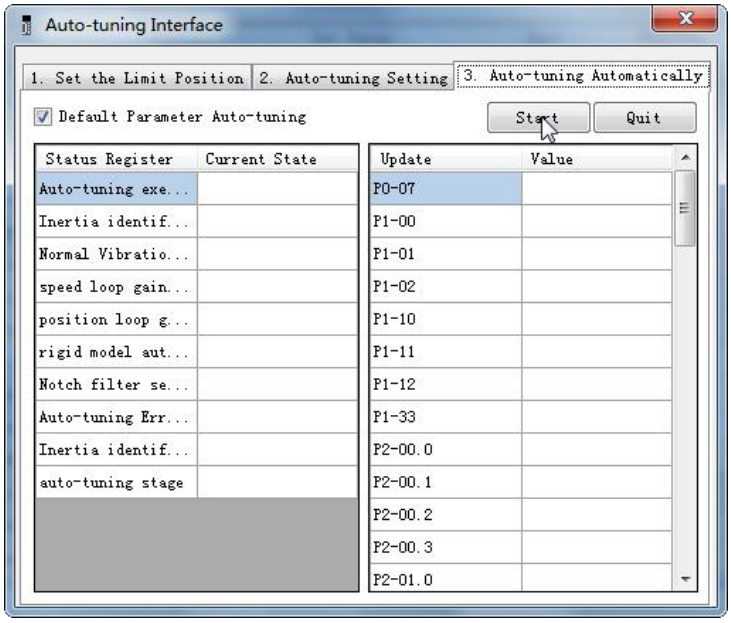
5. Adjust parameter settings;



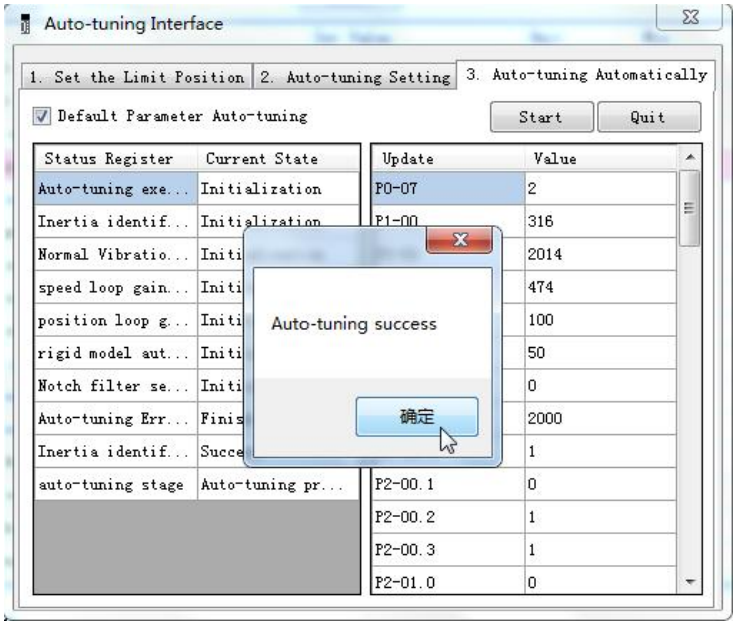
Calibration Method	Explain
soft	Make gentle gain adjustments. In addition to gain adjustment, the notch filter is automatically adjusted.
quick	Perform dedicated adjustments for positioning purposes. In addition to gain

positioning	adjustment, it automatically adjusts the model loop gain and notch filter.
quick positioning (Correct overshoot)	During application-specific configuration, adjust parameters to avoid overshoot. In addition to gain adjustment, the system automatically adjusts model loop gain and notch filter settings.
Rigidity Level	Explain
Synchronous belt	Perform adjustments suitable for mechanisms with low rigidity, such as synchronous belt systems.
lead screw	Perform adjustments suitable for highly rigid mechanisms such as ball screw systems. If no corresponding mechanism is available, select this type.
fixed joint	Perform adjustments suitable for rigid systems and other mechanisms with high rigidity.

6. Begin calibration;



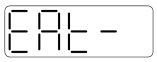
7. Wait for the calibration to complete.



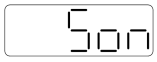
7.4.5 External Command-Based Self-Setting Operation Steps

1. Self-Calibration Steps for the Drive Panel

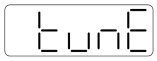
1. Perform inertia identification by following the driver panel inertia estimation procedure outlined in Step 7.2.4 of the rotational inertia estimation section.
2. When entering parameter F0-08, the display shows Eat-(External Reference Auto-tuning);



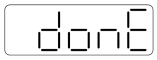
3. Press and hold the ENTER key: if enabling is not enabled, the panel will display "Son" and flash; wait for enabling to activate; if enabling is already enabled, skip this step.



4. Enable the servo function; the panel displays "Tune" and flashes, entering the calibration state.



5. The upper-level device initiates pulse command transmission for operation; if successfully configured, it displays "done" and flashes.



6. Press and hold the STA/ESC key to exit external command auto-setting.

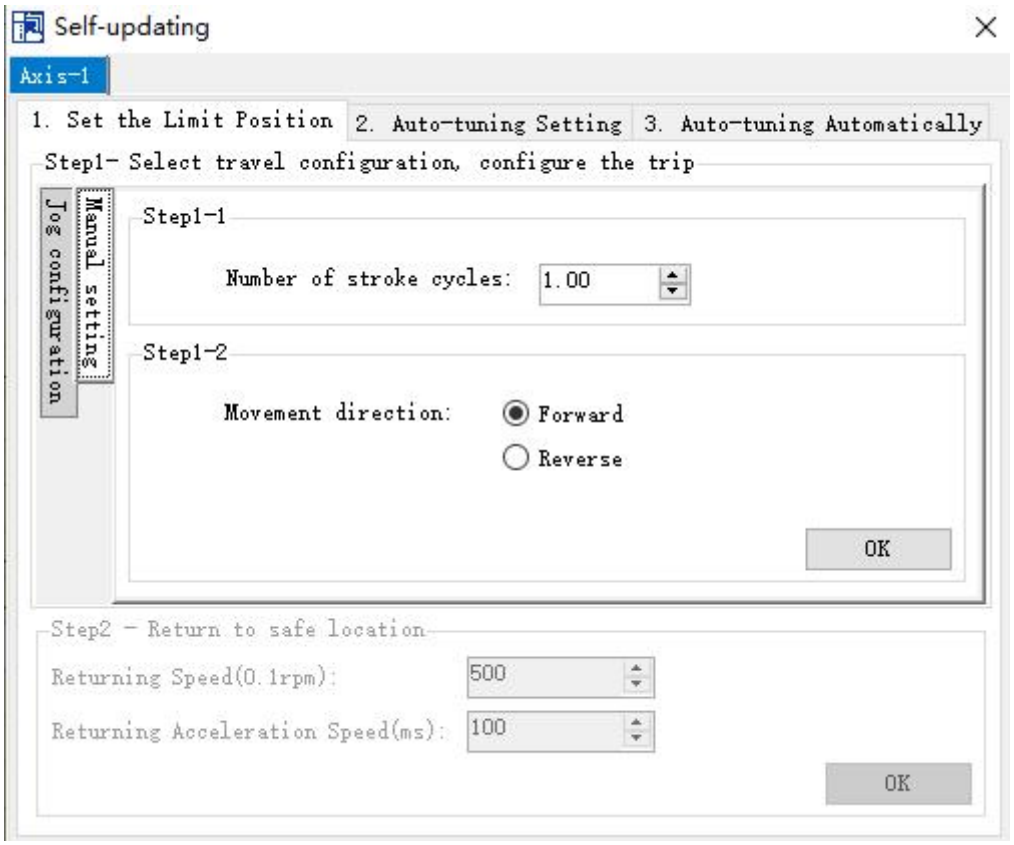
During the calibration process, briefly pressing STA/ESC at any time will terminate the operation and apply the gain parameters at the time of termination.

Error alarm on the self-calibration process panel

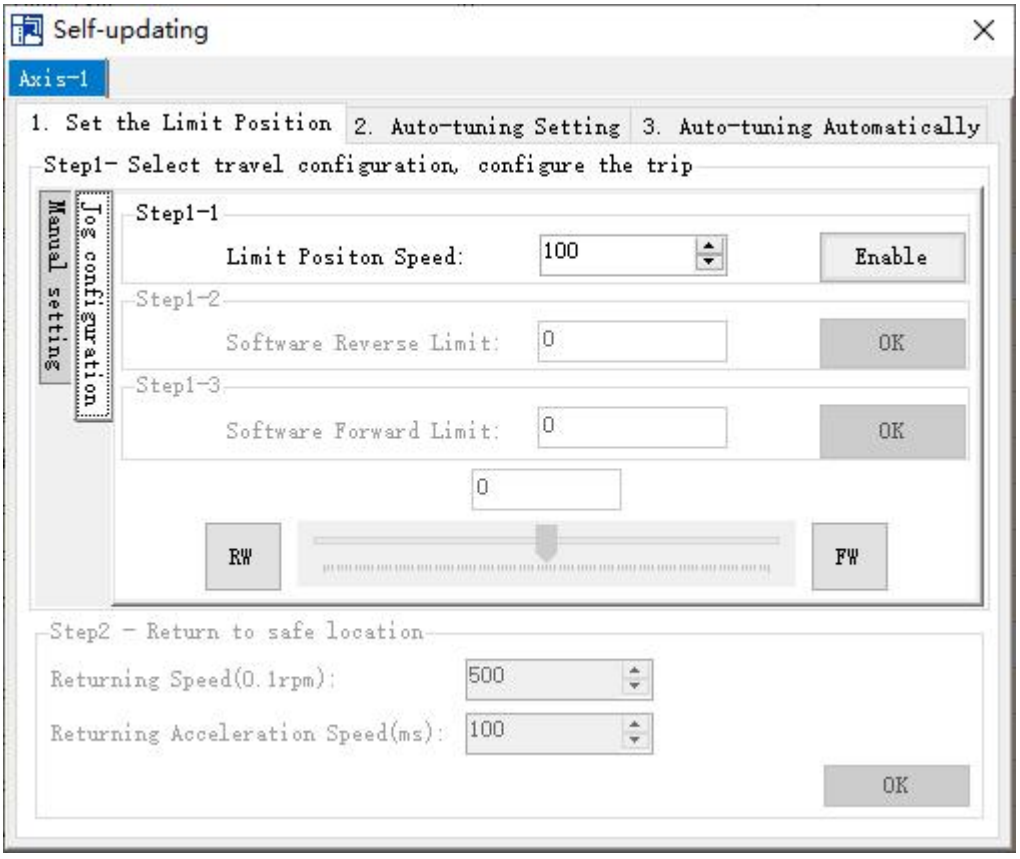
Error code	Meaning	Possible Reasons
Err-1	Search for optimal gain failed	The moment of inertia ratio is too high; the mechanism rigidity is too low
Err-2	① Over-range/alarm occurred during the calibration process ② External command setting/vibration suppression mode: Servo function is enabled during the setting process	Ensure the journey does not exceed limits or trigger alarms before auto-resetting Confirm that enabling is not disabled during the calibration process
Err-3	Current Non-Position Control Mode	Self-adjust in location mode
Err-4	Adaptive feature is not turned off	Change P2-01.0 to 0 before performing self-calibration
Err-7	An alarm occurred in the driver during the calibration process.	The drive has issued an alarm
Err-8	The positioning completion signal is unstable.	The instruction interval is too short

II. XINJE Servo Self-Calibration Steps

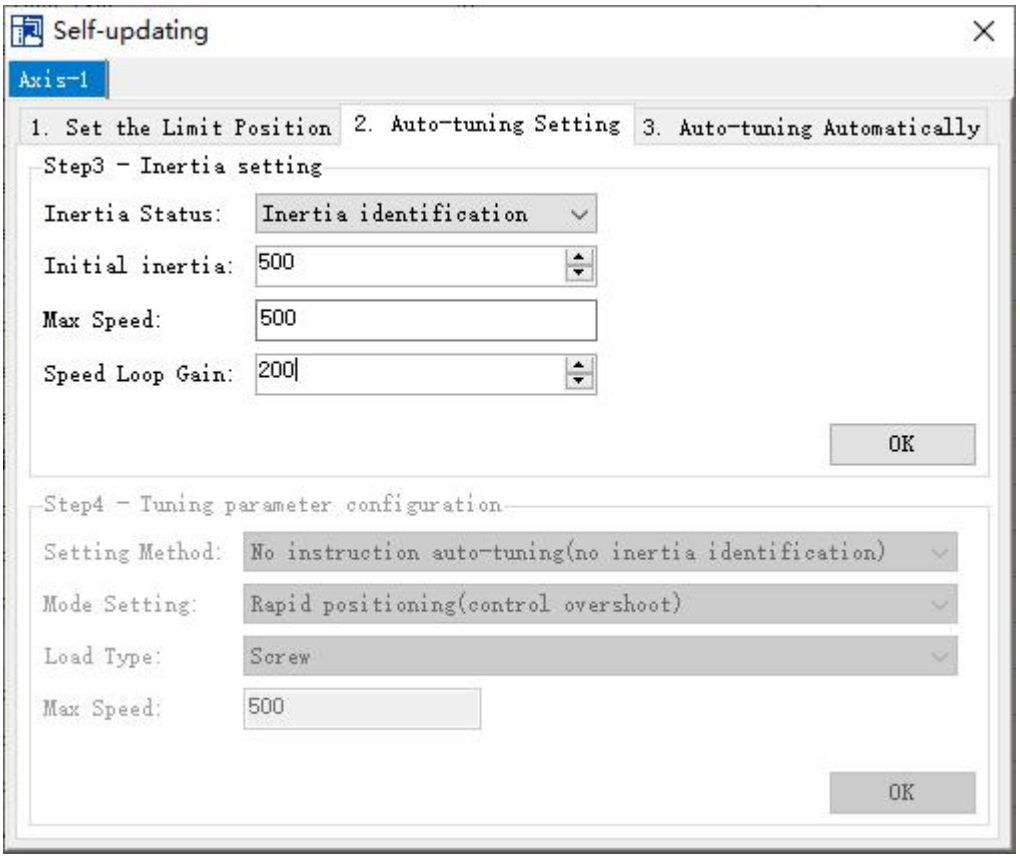
1. On the XINJE Servo main menu screen, click [Gain Adjustment];



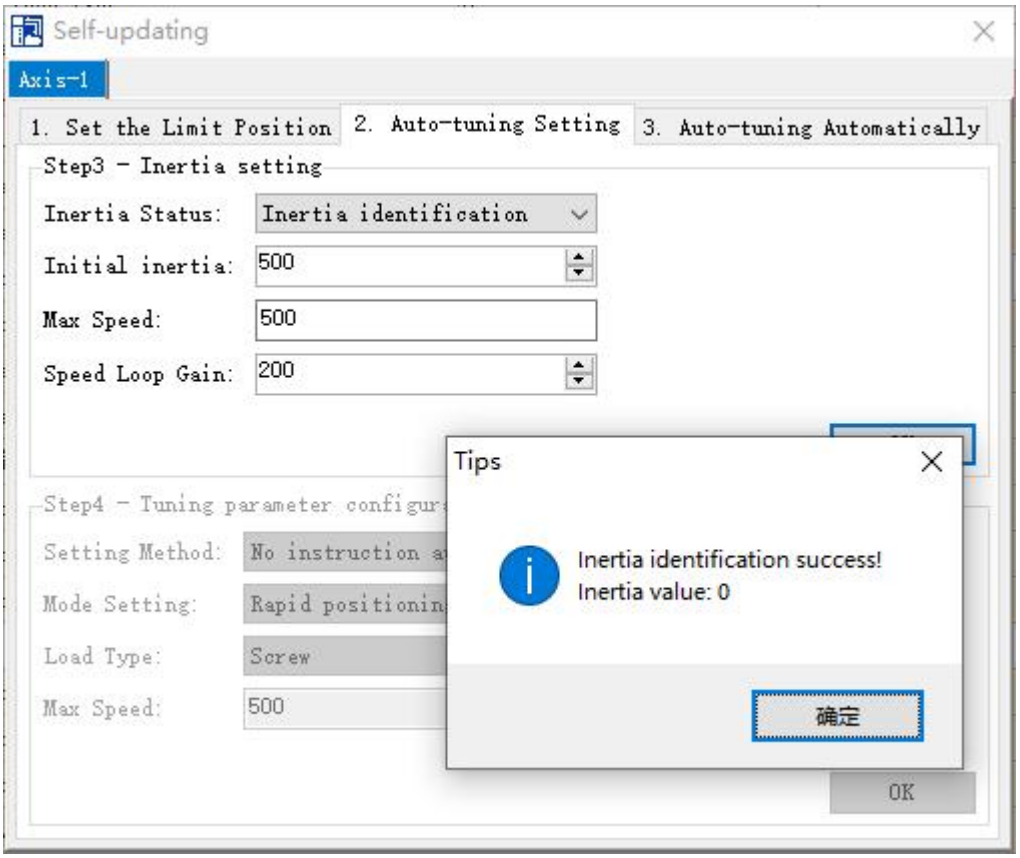
2. Select [Dynamic Configuration] or [Manual Setting] to configure the inertia estimation travel distance;



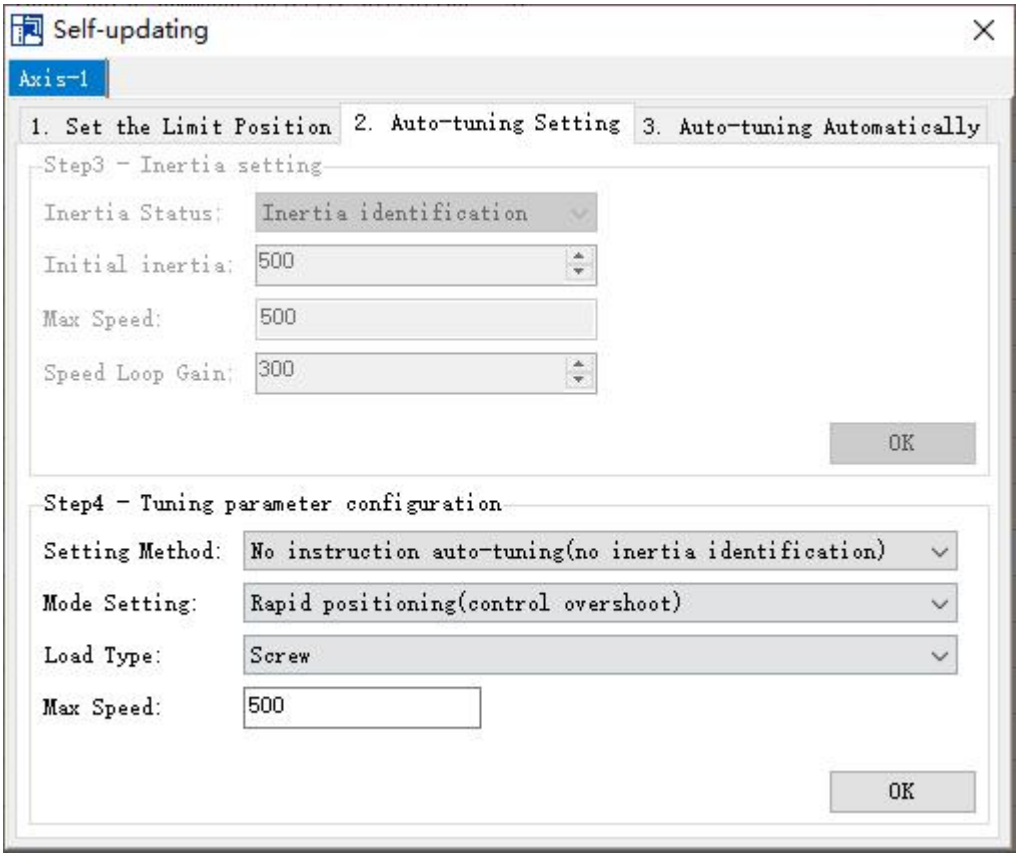
3. Configure the settings interface;



4. Click [Confirm] to start calculating the inertia;



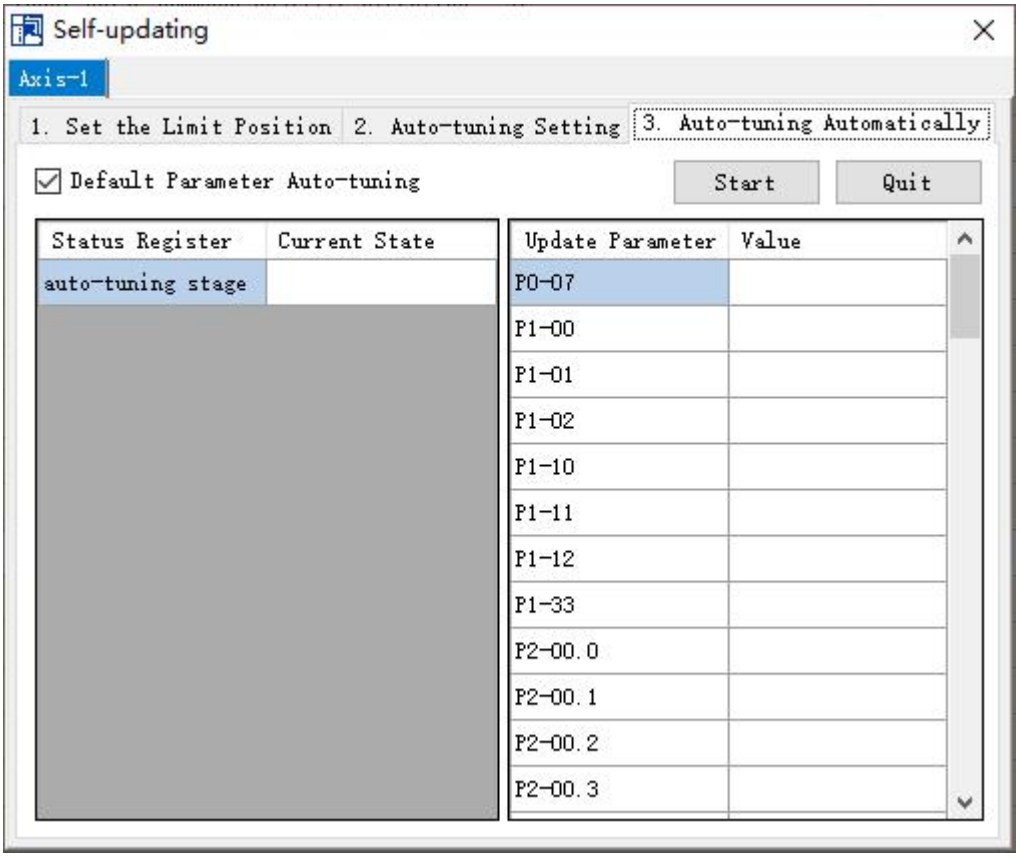
5. Adjust parameter settings;



Calibration Method	Explain
soft	Make gentle gain adjustments. In addition to gain adjustment, the notch filter is automatically adjusted.
quick positioning	Perform dedicated adjustments for positioning purposes. In addition to gain adjustment, it automatically adjusts the model loop gain and notch filter.
quick positioning (Correct overshoot)	During application-specific configuration, adjust parameters to avoid overshoot. In addition to gain adjustment, the system automatically adjusts model loop gain and notch filter settings.

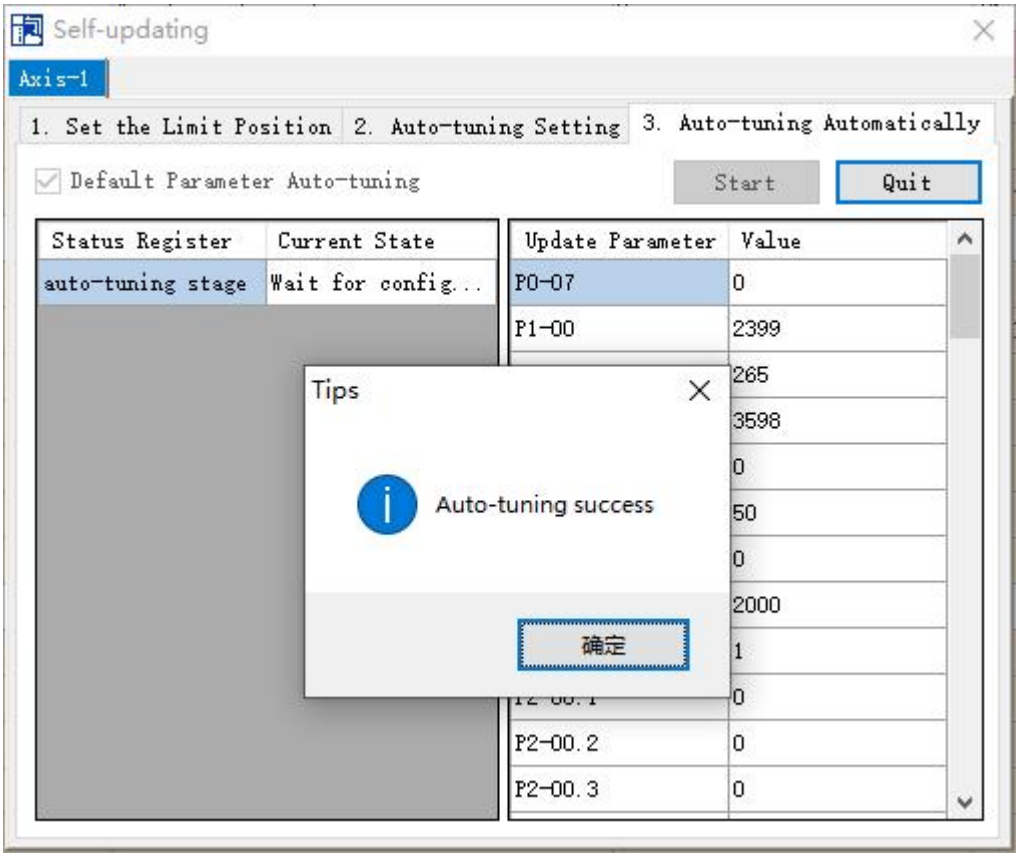
Rigidity Level	Explain
Synchronous belt	Perform adjustments suitable for mechanisms with low rigidity, such as synchronous belt systems.
lead screw	Perform adjustments suitable for highly rigid mechanisms such as ball screw systems. If no corresponding mechanism is available, select this type.
fixed joint	Perform adjustments suitable for rigid systems and other mechanisms with high rigidity.

6. Begin calibration;



7. After enabling the servo, click OK;

8. After calibration is complete, click OK.



7.4.6 Relevant Parameters

The following parameters may be modified during automatic adjustment. Do not change them manually.

Parameter	Name	Parameter attribute	After the calibration is completed, the numerical values have an impact on the gain.
P0-07	First Inertia Ratio	Gain Performance parameter	have
P1-00	First Speed Loop Gain		
P1-01	First-speed loop integration time constant		
P1-02	First-position ring gain		
P2-00.0	Disturbance Observer Switch		
P2-01.0	Adaptive Mode Switch		
P2-35	Torque command filtering time constant 1		
P2-41	Disturbance observer gain		
P2-47.0	Model Loop Switch		
P2-49	Model Ring Gain		
P2-55	Model Speed Feedforward Gain		
P2-60.0	Active Vibration Suppression Switch		
P2-61	Active vibration suppression frequency		
P2-62	Active vibration suppression gain		
P2-63	Active vibration suppression damping		
P2-64	Active vibration suppression filtering time 1		
P2-65	Active vibration suppression filtering time 2		
P2-66	The second group uses active vibration suppression damping techniques.		
P2-67	Second group of active vibration suppression frequencies		
P2-69.0	First notch switch		
P2-69.1	Second suppression switch		
P2-71	First notch frequency		
P2-72	First notch attenuation		
P2-73	First notch bandwidth		
P2-74	Second absorption frequency		
P2-75	Second absorption attenuation		
P2-76	Second absorption band width		
P2-17	Inertia identification and the maximum speed determined through internal command-based self-adjustment	Calibration Configuration parameter	not have
P2-86	Set the manual operation mode		
P2-87	Minimum limit for the adjustment movement		
P2-88	Maximum limit for the adjustment		

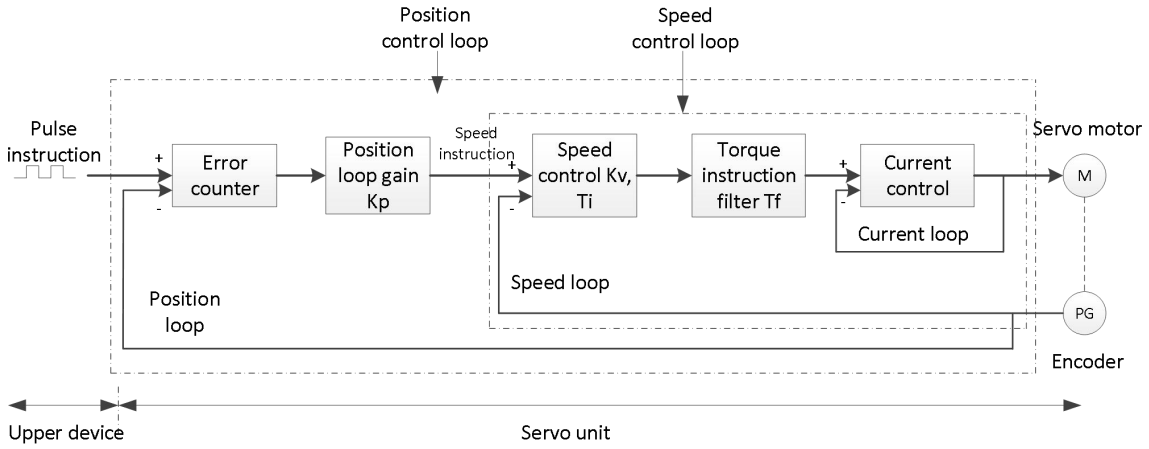
Parameter	Name	Parameter attribute	After the calibration is completed, the numerical values have an impact on the gain.
	movement		
P2-89	Maximum speed during the adjustment movement		
P2-90	Set-up acceleration and deceleration time		



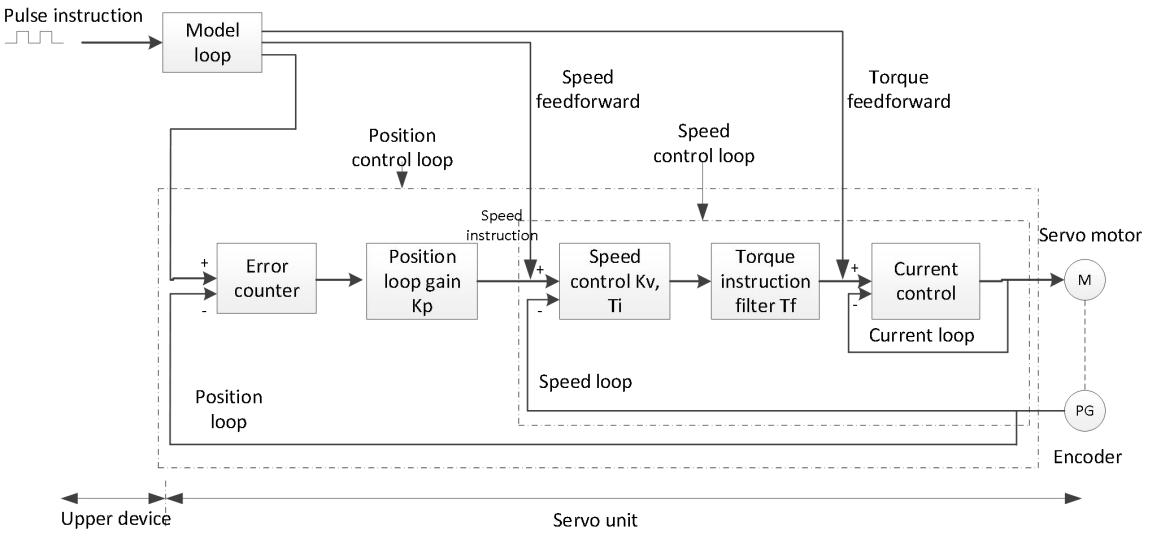
Values P2-60 to P2-63 are automatically adjusted during the self-calibration process and cannot be modified manually by users; doing so may cause system instability.

7.5 Manual Adjustment

7.5.1 Overview



Control block diagram for position control (close model loop)



Control block diagram for position control (model loop enabled)

The servo unit consists of three feedback loops (from inner to outer: current loop, speed loop, and position loop). The innermost loop requires the highest responsiveness. Failure to adhere to this principle may result in reduced responsiveness or vibration. The current loop parameters are fixed values that ensure adequate responsiveness, eliminating the need for user adjustment.

Use manual adjustment in the following situations:

- When rapid gain adjustment fails to achieve the desired effect
- When automatic gain adjustment fails to achieve the desired effect

7.5.2 Example of Adjustment Steps

In position mode, if the soft mode (P2-02.0=1) is selected during self-adjustment, the model loop function is disabled; in speed mode, the position loop gain becomes ineffective.

Improve response time

1. Reduce the torque command filtering time constant (P2-35)
2. Increase the speed loop gain (P1-00)
3. Reduce the velocity loop integration time parameter (P1-01)
4. Increase the position loop gain (P1-02)
5. Increase the model loop gain (P2-49)

Reduce response, prevent vibration and overshoot

1. Reduce the speed loop gain (P1-00)
2. Increase the integration time constant of the velocity loop (P1-01)
3. Reduce position loop gain (P1-02)
4. Increase the torque command filtering time constant (P2-35)
5. Reduce model loop gain (P2-49)

7.5.3 Adjusted Gain Parameters

The gain parameters that need adjustment are generally:
P1-00 Speed Loop Gain
P1-01 Integration Time Constant for the Speed Loop
P1-02 Position Ring Gain
P2-35 Torque Command Filter Time Constant
P2-49 Model Ring Gain

- Speed Loop Gain

When the speed loop exhibits low responsiveness, it becomes a delay factor for the lateral position loop, leading to overshoot or vibration in the speed command. Therefore, within the range where no vibration occurs in the mechanical system, the higher the set value, the more stable and responsive the servo system becomes.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P1-00	Speed Loop Gain	<=20P7：300 >=21P0：200	0.1Hz	10～20000	at any time	immediately

- Speed loop integral time constant

To ensure responsiveness even to minimal inputs, the speed loop incorporates an integral element. Since

this integral element acts as a delay component in servo systems, setting the time constant too large may cause overshoot or prolong positioning time, thereby reducing responsiveness.

The speed-loop gain and the speed-loop integration time constant approximately satisfy the following relationship: P1-00 × P1-01 = 636620

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P1-01	Speed loop integral time constant	<=20P7: 2122 >=21P0: 3183	0.01ms	15 ~ 51200	at any time	immediately

- Position Loop Gain

When the model loop is inactive (P2-47.0 = 0), the responsiveness of the servo unit's position loop is determined by its gain. A higher position loop gain results in greater responsiveness and shorter positioning time. Generally, the gain should not be set beyond the range of the mechanical system's natural frequencies. Therefore, achieving a high position loop gain requires increasing the machine's rigidity and raising its natural frequencies.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P1-02	Position Loop Gain	<=20P7：300 >=21P0：200	0.1/s	10 ~ 20000	at any time	immediately

- Torque command filtering time constant

Vibrations caused by servo drive can be eliminated by adjusting the filtering time parameter for torque commands. A smaller value enables better responsive control, though subject to machine constraints.

When vibrations occur, reduce this parameter; the recommended range is 10–150.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P2-35	Torque command filtering time constant 1	<=20P7：66 >=21P0：111	0.01ms	0 ~ 65535	at any time	immediately
P2-36	Torque command filtering time constant 2	100	0.01ms	0 ~ 65535	at any time	immediately

- Model Ring Gain

When the model loop is active (P2-47.0=1), the servo system's responsiveness is determined by its model-loop gain. Increasing this gain enhances responsiveness and reduces positioning time; in this case, the system's responsiveness depends on this parameter rather than P1-02 (position-loop gain). The model-loop gain applies only to position mode.

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P2-49	Model Ring Gain	<=20P7：500 >=21P0：350	0.1Hz	10～20000	at any time	The server has not started.

7.6 Adaptive Adjustment

7.6.1 Overview

The adaptive function enables stable response through automatic adjustment regardless of machine type or load fluctuations. Servo ON automatically initiates the adjustment process.

7.6.2 Precautions

- After the servo unit is installed on the machine, it may produce a brief sound when first powered on. This is due to the automatic notch filter being configured and does not indicate a fault. No sound will be heard during subsequent power-ups.
- When operating beyond the motor's allowable load moment of inertia, the motor may vibrate. In this case, adjust the relevant adaptive parameters to match the current load moment of inertia.
- During adaptive operation, to ensure safety, enable the adaptive function with the option to stop or shut down immediately in emergencies.

7.6.3 Operating Procedures

The factory-set self-tuning is effective and requires no other parameter changes. Whether adaptive tuning is enabled is controlled by the following parameters.

Parameter		Meaning	Factory Settings	Unit	Set Range
P2-01	n.□□□0	Adaptive Closure	n.□□□0	servo bb	Power On Again
	n.□□□1	Adaptive Open			

7.6.4 Momentum Mode and Related Parameters

The adaptive default parameter is set to the low-inertia mode. If the load inertia significantly exceeds the motor's allowable rotational inertia (e.g., 60 times the inertia of a 60-watt motor), you can activate the adaptive high-inertia mode.

Parameter		Meaning	Factory Settings	Unit	Set Range
P2-03	n.0□□□	Adaptive Low-Inertia Mode	n.0□□□	servo bb	Power On Again
	n.1□□□	Adaptive High-Inertia Mode			

Parameter	Meaning	Factory Settings	Unit	Set Range
P2-05	Adaptive Speed Loop Gain	400 Notes 1	servo bb	Power On

Parameter	Meaning	Factory Settings	Unit	Set Range
				Again
P2-10	Adaptive Speed Loop Integration	500	servo bb	Power On Again
P2-11	Adaptive Position Loop Gain	100	servo bb	Power On Again
P2-07	Adaptive Inertia Ratio	0	servo bb	Power On Again
P2-08	Adaptive Speed Observer Gain	60	servo bb	Power On Again
P2-12	Adaptive Stable Maximum Inertia Ratio	30	servo bb	Power On Again
P2-16	Adaptive control of the motor rotor inertia coefficient	100	servo bb	Power On Again
P2-19	Adaptive Control Bandwidth	50 Notes 2	Change at any time	Effective immediately
P6-05	Adaptive large-inertia mode velocity-loop gain	200	servo bb	Power On Again
P6-07	Adaptive Large-Inertia Mode Inertia Ratio	50	servo bb	Power On Again
P6-08	Gain of the adaptive large-inertia mode velocity observer	40	servo bb	Power On Again
P6-12	Adaptive large-inertia mode stabilizes the maximum inertia ratio.	50	servo bb	Power On Again

- Note 1: For DS5 series servos with 750 W or lower power, the default value is 400; for other power ranges, the default value is 200.
- Note 2: For DS5 series servos with 400 W or lower power, the default value is 70; for other power ranges, the default value is 50.

7.6.5 Recommended Inertia Ratio Parameters

Under adaptive default parameters, the system only ensures stable operation of the load at a specific moment of inertia. If the load has high inertia, some parameters still need adjustment. The recommended parameters are as follows (all modified parameters were set under the default configuration).

Motor Housing	Inertia	Parameter
40～90 Base	Within 20 times the inertia value	Adaptive Low-Inertia Mode (Default Parameter)
	Inertia of 20 to 30 times	Change P2-08 to 50 and P2-12 to 40
	Inertia of 30 to 40 times	Modify P2-08 to 50, P2-12 to 40, and P2-07 to 10

Motor Housing	Inertia	Parameter
	Inertia of 40 to 50 times	Change P2-08 to 50, P2-12 to 40, and P2-07 to 30
	Inertia of 50 to 80 times	Switch to Adaptive High-Inertia Mode or modify P2-08=40, P2-12=50, P2-07=50
110/130 Base	Within 10 times the inertia	Adaptive Low-Inertia Mode (Default Parameter)
	Inertia of 10 to 15 times	Change P2-08 to 50 and P2-12 to 40
	Inertia of 15 to 20 times	Switch to Adaptive High-Inertia Mode or modify P2-08=40, P2-12=50, P2-07=50
Base with a height of 180 cm or more	Within 5 times the inertia	Adaptive Low-Inertia Mode (Default Parameter)
	Inertia of 5 to 10 times	Change P2-08 to 50 and P2-12 to 40
	Inertia of 10 to 20 times	Switch to Adaptive High-Inertia Mode or modify P2-08=40, P2-12=50, P2-07=50

Parameters with higher inertia can still handle loads with lower inertia; for example, a parameter with 50 times the inertia can be used in a mechanism requiring 20 times the load inertia, though its responsiveness will decrease.

7.6.6 Effects of Adaptive Correlation Parameters

Parameter Small Inertia / Large Inertia	Name	Windows default	Reference Angle Section Range	Effect
P2-05/P6-05	Speed loop gain in adaptive mode	400/200	200 ~ 400	Reduction improves inertia capacity but decreases responsiveness, significantly impacting it.
P2-07/P6-07	Load Inertia Ratio in Adaptive Mode	0/50	0 ~ 200	An increase in this parameter can significantly enhance the system's ability to handle inertia without compromising responsiveness; however, excessive increases may easily lead to oscillations.
P2-08/P6-08	Speed Observer Gain	60/40	30 ~ 60	Reducing P2-08 while increasing P2-12 can significantly enhance the system's inertia capacity, but it will compromise responsiveness, with a substantial impact on response performance.
P2-12/P6-12	Adaptive Mode Stabilizes the Maximum Inertia Ratio	30/50	30 ~ 60	
P2-10	Adaptive Mode Speed	500	200 or	Adjust as needed; generally

Parameter Small Inertia / Large Inertia	Name	Windows default	Reference Angle Section Range	Effect
	Loop Integration Time Coefficient		greater	increase
P2-11	Adaptive Mode Position Loop Gain Coefficient	100	50 ~ 200	Adjust as needed to increase response speed and magnitude, or decrease response magnitude and speed
P2-16	Adaptive Mode Motor Rotor Inertia Coefficient	100	100 ~ 200	Enhances servo rigidity and disturbance resistance, effectively addressing operational jitter.
P2-19	Adaptive Control Bandwidth	50 ~ 70	40 ~ 80	Increasing the magnitude slightly enhances the inertia capacity with minimal impact on responsiveness, serving as an auxiliary parameter.

7.6.7 Parameters whose adaptive validity period becomes invalid

When the adaptive function is active (P2-01.0=1), the parameters that become inactive are listed in the table below:

Project	Parameter	Parameter Name
Gain Class	P1-00 P1-05	First Speed Loop Gain Second Speed Loop Gain
	P1-01 P1-06	First-speed loop integration time constant Second speed loop integration time constant
	P1-02 P1-07	First-position ring gain Second Position Ring Gain
	P2-49	Model Ring Gain
	P0-07 P0-08	First Inertia Ratio Second Inertia Ratio
	P5-36	-I-SEL Inertia Ratio Switching

7.7 Vibration Suppression

7.7.1 Overview

Mechanical systems possess a specific resonant frequency; when the servo gain is increased, sustained vibrations may occur near this frequency (typically between 400 Hz and 1000 Hz), preventing further gain improvement. Vibrations can be eliminated either through automatic detection or manual adjustment of the vibration frequency. Once vibrations are eliminated, the gain may be further increased to enhance responsiveness.

- After performing vibration suppression, the servo responsiveness will change compared to before.
- Before performing vibration suppression, correctly set the moment of inertia ratio and gain parameters; otherwise, control will not function properly.

7.7.2 Operating Tools

Adjustment Method	Operation Tools	Control model	Refer to the operational steps for guidance.	Restriction Item
Adaptive Mode	XINJE Servo Mechanical Property Analysis	In Position Mode	7.7.4 Vibration Suppression (Host Computer Software)	All versions of the host software support it.
Self-Calibration Mode	Panel Vibration Suppression Operation		7.7.3 Vibration Suppression (Panel)	The driver firmware requires version 3700 or higher
	XINJE Servo Mechanical Property Analysis		7.7.4 Vibration Suppression (Host Computer Software)	All versions of the host software support it.
Self-Tuning/Adaptive Mode	Panel Vibration Suppression Operation		7.7.6 Vibration Suppression (easyFFT)	The driver firmware requires version 3730 or higher

The driver firmware version can be viewed via U2-07.

7.7.3 Vibration Suppression (Panel)

The panel vibration suppression system has two operating modes: Mode 1 (vib-1) and Mode 2 (vib-2).

Two Differences in Vibration Suppression Mechanisms

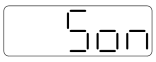
Vibration Suppression Mode	show	changed parameters
pattern 1	vib-1	Only changes vibration suppression-related parameters
pattern 2	Vib-2	Changes vibration suppression parameters and speed loop gain

The following describes the steps:

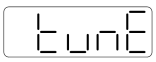
1. In self-calibration mode, select parameter F0-10 to display vib-1 on the panel, or select F0-11 to display vib-2.

perhaps 

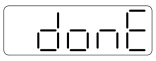
2. Press and hold the ENTER key; the panel will display "Son" and flash. At this point, manually enable it.



3. After enabling the servo, the panel displays "Tune" and flashes, indicating that the system has entered the calibration state.



4. The upper-level device initiates pulse command transmission until the "done" indicator flashes, indicating successful vibration suppression.



5. Press and hold the STA/ESC key to exit;

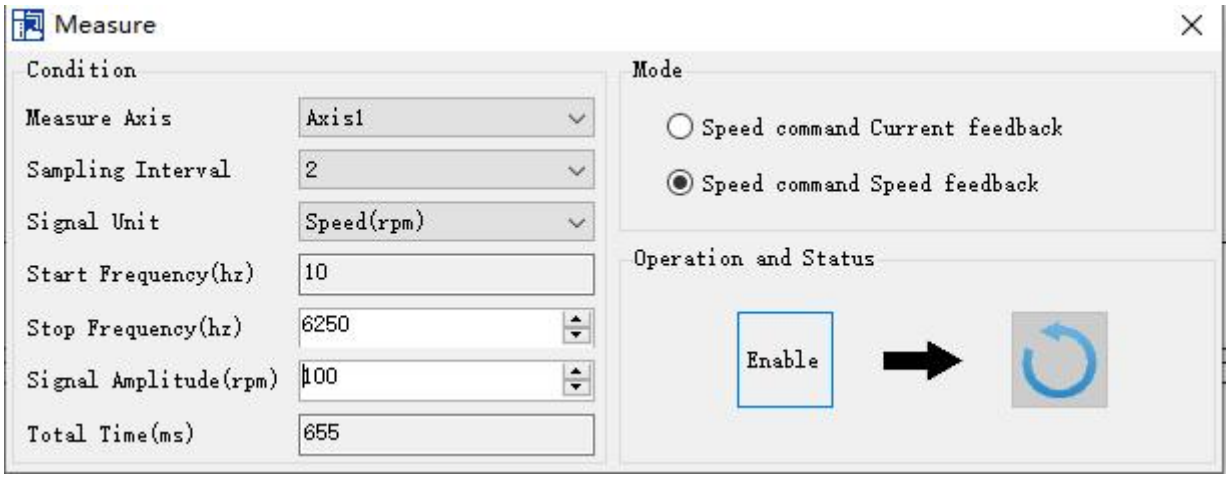
6. Vibration suppression parameters are automatically written to both the first and second notch filters (the second filter is prioritized when there is only one vibration point). For detailed parameters, see Section 7.7.7 Notch Filters.

Panel error alarm for vibration suppression process

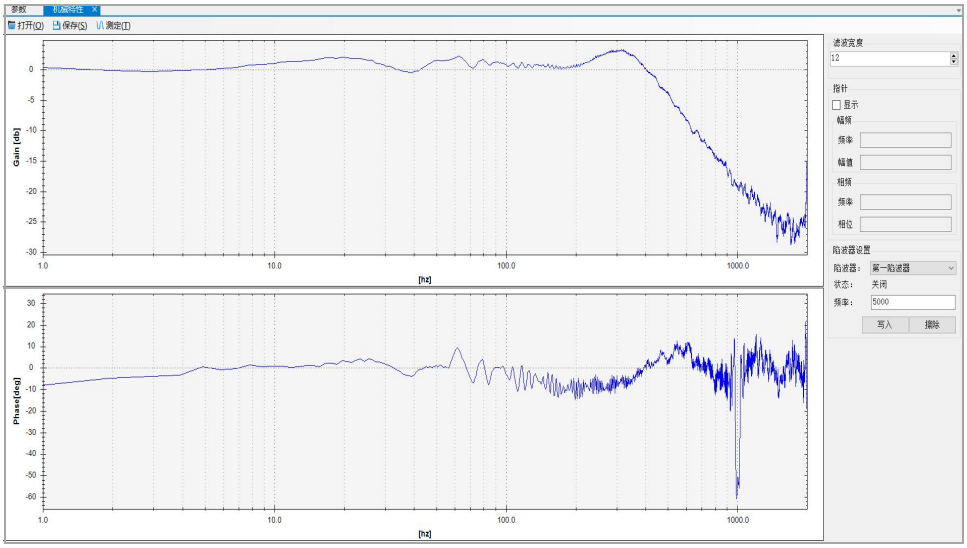
Error code	Meaning	Possible Reasons
Err-1	Search for optimal gain failed	The moment of inertia ratio is too high; the mechanism rigidity is too low
Err-2	① Over-range/alarm occurred during the calibration process ② External command setting/vibration suppression mode: Servo function is enabled during the setting process	Ensure the journey does not exceed limits or trigger alarms before auto-resetting Confirm that enabling is not disabled during the calibration process
Err-3	Current Non-Position Control Mode	Self-adjust in location mode
Err-4	Adaptive feature is not turned off	Change P2-01.0 to 0 before performing self-calibration
Err-7	An alarm occurred in the driver during the calibration process.	The drive has issued an alarm
Err-8	The positioning completion signal is unstable.	The instruction interval is too short

7.7.4 Vibration Suppression (Host Computer Software)

1. Open the XINJE Servo host software and select Mechanical Properties;
2. Click [Measure];



3. Configure the test conditions, then click [Run];
4. Select [Amplitude and Phase];



5. Set the filter width (to clearly view the resonance frequency) and identify the resonance frequency;
6. The band-stop parameters need to be configured manually; refer to Section 7.7.7 Band-stop Filter for details.

Taking the above figure as an example, mechanical analysis reveals a resonance frequency of 328 Hz. The third notch filter can be employed with the following parameter settings:
P2-69=n.1000 P2-77=328

Whether in adaptive or self-tuning mode, using mechanical characteristic analysis constitutes manual notch setting. If multiple resonance points exist, configure the third to fifth notch filters sequentially.

7.7.5 Vibration Suppression (Manual Setting)

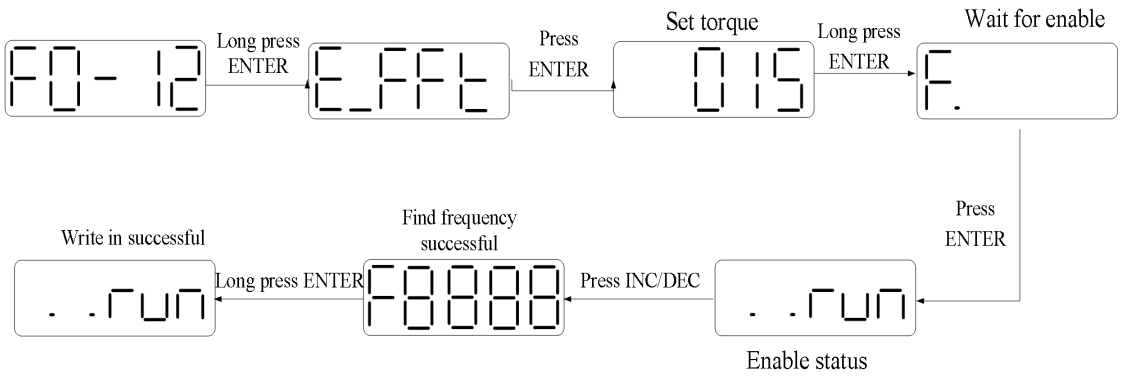
When the resonant frequency of the mechanical system is known, you can eliminate vibration by manually setting the vibration frequency. Configure the third to fifth notch filters. For detailed parameters,

see Section 7.7.7 Notch Filters.

7.7.6 Vibration Suppression (EasyFFT)

This function enables mechanical characteristic analysis via parameters F0−12 on the servo control panel, identifying mechanical resonance frequencies to achieve vibration suppression.

The complete procedure is shown below:



The following describes the steps:

1. For F0−12, press and hold [ENTER] to enter the EasyFFT mode, where "E_FFt" will be displayed;



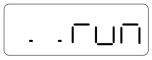
2. Press [ENTER] to enter the torque setting interface, where the currently set torque value (i.e., the P6-89 value) will be displayed. Use [INC] or [DEC] to adjust the torque setting; when increasing the value, increment it gradually to avoid excessive equipment vibration.



3. After setting the torque command, press and hold [ENTER] to enter the "Prepare Enable" phase; the interface will display “F”.



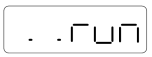
4. Press [ENTER] to enable and display “...run”;



5. Press [INC] and [DEC] to switch directions and identify the resonant frequency. During operation, the interface will flash “E_FFt”; if the resonant frequency is found, it will display “Fxxxx”, where “xxxx” represents the resonant frequency. If the search fails, the interface will show “F----”.



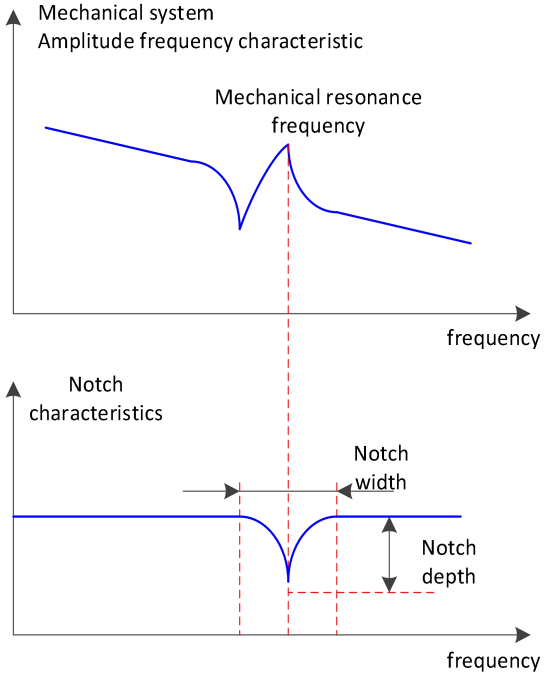
6. Whether the display shows “Fxxxx” or “F----”, continue pressing [INC] and [DEC] to locate the resonant frequency again. Once identified, hold [ENTER] to set the displayed resonant frequency in the driver's notch filter.



Press and hold the STA/ESC key to return to the previous step; tap [STA] to exit.

7.7.7 Passband Filter

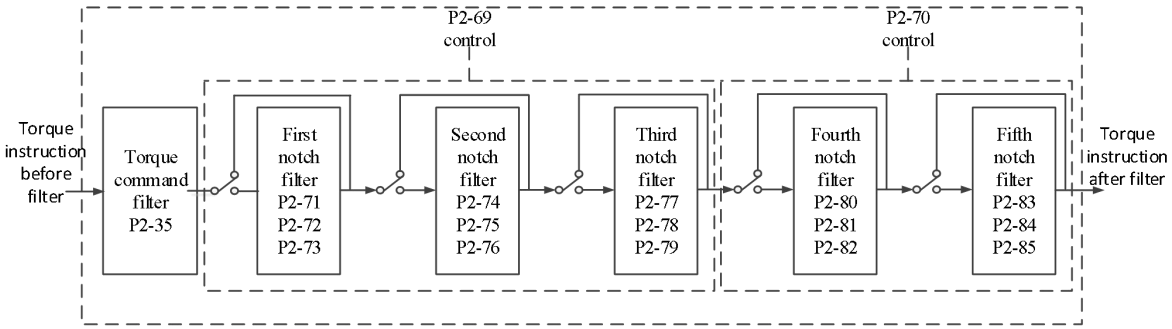
A notch filter suppresses mechanical resonance by reducing the gain at specific frequencies. Once properly configured, the vibration is effectively suppressed; you may then increase the servo gain further. The schematic diagram of the notch filter is shown below:



Slokker Circuit Diagram

The servo driver features five groups of notch filters, each with three parameters: notch frequency, notch attenuation, and notch bandwidth. The first and second notch filters are automatically set, while the third, fourth, and fifth are manually adjustable.

The torque command filter and notch filter are connected in series within the system, as shown in the figure below, with their switching controlled by P2-69 and P2-70.



Parameter		Meaning	Factory Settings	Revise	Come into force
P2-69	n.□□□0	First notch is off	n.□□□0	at any time	immediately

Parameter		Meaning	Factory Settings	Revise	Come into force
	n.□□□1	First notch is open			
	n.□□0□	The second bandpass filter is off	n.□□0□	at any time	immediately
	n.□□1□	Second bandpass filter is turned on			
	n.0□□□	The third filter is turned off.	n.0□□□	at any time	immediately
	n.1□□□	The third filter is open			
P2-70	n.□□□0	The fourth absorber is turned off.	n.□□□0	at any time	immediately
	n.□□□1	The fourth absorber is open			
	n.□□0□	The fifth filter is turned off.	n.□□0□	at any time	immediately
	n.□□1□	The fifth notch filter is turned on			

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P2-71	First notch frequency	5000	Hz	50 ~ 5000	at any time	immediately
P2-72	First notch attenuation	70	0.1dB	50 ~ 1000	at any time	immediately
P2-73	First notch bandwidth	0	Hz	0 ~ 1000	at any time	immediately
P2-74	Second absorption frequency	5000	Hz	50 ~ 5000	at any time	immediately
P2-75	Second absorption attenuation	70	0.1dB	50 ~ 1000	at any time	immediately
P2-76	Second absorption band width	0	Hz	0 ~ 1000	at any time	immediately
P2-77	Third absorption frequency	5000	Hz	50 ~ 5000	at any time	immediately
P2-78	Third waveguide attenuation	70	0.1dB	50 ~ 1000	at any time	immediately
P2-79	Third absorption band width	0	Hz	0 ~ 1000	at any time	immediately
P2-80	Fourth absorption frequency	5000	Hz	50 ~ 5000	at any time	immediately
P2-81	Fourth absorption wave attenuation	70	0.1dB	50 ~ 1000	at any time	immediately

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P2-82	Fourth absorption band bandwidth	0	Hz	0 ~ 1000	at any time	immediately
P2-83	Fifth absorption frequency	5000	Hz	50 ~ 5000	at any time	immediately
P2-84	Fifth: Waveform attenuation	70	0.1dB	50 ~ 1000	at any time	immediately
P2-85	Fifth absorption band bandwidth	0	Hz	0 ~ 1000	at any time	immediately



- In adaptive mode, the second notch filter is automatically configured when vibration is detected.
- In automatic adjustment mode, the second and first notch filters are automatically configured when vibration is detected (the second filter is prioritized when there is only one vibration point).
- Whether in adaptive or self-tuning mode, using mechanical characteristic analysis requires manual setup of notch filters; configure the third to fifth notch filters.

7.8 Benefit Adjustment Application Features

7.8.1 Model Ring Control

In self-tuning mode, in addition to the gain of the speed loop and position loop, there is also a model-loop gain, which significantly affects servo responsiveness. When the model loop is disabled, servo responsiveness is determined by the position-loop gain; when enabled, it is determined by the model-loop gain. The model loop serves as a feedforward function in the driver control circuit, with its specific role detailed in Section 6.5 (Manual Adjustment).

The model loop function automatically turns off when the auto-adjust mode is set to Soft; it turns on automatically when the auto-adjust mode is set to Fast Positioning or Fast Positioning (Control Overlap).

Self-Calibration Mode

Parameter		Meaning	Factory Settings	Revise	Come into force
P2-02	n.□□□1	soft	n.□□□3	at any time	immediately
	n.□□□2	quick positioning			
	n.□□□3	Quick Localization (Control Overlap)			

Selection of Self-Calibration Mode:

① Soft (P2-02.0 = 1):

This method does not enable model loop gain, operates smoothly, and is suitable for applications with insufficient mechanical rigidity and low response requirements.

② Rapid positioning (P2-02.0 = 2):

This method offers the fastest response in parameter tuning, but provides no significant suppression of overshoot.

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

This method features rapid response in parameter tuning and effectively suppresses overshoot.

Load type	Explain
Synchronous belt	Perform adjustments suitable for mechanisms with low rigidity, such as synchronous belt systems.
lead screw	Perform adjustments suitable for highly rigid mechanisms such as ball screw systems. If no corresponding mechanism is available, select this type.
fixed joint	Perform adjustments suitable for rigid systems and other mechanisms with high rigidity.

Self-Calibration Mode	Explain
soft	Make gentle gain adjustments. In addition to gain adjustment, the notch filter is automatically adjusted.
quick positioning	Perform dedicated adjustments for positioning purposes. In addition to gain adjustment, it automatically adjusts the model loop gain and notch filter.
quick positioning (Correct overshoot)	During application-specific configuration, adjust parameters to avoid overshoot. In addition to gain adjustment, the system automatically adjusts model loop gain and notch filter settings.

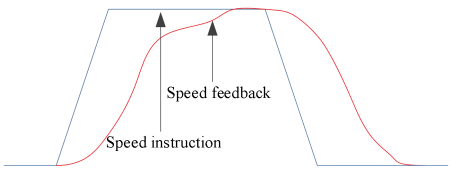
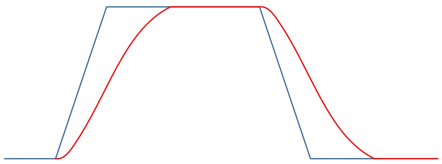
Parameter		Meaning	Factory Settings	Revise	Come into force
P2-02	n.□□□1	soft	n.□□□3	at any time	immediately
	n.□□□2	quick positioning			
	n.□□□3	Quick Localization (Control Overlap)			

Model Ring Function Switch

parameter		meaning	Factory Settings	revise	come into force
P2-47	n.□□□0	Model loop closed	n.□□□0	at any time	immediately
	n.□□□1	Model loop enabled			

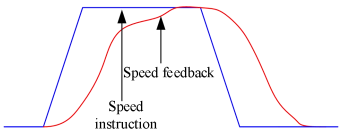
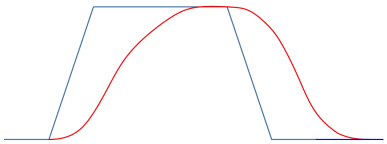
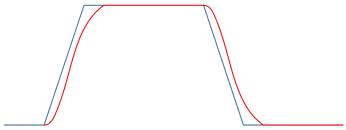
Using the DS5 series servo self-tuning mode as an example with a 750 W servo motor operating at five times its rated load inertia:

- Model loop function disabled (Soft Mode)

Low rigidity, low response	High rigidity, moderate response
	
Load Inertia Ratio P0-07:500%	
Speed Loop Gain P1-00:200	Speed Loop Gain P1-00:800
Speed loop integral P1-01:3300	Speed loop integral P1-01:825
Position Loop Gain P1-02:200	Position Loop Gain P1-02:700

Low rigidity, low response	High rigidity, moderate response
Phenomenon: Operation jitter and slow response	Phenomenon: Stable operation and fast response

- Model loop function enabled (Quick Positioning or Quick Positioning with Control Overlap)

Low rigidity, low response	High rigidity, low response	High rigidity, high responsiveness
		
Load Inertia Ratio P0-07:500%		
Speed Loop Gain P1-00:200	Speed Loop Gain P1-00:800	Speed Loop Gain P1-00:800
Speed loop integral P1-01:3300	Speed loop integral P1-01:825	Speed loop integral P1-01:825
Position Loop Gain P1-02:200	Position Loop Gain P1-02:700	Position Loop Gain P1-02:700
Model Ring Gain P2-49:300	Model Ring Gain P2-49:300	Model Ring Gain P2-49:4000
Phenomenon: Operation jitter and slow response	Phenomenon: Stable operation, slow response	Phenomenon: Smooth operation and fast response

The above curve diagram only illustrates the parameter effects and does not represent the actual operational curve.

7.8.2 Torque Perturbation Observation

The disturbance observer detects and estimates the external disturbance torque acting on the system, compensates for it in the torque command, thereby reducing the impact of external disturbances on the servo system and enhancing its disturbance resistance.

Selecting the Soft Mode in Self-Regulation Mode automatically turns off the disturbance observer without changing its gain. Selecting Fast Positioning or Fast Positioning (Control Overlap) activates the disturbance observer and sets its gain to 85. These parameters require no manual adjustment.

Parameter		Meaning	Factory Settings	Revise	Come into force
P2-00	n.□□□0	Disruptive observer turned off	n.□□□0	servo bb	immediately
	n.□□□1	Enable the disturbance observer			

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P2-41	Disturbance observer gain	85	%	0 ~ 100	at any time	immediately

7.8.3 Gain Adjustment Parameters

Parameter	Meaning	Factory Settings	Unit	Set Range	Revise	Come into force
P1-00	First Speed Loop Gain	200	0.1Hz	10~20000	servo bb	immediately
P1-01	First-speed loop integration time constant	2653	0.01ms	15~51200	servo bb	immediately
P1-02	First-position ring gain	480	0.1/s	10~20000	servo bb	immediately
P1-05	Second Speed Loop Gain	200	0.1Hz	10~20000	servo bb	immediately
P1-06	Second Speed Loop Integration Constant	3300	0.01ms	15~51200	servo bb	immediately
P1-07	Second Position Ring Gain	200	0.1/s	10~20000	servo bb	immediately

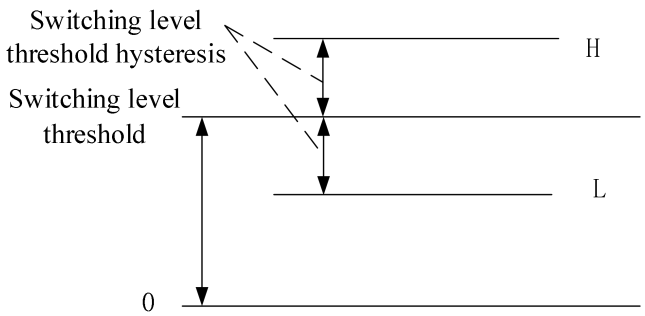
7.8.4 Gain Switching

Parameter		Meaning	Factory Settings	Revise	Come into force
P1-14	n.□□□X	n.□□□X: Gain switching function switch 0: SI terminal gain switching is effective (gain switching condition parameters are not applied) 1: Perform gain switching according to	0	at any time	immediately

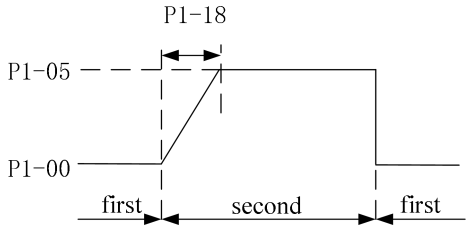
Parameter		Meaning	Factory Settings	Revise	Come into force
		the gain switching conditions 2: Reserve			
	n.□□X□	n.□□X□: Selection of gain switching conditions 0: First gain fixed 1: Switch using the external SI terminal 2: High Torque Command 3: Large Speed Instruction 4: Significant variations in speed commands 5: [Keep] – Fixed to the first gain 6: Significant positional deviation 7: Position Command 8: Localization completed 9: Actual speed is high A: Position command + actual speed			
P1-15		Gain switching wait time	5	servo bb	immediately
P1-16		Gain Switching Level Threshold	50	servo bb	immediately
P1-17		Hysteresis loop of the gain switching level threshold	30	servo bb	immediately
P1-18		Position loop gain switching time	2	servo bb	immediately

Explain ：

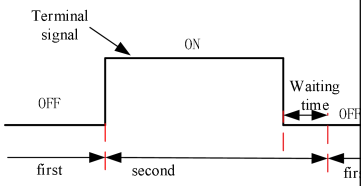
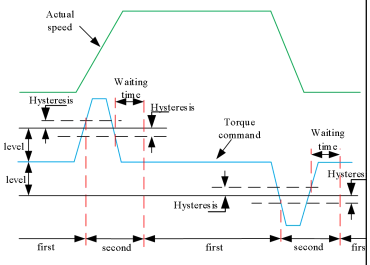
1) Gain switching wait time applies only during the transition from the second gain to the first gain
2) The definition of "gain switching level threshold hysteresis loop" is shown in the figure below:

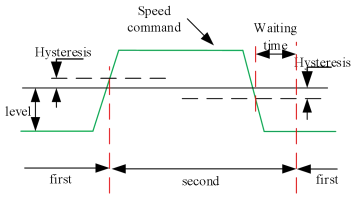
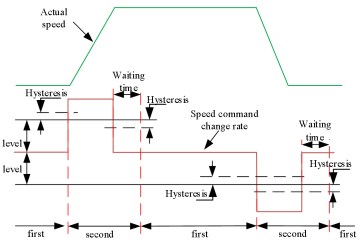


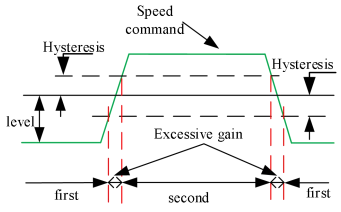
3) Explanation of "Position Gain Switching Time":

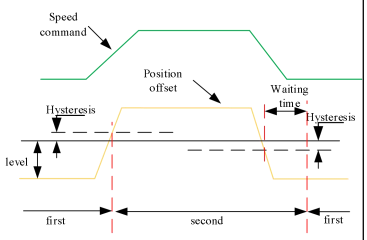


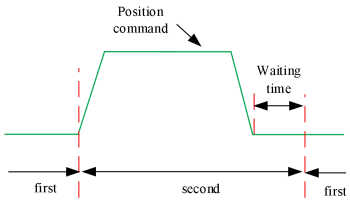
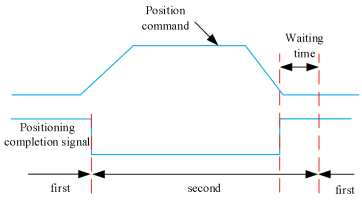
4) Explanation of Gain Switching Conditions

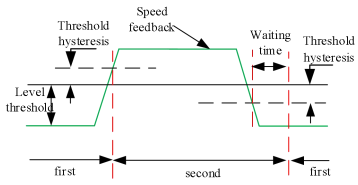
Gain Switching Condition Settings				Relevant Parameter		
P1-14.1	Condition	Diagrammatic sketch	Remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis
0	First gain fixed	-	-	invalid	invalid	invalid
1	Terminal Switching		Use the G-SEL signal for gain switching: The G-SEL signal is invalid; Group 1 gain The G-SEL signal is active; Group 2 gain	valid	invalid	invalid
2	Torque Command		When the absolute value of the torque command exceeds (level + hysteresis) [%] during the previous first gain setting, switch to the second gain. During the previous second gain application, if the absolute value of the torque command remains below [level-hysteresis] [%] for the duration specified by P1-15, return to the first gain setting.	valid	valid (%)	valid (%)

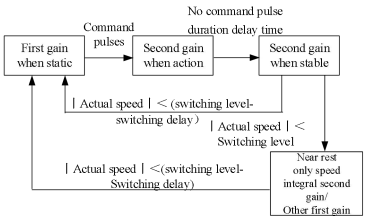
Gain Switching Condition Settings				Relevant Parameter		
P1-14.1	Condition	Diagrammatic sketch	Remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis
3	Speed Instruction		When the absolute value of the speed command exceeds (level + hysteresis) [rpm] during the previous first gain setting, switch to the second gain. During the previous second gain application, when the absolute value of the speed command was below (level minus hysteresis) [rpm] and P1-15 remained in this state throughout the entire duration, switch back to the first gain setting.	valid	valid	valid
4	Speed Command Change Rate		When the absolute value of the speed command change rate exceeds (level + hysteresis) [10 rpm/s] during the previous first gain setting, switch to the second gain. During the previous second gain application, when the absolute value of the velocity command change rate remained below	valid	valid (10rpm/s)	valid (10rpm/s)

Gain Switching Condition Settings				Relevant Parameter		
P1-14.1	Condition	Diagrammatic sketch	Remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis
			(level minus hysteresis) [10 rpm/s] for the duration specified by P1-15, the system returns to the first gain setting.			
5	Speed command high/low threshold [Not supported]		During the previous application of Gain 1, when the absolute value of the speed command exceeds (Level − Hysteresis) [rpm], the system switches to Gain 2. The gain gradually adjusts until the absolute value reaches (Level + Hysteresis) [rpm], at which point the gain fully transitions to Gain 2. During the previous second gain phase, when the absolute value of the speed command fell below (level + hysteresis) [rpm], it began returning to the first gain level. The gain	invalid	valid (rpm)	valid (rpm)

Gain Switching Condition Settings				Relevant Parameter		
P1-14.1	Condition	Diagrammatic sketch	Remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis
			gradually adjusted until the absolute value reached (level − hysteresis) [rpm], at which point the gain fully returned to the initial setting.			
6	position deviation		Only active in Position Mode (other modes fixed at gain 1) When the absolute value of position deviation exceeds (level + hysteresis) [encoder units] during the previous first gain setting, switch to the second gain. When the absolute value of position deviation is less than (level-hysteresis) [encoder units] during the previous second gain application, and P1-15 remains in this state throughout the entire duration, return to the first gain setting.	valid	valid (Encoder Unit)	valid (Encoder Unit)

Gain Switching Condition Settings				Relevant Parameter		
P1-14.1	Condition	Diagrammatic sketch	Remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis
7	Position Instruction		Only active in Position Mode (other modes fixed at gain 1) During the previous first gain setting, switch to the second gain if the position command is not 0. During the previous second gain application, if the position instruction remains at state 0 throughout the waiting period P1−15, the system returns to the first gain setting.	valid	invalid	invalid
8	Positioning completed		Only active in Position Mode (other modes fixed at gain 1) When the first gain is applied, if positioning is not complete, switch to the second gain. During the previous second gain application, if the positioning completion status remains unchanged throughout the waiting period P1	valid	invalid	invalid

Gain Switching Condition Settings				Relevant Parameter		
P1-14.1	Condition	Diagrammatic sketch	Remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis
			−15, proceed to the first gain step. [Note] The detection mode must be configured according to P5-01 to complete positioning.			
9	actual velocity		Only valid in Position mode (other modes are set to Gain 1): During the previous first gain application, if the absolute value of the actual speed exceeded (level + hysteresis) [rpm], switch to the second gain. During the previous second gain application, when the absolute value of relative speed remained below [level-hysteresis] [rpm] and this condition persisted throughout the duration of P1-15, return to the first gain setting.	valid	valid (rpm)	valid (rpm)

Gain Switching Condition Settings				Relevant Parameter		
P1-14.1	Condition	Diagrammatic sketch	Remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis
A	Position Command + Actual Speed		Only valid in Position mode (other modes are set to Gain 1): When switching to the first gain level, if the position command is not 0, switch to the second gain level. During the previous second gain application, when the position command was set to 0, the second gain remained active throughout the waiting period P1−15. When the position command is 0 and the waiting time P1-15 has elapsed, if the absolute value of the actual speed is less than (level)[rpm], the speed integration time constant is set to the second speed-loop integration time constant (P1-06); otherwise, it returns to the first gain. If the absolute value of the actual speed is	valid	valid (rpm)	valid (rpm)

Gain Switching Condition Settings				Relevant Parameter		
P1-14.1	Condition	Diagrammatic sketch	Remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis
			less than (level-hysteresis loop)[rpm], the speed integration also returns to the first speed-loop integration time constant (P1-02).			

7.8.5 Switching between the Speed Loop P-PI Mode

7.8.5.1 Switching Between Speed Control Modes

Parameter		Meaning	Factory Settings	Revise	Come into force
P1-26	n.□□□1	0: Do not use mode switching 1: Use the internal torque command as the switching condition 2: Use speed commands as the switching condition 3: Use acceleration as the switching condition 4: Use position deviation as the switching condition	<=22P6：1 Others：0	servo bb	immediately
	n.□□0□	0: Clear the ASR score 1: Keep the velocity loop integral constant without accumulation	0		
P1-27		Mode Switch – Torque Command Threshold	200	servo bb	immediately
P1-28		Mode Switch – Speed Command Threshold	0	servo bb	immediately
P1-29		Mode Switch – Acceleration Threshold	0	servo bb	immediately
P1-30		Mode Switch – Position Deviation Threshold	0	servo bb	immediately

For power levels up to 22P6, the Asr P/PI mode switching is enabled by default (i.e., P1−26.0 = 1), and this switching occurs when the torque command from P1−27 exceeds 200%.

7.8.5.2 IP Control Selection

parameter		meaning	Factory Settings	revise	come into force
P2-03	n.□0□□	0: PI Control 1: IP Control	0	servo bb	Power On Again
P1-31		I-P Control Switching Threshold	100	servo bb	immediately

When P1-31 = 0, the speed loop corresponds to PI control; when P1-31 = 100, it corresponds to IP control.

7.9 Benefits Adjustment Related Matters

7.9.1 When load vibration occurs

The following reasons can cause load fluctuation:

1. The command is not smooth enough when the load inertia is too high.

the way to deal with a situation ：

① Apply position-based smoothing filter P1-25;

② Optimize the commands of the upper-level device to reduce command acceleration;

③ Replace with a motor of greater inertia.

2. The servo gain is too low, resulting in insufficient rigidity.

Countermeasures: ① Increase the gain parameter to enhance rigidity and improve disturbance resistance.

3. Insufficient structural rigidity and equipment vibration

the way to deal with a situation ：

① Reduce the gain parameter;

② Optimize the commands of the upper-level device to reduce command acceleration.

7.9.2 When vibration occurs

The following reasons can cause machine vibration:

1. Vibration caused by inappropriate servo gain

Countermeasure: Reduce the gain.

2. Mechanical resonance point

Countermeasure: Analyze mechanical characteristics or manually set notch parameters.

7.9.3 When noise occurs

In Adaptive Mode:

1. Caused by inappropriate servo gain

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

In self-calibration mode:

1. Caused by inappropriate servo gain

Countermeasure: In rapid adjustment mode, reduce the rigidity level.

In automatic adjustment mode: Reduce model loop gain P2-49

1. Noise generated by mechanical resonance

Countermeasure: Refer to 7.9.2 for handling vibration occurrences.

8. Alarm Analysis

8.1 Overview Table of Alarm Parameters

History record: The "√" indicates that historical alarms are recorded; "○" means no recording.

Clearable column: "" √ "" indicates an alarm that can be cleared; "○" indicates one that cannot be cleared.

Alarm Code		Confirm code	Explain	Attribute			Servo status when an alarm occurs
Major Category	Subd			History take notes	Can be deleted	Do you want to power on the device to activate the alarm clearance?	
EEEE	1	EEEE1	Communication error between the panel and the CPU	○	○	deny	servo run
	2	EEEE2			○	deny	servo run
	3	EEEE3			○	deny	servo run
	4	EEEE4			○	deny	servo run
01	0	E-010	Firmware version does not match	○	○	yes	servo run
	3	E-013	FPGA loading error	○	○	yes	servo run
	5	E-015	Program execution error	○	○	yes	servo run
	6	E-016	hard error	○	○	deny	servo run
	7	E-017	Processor operation timed out	○	○	yes	servo run
	9	E-019	System Password Error	○	○	yes	servo run
02	0	E-020	Parameter loading error	○	○	yes	servo run
	1	E-021	Parameter range exceeded	√	√	deny	servo run

Alarm Code		Confirm code	Explain	Attribute			Servo status when an alarm occurs
Major Category	Subd			History take notes	Can be deleted	Do you want to power on the device to activate the alarm clearance?	
	2	E-022	Parameter Conflict	○	√	deny	servo run
	3	E-023	Incorrect sampling channel configuration	○	○	yes	servo run
	4	E-024	Parameter loss	√	√	deny	servo run
	5	E-025	Erasing FLASH Error	√	√	deny	servo run
	6	E-026	Initialization Flash error	√	√	deny	servo run
	8	E-028	EEPROM write error	√	√	deny	servo run
	9	E-029	Frequent EEPROM write operation alarm	√	√	deny	servo run
03	0	E-030	Busbar voltage overvoltage	√	√	deny	servo off
04	0	E-040	Busbar voltage is too low. ① Low grid voltage	√	√	deny	servo run
			Busbar voltage is too low. ② Power loss in the drive unit causes low bus voltage.	○	√	deny	servo off
	1	E-041	Drive power failure	○	√	deny	servo run
	3	E-043	Busbar voltage charging failed	√	√	yes	servo off
	4	E-044	Three-phase voltage input with one phase missing	√	√	deny	servo off
06	0	E-060	The module temperature is too high.	√	√	deny	servo run
	1	E-061	Motor overheating	√	√	deny	servo run
	3	E-063	Thermistor wire break alarm	√	√	deny	servo run
08	0	E-080	Excessive Speed Alarm	√	√	deny	servo off

Alarm Code		Confirm code	Explain	Attribute			Servo status when an alarm occurs
Major Category	Subd			History take notes	Can be deleted	Do you want to power on the device to activate the alarm clearance?	
	2	E-082	Encoder Zero Position Deviation Protection 1	√	√	deny	servo off
	3	E-083	Speed command exceeded limits	√	√	deny	servo off
09	2	E-092	The analog signal Tref's zero calibration value exceeds the allowed limit.	√	√	deny	servo run
	3	E-093	The analog signal Vref's zero calibration value exceeds the allowed limit.	√	√	deny	servo run
10	0	E-100	Excessive positional deviation	√	√	deny	servo run
11	0	E-110	During self-check, a short circuit was detected in the external UVW component.	√	√	deny	servo off
	4	E-114	Discharge overcurrent protection (only for 22−32 kW)	√	√	deny	servo off
	5	E-115	U-phase short-circuit protection (only for 22−32 kW loads)	√	√	deny	servo off
	6	E-116	V-phase short-circuit protection (only for 22−32 kW loads)	√	√	deny	servo off
	7	E-117	W-phase short-circuit protection (only for 22−32 kW)	√	√	deny	servo off
13	0	E-150	Power line has been disconnected	√	√	deny	servo off
16	1	E-161	Drive thermal power overload	√	√	deny	servo run
	5	E-165	Blockage Prevention and Turnaround Alarm	√	√	deny	servo run
20	0	E-200	Braking resistor overload	√	√	deny	servo run
22	0	E-220	Absolute value servo encoder communication error	√	√	deny	servo off

Alarm Code		Confirm code	Explain	Attribute			Servo status when an alarm occurs
Major Category	Subd			History take notes	Can be deleted	Do you want to power on the device to activate the alarm clearance?	
	1	E-221	Too many CRC error occurrences in encoder communication	√	√	deny	servo off
	2	E-222	Absolute value servo encoder battery low-voltage alarm	√	√	deny	servo off
	3	E-223	Absolute value servo encoder itself data access alarm	√	√	deny	servo off
	7	E-227	Error in the multi-turn signal data of the Shanghai Electric encoder	√	√	deny	servo off
	8	E-228	Absolute value servo encoder value overflow	√	√	deny	servo off
	9	E-229	Encoder Electric Angle Deviation Protection	√	√	deny	servo off
23	6	E-236	The feedback deviation between the motor encoder's position and that of the external displacement sensor is excessively large.	√	√	deny	servo off
	7	E-237	The fully closed-loop motor encoder and the external optical grating scale have opposite counting directions.	√	√	deny	servo off
	8	E-238	The speed of the fully closed-loop external optical grating scale exceeds the allowed limit.	√	√	deny	servo off
24	0	E-240	Timing error in reading encoder position data	√	√	deny	servo off
	1	E-241	The encoder returned corrupted data.	√	√	deny	servo off
25	0	E-250	Return to Origin Error Alarm	√	√	deny	servo off
26	0	E-260	Excess Travel Alarm	√	√	deny	servo run
	1	E-261	Out-of-range signal connection error	√	√	deny	servo run
	2	E-262	Control Stop Timeout	√	√	deny	servo off
	4	E-264	Excessive vibration	√	√	deny	servo run

Alarm Code		Confirm code	Explain	Attribute			Servo status when an alarm occurs
Major Category	Subd			History take notes	Can be deleted	Do you want to power on the device to activate the alarm clearance?	
	5	E-265	The motor is vibrating excessively.	√	√	deny	servo run
28	0	E-280	Failed to access motor parameters	√	√	deny	servo off
	1	E-281	An error occurred while writing data to the encoder EEPROM.	√	○	deny	servo off
31	0	E-310	Motor power mismatch	√	○	yes	servo off
	1	E-311	Motor code lost	√	○	yes	servo off
	1	E-312	The motor parameters have been corrupted during reading.	√	○	yes	servo off
	3	E-313	Encoder software version does not match	√	○	yes	servo off
	4	E-314	The encoder software version is not supported	√	○	yes	servo off
	5	E-315	Cannot read motor parameters	√	○	yes	servo off
	6	E-316	The motor code read differs from the set code	√	○	yes	servo off

8.2 Analysis of Alarm Types

The DS5 alarm code follows the format E-XX□, where "XX" indicates the major category of the alarm and "□" specifies the exact sub-category.

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
EEEE	1	EEEE1	Communication error between the panel and the CPU	① Significant fluctuations in power supply voltage; insufficient voltage causes panel refresh failure. ② The panel program is damaged	① Stable power supply, ensuring consistent voltage levels; ② Power off and then power on again. If the alarm persists, contact your dealer or manufacturer.
	2	EEEE2			
	3	EEEE3			
	4	EEEE4			
01	0	E-010	Firmware version does not match	The downloaded firmware version is incorrect	Contact the agent or manufacturer
	3	E-013	FPGA loading error	①The program is damaged; ② Device damage	Contact the agent or manufacturer
	4	E-014	FPGA access error	①The program is damaged; ② Hardware damage; ③ The intensity of external interference is too high	Contact the agent or manufacturer
	5	E-015	Program execution error	Program malfunction	Contact the agent or manufacturer
	6	E-016	hard error	①The program is damaged; ② Hardware damage; ③ The intensity of	① Check the input voltage for phase loss or excessively low supply voltage; ②Contact the agent or manufacturer

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
				external interference is too high	
	7	E-017	Processor operation timed out	Program malfunction	Contact the agent or manufacturer
	9	E-019	System Password Error	Program malfunction	Contact the agent or manufacturer
02	0	E-020	Parameter loading error	Parameter self-check failed	Repowering will restore parameters to their default values. If the issue persists, contact your dealer or manufacturer.
	1	E-021	Parameter range exceeded	The value is outside the specified range	Check parameters and reset
	2	E-022	Parameter Conflict	TREF or VREF function settings conflict	In P0-01=4 mode, setting P3-00 to 1 will trigger an alarm.
	3	E-023	Incorrect sampling channel configuration	Incorrect settings for custom output trigger channel or data monitoring channel	Check if the settings are correct
	4	E-024	Parameter loss	The grid voltage is too low.	① For a single-phase 220V power supply, connect R and T; ② Turning the power back on immediately after a power outage will trigger an E-024 alarm; ③ Reset Parameters
	5	E-025	Erasing FLASH Error	Parameter saving failed during power outage	Contact the agent or manufacturer
	6	E-026	Initialization Flash error	The FLASH chip's power supply is unstable.	Contact the agent or manufacturer
	8	E-028	EEPROM write error	Unstable voltage or chip malfunction	Contact the agent or manufacturer
	9	E-029	Frequent EEPROM write operation alarm	Parameter writes occur too frequently	① Reduce the parameter erase/write frequency; ②Contact the agent or manufacturer
03	0	E-030	The bus voltage U0-05 exceeds	The grid voltage is too high.	Check the power supply voltage fluctuations: 220V drivers require

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
			the preset threshold. Machine powered by 220 V (U0–05 ≥ 402 V) Machines powered by 380V electricity (U0–05 ≥ 780V)		a normal voltage range of 200V– 240V, while 380V drivers require 380V–440V. Significant voltage fluctuations indicate the need for an appropriate voltage source and regulator.
				Excessive load rotational inertia (insufficient braking capability)	① Connect an external braking resistor; specify the resistance values as detailed in Section 1.4.1: (For 220 V power supply: discharge begins at U0-05 = 392 V and ends at U0-05 = 377 V; for 380 V power supply: discharge begins at U0-05 = 750 V and ends at U0-05 = 720 V.) ② Increase acceleration and deceleration times; ③ Reduce load inertia; ④ Reduce the start-stop frequency; ⑤ Replace with a higher-power driver and motor
				The braking resistor is damaged or has an excessively high resistance value.	Check the braking resistor and replace it with an external resistor of appropriate resistance value; refer to Section 1.4.1 for selection guidelines.
				The acceleration and deceleration times are too short.	Extend acceleration and deceleration times
03	0	E-030	The bus voltage U0-05 exceeds the preset threshold. Machine powered by 220	Hardware failure in the sampling circuit inside the drive unit	Use the AC range of a multimeter to measure the input voltage of the servo LN (R/S/T); normal value is 220 V ± 10% (or 380 V ± 10%). If the reading exceeds 220

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
			V (U0–05 ≥ 402 V) Machines powered by 380V electricity (U0–05 ≥ 780V)		V ± 10% (or 380 V ± 10%), check the supply voltage; if normal, the servo is operational. Monitor U0-05: if the measured voltage on the multimeter × 1.414 <U0-05 (within ±10 V error), the servo driver is faulty and requires replacement.
04	0	E-040	The bus voltage U0-05 is below the preset threshold. Machines powered by 220 V (U0–05 ≤ 150 V) Machines powered by 380V electricity (U0–05 ≤ 300V)	An alarm is triggered during normal power-on when the grid voltage is too low.	① Check the power grid voltage fluctuations: 220V drivers operate within a normal voltage range of 200V–240V, while 380V drivers require 380V–440V. Significant voltage fluctuations may necessitate the use of a voltage stabilizer. ② Replace with a transformer of greater capacity
				Occurred during a sudden power outage	Power on again after the voltage stabilizes
				Hardware failure in the sampling circuit inside the drive unit	Use the AC range of a multimeter to measure the input voltage of the servo LN (R/S/T). Normal value: 220 V ± 10% (or 380 V ± 10%). If <220 V ± 10% (or 380 V ± 10%), check the supply voltage; if normal, the servo is operational—monitor U0-05. If the measured voltage on the multimeter × 1.414> U0-05 (within ±10 V error), the servo

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					driver is faulty and requires replacement.
	1	E-041	Drive power failure	The drive power supply has been disconnected	Check the power supply
	3	E-043	Busbar voltage charging failed	An alarm is triggered during normal power-on when the grid voltage is too low.	An alarm is triggered during normal power-on when the grid voltage is too low.
				Hardware damage	When powering on the drive, check for any relay engagement sound.
	4	E-044	Three-phase voltage input with one phase missing	Three-phase input power supply lacks one phase	Check the power supply
06	0	E-060	The module temperature is too high. (Module temperature U0-06 ≥ 90°C alarm) U0-06 ≥ 70°C Warning)	Running under heavy load for extended periods	Re evaluate the motor capacity and monitor the U0-02 torque during operation to determine if it remains above 100 for extended periods. If so, consider using a higher-capacity motor or reducing the load.
				The ambient temperature is too high.	①Enhance ventilation measures to reduce ambient temperature; ② Check whether the fan rotates during servo enable; module temperature U0-06 ≥ 45°C, and the fan is activated
				Fan damage	Change the fan
	1	E-061	Motor overheating	An alarm is triggered when the motor temperature exceeds 140°C.	① Check whether the motor fan is abnormal; ② Contact the manufacturer's technical support
	3	E-063	Thermistor wire break alarm	① The thermistor in a motor with a power rating of 11 kW or higher has broken;	① Check the connection status of the external thermistor; ② Shielded thermistor wire break alarm: P0-69.1=1

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
				② Alarm triggered when a motor below 11 kW is mistakenly turned on due to a broken wire.	
08	0	E-080	Over-speed (actual speed ≥ P3-21/P3-22) The maximum forward speed is P3-21, and the maximum reverse speed is P3-22.	Motor code does not match	Check whether the motor code (the number following MOTOR CODE) on drive U3-70 matches that on the motor label. If they do not match, contact the manufacturer's technical support.
				UVW wiring error	Check the UVW wiring of the motor; connect it according to the phase sequence.
				The motor speed is too high.	① The maximum speed limit values P3-21/P3-22 have been reduced; ② Verify whether any external force is causing the motor to rotate at excessive speed, whether the pulse input frequency is too high, or whether the electronic gear ratio is excessively large.
				Encoder malfunction	① Check the encoder cable or replace it; ② Set the servo driver to BB mode and adjust it to U0-10. Slowly rotate the motor shaft manually to verify normal value changes: one direction shows increasing values while the other decreases (with cyclic display from 0 to 9999).
	2	E-082	Encoder Zero Position Deviation Protection 1	① Phase sequence mismatch in the UVW phase; ② Motor encoder zero position deviation	① Check whether the three-phase power lines are connected in the UVW sequence. ② Check the encoder zero position; contact the

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					manufacturer's technical support.
	3	E-083	Speed command exceeded limits	Speed indicator in Position Mode Set it to a value greater than 1.3*P3-21/P3-22	① Check the set values for P3-21/P3-22 ② Abnormal position command
09	2	E-092	The analog signal Tref's zero calibration value exceeds the allowed limit.	Error in analog signal zeroing operation	Zero the measurement when no analog voltage is applied
	3	E-093	The analog signal Vref's zero calibration value exceeds the allowed limit.	Error in analog signal zeroing operation	Zero the measurement when no analog voltage is applied
10	0	E-100	Excessive positional deviation	During position control, the difference between the set position and the actual position exceeds the limit value.	① Check whether the motor is running under locked rotor conditions; ② Reduce the position-given speed; ③ Increase the deviation pulse limit value P0-23
11	0	E-110	During self-check, a short circuit was detected in the external UVW component.	No matching motor code found	Check whether the motor code (the number following MOTOR CODE) on the U3-70 drive motor label matches. If not, contact the manufacturer's technical support.
				incorrect wiring for U, V, and W	Check the UVW wiring of the motor; connect it according to the phase sequence.
				The UVW output driver is short-circuited or the motor is faulty.	① Check whether the UVW phase-to-phase resistance of the motor is baBlueced; if the resistance values are unbaBlueced, replace the motor. ② Check for a short circuit between the UVW and PE

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					terminals of the motor; if present, replace the motor. ③ Measure the UVW output on the driver side using a multimeter (diode mode): connect the black probe to P+ and the red probe to measure UVW; connect the red probe to P-and the black probe to measure UVW. If any of the six voltage drop values is 0, replace the driver.
				The load section is experiencing a blockage.	Run the motor with an empty shaft to identify any load issues
				Instant alarm during rapid start/stop	Increase acceleration and deceleration time
				Encoder Problem	① Check the encoder cable or replace it; ② Set the servo driver to BB mode and adjust it to U0-10. Slowly rotate the motor shaft manually to verify normal value changes: one direction shows increasing values while the other decreases (with cyclic display from 0 to 9999).
	1	E-111	Short-circuit current alarm	incorrect wiring for U, V, and W	Check the UVW wiring of the motor; ensure proper phase connection (brown U, black V, blue W).
				The UVW output driver is short-circuited or the motor is faulty.	① Check whether the UVW phase-to-phase resistance of the motor is baBlueced; if the resistance values are unbaBlueced, replace the motor. ② Check for a short circuit between the UVW and PE terminals of the motor; if present, replace the motor.

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					③ Measure the UVW output on the driver side using a multimeter (diode mode): connect the black probe to P+ and the red probe to measure UVW; connect the red probe to P-and the black probe to measure UVW. If any of the six voltage drop values is 0, replace the driver.
	4	E-114	Discharge overcurrent protection (only for 22–32 kW)	1. The resistance value of the braking resistor is improperly selected 2. Short circuit in the braking resistor 3. Brake tube damaged	① Check whether the brake resistor is short-circuited; ② Check whether the resistance value of the brake resistor is appropriate; ③ Check whether the brake tube pressure drop is normal (place the red probe at P-, use the black probe to measure PB).
	5	E-115	U/V/W-phase short-circuit protection (only for 22–32 kW loads)	No matching motor code found	Check whether the motor code (the number following MOTOR CODE) on drive U3-00 matches that on the motor label. If they don't match, adjust them to match and power on again.
	6	E-116		incorrect wiring for U, V, and W	Check the UVW wiring of the motor; ensure it is connected in the correct phase sequence.
	7	E-117		The UVW output driver is short-circuited or the motor is faulty.	① Check whether the UVW phase-to-phase resistance of the motor is baBlueced; if the resistance values are unbaBlueced, replace the motor. ② Check for a short circuit between the UVW and PE terminals of the motor; if present, replace the motor. ③ Measure the UVW output on

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					the driver side using a multimeter (diode mode): connect the black probe to P+ and the red probe to measure UVW; connect the red probe to P-and the black probe to measure UVW. If any of the six voltage drop values is 0, replace the driver.
15	0	E-150	Power line has been disconnected	The drive unit/cable/motor experiences a break in any one of the U/V/W three-phase power lines.	Disconnect the drive power supply and check the power line connections. Use a multimeter to test for continuity. After resolving the issue, power on the device again.
16	1	E-161	Drive thermal power overload	Motor code does not match	Check whether the motor code (the number following MOTOR CODE) on drive U3-70 matches that on the motor label. If they do not match, contact the manufacturer's technical support.
				Overloaded: The actual operating torque exceeds the rated torque and continues for an extended period.	Monitor U0-02 to check the actual operating torque. If the motor runs normally without seizing or vibration, and U0-02 remains above 100 for an extended period, this indicates improper motor selection. Increase the drive and motor capacity, extend acceleration/deceleration time, and reduce load. Monitor U0-00 for overspeed operation.
				The mechanism experiences impact, sudden weight increase, or distortion.	Eliminate mechanical distortion factors and reduce the load.
				The motor operates when the brake is not released.	① Measure the voltage at the brake lever terminal to confirm that the brake is released; ② Determine the brake engagement control method; it is recommended to use a servo BK brake signal for control. If servo

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					control is not employed, careful attention must be paid to the timing relationship between brake release and motor operation.
				There are wiring errors in the encoder and power lines, or there may be broken wires or loose connectors with reduced pins.	① Check the wiring of the U, V, and W power lines for potential phase sequence errors; ② Use a multimeter to check whether all encoder wires are properly connected and if there are any breaks. ③ Check for any looseness at the connector, monitor machine vibration, and verify that the connectors do not exhibit pin shrinkage, poor soldering, or damage.
				In multi-machine wiring, the motor wire was mistakenly connected to another shaft, resulting in incorrect wiring.	Check the servo wiring by correctly connecting the motor wires and encoder wires to their respective shafts.
				Improper gain adjustment causes the motor to vibrate, oscillate back and forth, and produce abnormal noises.	Re-adjust the gain parameters
				Hardware failure of the drive or motor;	① On-site servo cross-test indicates either motor shaft misalignment or motor failure: F1-01 fails during trial run, and F1-00 cannot rotate at constant speed when jogged. ② Replace with a new drive or motor; return the faulty unit to the manufacturer for repair.

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
16	5	E-165	Blockage Prevention and Turnaround Alarm If the current motor output torque exceeds the forward/reverse torque limits P3-38/P3-39, and the duration reaches P0-74 ms while the rotational speed falls below P0-75 rpm, an alarm will be triggered.	① The machinery experiences impact, sudden weight increase, or distortion; ②The motor operates when the brake is not released; ③ The parameter settings are unreasonable	① Eliminate mechanical distortion factors; reduce the load. ② Measure the voltage at the brake lever terminal to confirm that the brake is released; Determine the brake control method; it is recommended to use a servo BK brake signal for control. If servo control is not used, careful attention must be paid to the timing between brake activation and motor operation. ③ Monitor the actual output torque range of U0-02 and verify whether the torque limit settings for P3-38/39 are appropriate.
20	0	E-200	Braking resistor overload	The grid voltage exhibits significant fluctuations, resulting in excessively high voltage levels.	Improve input voltage
				The braking resistor is selected to be too small.	Replace with a higher-power brake discharge resistor (refer to resistance value in 1.4.1)
				The acceleration and deceleration times are too short.	Extend acceleration and deceleration times
				Hardware damage	Use the AC range of a multimeter to measure the input voltage of the servo LN (R/S/T); normal value is 220 V ± 10% (or 380 V ± 10%). If the reading exceeds 220 V ± 10% (or 380 V ± 10%), check the supply voltage; if normal, the servo is operational. Monitor U0-05: if the measured voltage on the multimeter ×

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					1.414 <U0-05 (within ±10 V error), the servo driver is faulty and requires replacement.
22	0	E-220	Absolute value servo encoder communication error	Motor mismatch	Check if the motor matches correctly
				The encoder cable is not connected, has a wiring error, or is loose.	Check if the value of U0-54 increases rapidly; if so, determine that the encoder circuit is disconnected. Turn off the drive power and check the encoder cable connections for any loose wires. Use a multimeter to test for continuity. Reconnect the wiring and ensure all terminals are securely fastened. ① Hot plugging is strictly prohibited; ② If using a tank chain, use a dedicated cable.
				Error in the received encoder data	Check whether the value of U0-54 has increased and the value of U0-79 is rising; if so, the encoder is experiencing interference. Do not route encoder wires through the same conduit as high-voltage cables; install a filter on the power input side of the servo driver; fit magnetic rings onto encoder wires.
	1	E-221	Too many CRC error occurrences in encoder communication	The encoder is affected by interference.	When using XINJE's original cables, if they are not the manufacturer's encoder-specific cables, verify that they employ twisted-pair shielded wiring or equivalent materials. Ensure separate routing for power and signal lines; do not bundle power cables with encoder cables. Proper grounding must be applied to servo motors and drivers. The encoder cable should be fitted with

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					a magnetic ferrule. Turn off welding machines and other highly interfering devices to identify the source of interference; isolate the source.
	2	E-222	Absolute servo encoder battery low-voltage alarm (this alarm can be disabled)	The battery voltage in the encoder line battery box is below 3 V.	Replace the battery while keeping the servo driver powered on to avoid encoder position errors. Battery specifications: AA battery, 3.6 V (model CP-B-BATT or CPT-B-BATT).
				Reminder: Encoder position lost	① The motor's absolute position memory during power failure relies on the battery connected to the encoder cable. If the encoder cable disconnects from the motor and power is lost, the current position will be lost, triggering Alarm E-222. Clearing this alarm by setting F0-00=1 restores normal operation. ② Using P0-79 can disable this alarm. When P0-79 is set to 1, the motor will operate as an incremental type, without performing multi-turn counting, and power loss will not retain the current position.
	3	E-223	Absolute value servo encoder itself data access alarm	The absolute value motor does not use the encoder cable that comes with the battery box.	① Use the encoder cable with a battery compartment; or replace it with a standard encoder cable for cross-testing. ② The encoder itself is faulty; the servo motor needs to be replaced.
				Encoder malfunction or unstable power supply to the encoder	
	7	E-227	Error in the multi-turn signal data of the Shanghai Electric encoder	This is usually due to issues with the encoder itself or unstable power supply to the encoder.	① Check whether the encoder cable is functioning properly and replace it with a functional one; ② Replace the motor.

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
	8	E-228	Absolute value servo encoder value overflow	The absolute encoder has rotated more than 32,767 revolutions in the positive direction or more than 32,768 revolutions in the negative direction.	① Set F1-06 to 1 and clear the absolute encoder's revolution count; ② In cases where recording the absolute position over multiple cycles is not required, Set P0-79 to 2 to disable this alarm
	9	E-229	Encoder Electric Angle Deviation Protection	① Incorrect phase sequence of the motor power lines; ② Encoder zero position offset	① Check whether the three-phase power lines are connected in the UVW sequence. ② Check the encoder zero position; contact the manufacturer's technical support.
24	0	E-240	Timing error in reading encoder position data	① Communication error between the servo driver and encoder; ② The encoder signal is interfered with; ③ Encoder malfunction	①Restart the drive; ② Check the wiring arrangement of transmission cables to ensure separate routing for high-voltage and low-voltage circuits; ③ Equipment requiring high current should be supplied with separate power sources; ④ Good grounding
	1	E-241	The encoder returned corrupted data.	① Incorrect encoder data received; ② The encoder signal is interfered with; ③ Encoder malfunction	① Check the wiring arrangement of transmission cables to ensure separate routing for high-voltage and low-voltage circuits; ② Equipment requiring high current should be supplied with separate power sources; ③ Good grounding
25	0	E-250	Return to Origin Error Alarm	①The total time required for P9-15 to	① Increase P9-15;

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
				return to the origin when its value is not zero exceeds the time set in P9-15; ② Incorrect settings for the original function parameters of the new version	② Ensure that the direction of the mechanical displacement (P9-19, P9-20) is opposite to that of returning to the origin; ③ Check whether there are any issues with the origin signal; ④ Check the original function parameter settings for the new device.
26	0	E-260	Excess Travel Alarm	An out-of-range signal was detected, and the out-of-range processing mode is set to alarm.	If you do not want the system to trigger an alarm immediately when exceeding the limit, change the signal processing method for exceeding limits.
	1	E-261	Out-of-range signal connection error	① The motor encounters a reverse overshoot signal during forward rotation; ② When the motor reverses, it encounters a forward overtravel signal.	Check the connection of over-limit signals and the allocation of over-limit terminals.
	2	E-262	Control Stop Timeout	① Excessive inertia; ② The stop timeout duration is too short; ③ The brake torque setting is too low	① Reduce inertia or use a brake motor; ② Increase the stop timeout time P0 to 30; ③ Increase braking torque P3-32
26	4	E-264	Excessive vibration	① Oscillation caused by external forces; ② Large load inertia, incorrect load inertia ratio settings, or insufficient gain can cause oscillation during	① Identify the source of external forces and check for any issues with mechanical installation; ② Increase the servo gain to enhance disturbance resistance; ③ Analysis of the collection

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
				positioning; ③ The encoder is subjected to interference	speed curve; When the first three peaks and troughs of the pulse signal converge (i.e., 0.8 × |first peak| ≤ |second peak| ≤ 0.8 × |third peak|) after the pulse command ends, no alarm should be triggered; in such cases, the relevant thresholds can be adjusted. When the three consecutive peak speed values during the pulse command period are no less than 300 rpm for three times, a drive alarm is triggered. The issue can be resolved using Method ① or Method ② as described above.
	5	E-265	The motor is vibrating excessively.	The machine is vibrating.	① Set P2-03.0 to 0; ② Check the motor installation.
28	0	E-280	Failed to read motor parameters	① Motor mismatch; ② The encoder cable is not connected, has incorrect wiring, or is loose.	① After professional verification, the drive and motor are compatible and can be used together. ② Check the connection status of the encoder wires, test their continuity, or replace the encoder for inspection; ③ Check whether the driver and motor are functioning properly by replacing them with new components. If issues are identified with either the driver or the motor itself, return the unit to the manufacturer for inspection.
	1	E-281	An error occurred while writing data to	EEPROM write request failed	Once professionals have confirmed that the drive and motor are compatible and can be used

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
			the encoder EEPROM.		together, you may proceed by setting P0-53 to 1 (to disable the motor parameter alarm) and correctly configuring the P0-33 motor code.
31	0	E-310	The drive and motor power are mismatched	For example, a 750 W drive paired with a 200 W motor.	Match the correct motor and driver, then use the self-update tool to write the motor parameters. After successful writing, set P0-53 to 1 (to disable the automatic parameter reading alarm) and correctly configure the P0-33 motor code.
	1	E-311	When reading the motor code automatically, the recorded motor parameters are 0, and driver P0-33 = 0.	Motor code not set	The product cannot have motor parameters manually configured at the factory. Upon power-on, the driver automatically reads the motor code; if this fails, an alarm is triggered. Only after a technician confirms proper compatibility between the driver and motor and that they can be used together should the motor parameters be updated using a self-update tool. Once successful, set P0-53 to 1 (to disable the automatic parameter reading alarm) and correctly configure the P0-33 motor code.
	2	E-312	Reading motor parameters has caused damage.	Parameter CRC check failed	Once professionals have confirmed the compatibility between the drive and motor and their mutual compatibility, use the self-update tool to write the motor parameters. After successful writing, set P0-53 to 1 (to disable the automatic motor parameter reading alarm) and correctly configure the P0-33 motor code.
	3	E-313	Encoder software version does not match	Encoder software version does not match	① Update the driver firmware to achieve optimal performance based on the current motor parameters; ② Use the self-update tool to

Big class	Small class	Confirm code	Explain	Possible Reasons	Solution
					write motor parameters. After successful writing, set P0-53 to 1 (to disable the motor parameter reading alarm) and correctly configure the P0-33 motor code. The motor parameters will then be stored in the driver and function properly, though this may affect certain performance characteristics.
	4	E-314	Motor code does not match the software version	The encoder hardware version is higher than the driver firmware version.	Contact technical support to update the driver firmware
	5	E-315	When reading the motor code automatically, the recorded motor parameters are 0, and driver P0-33 = 0.	The motor code read is 0	Once professionals have confirmed the compatibility between the drive and motor and their mutual compatibility, use the self-update tool to write the motor parameters. After successful writing, set P0-53 to 1 (to disable the automatic motor parameter reading alarm) and correctly configure the P0-33 motor code.
	6	E-316	Automatic code reading error	The automatically read motor code does not match the one set in P0-33.	Check the U3-70 and motor housing plate's MOTOR CODE. If the values differ, contact the manufacturer's technical support.

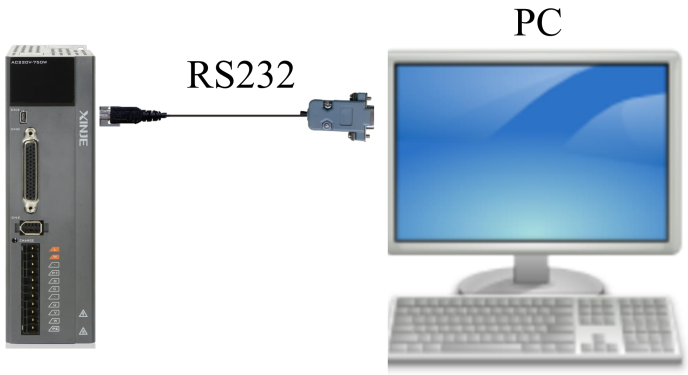
9. Modbus-RTU Communication

Our company provides users with the widely adopted RS485 communication interface for industrial control applications. The system employs the MODBUS standard protocol, enabling servos to communicate as slaves with host devices (such as PLC controllers or PCs) that share the same interface and protocol. This interface also supports integration with human-machine interfaces, facilitating remote operation of servos by users.

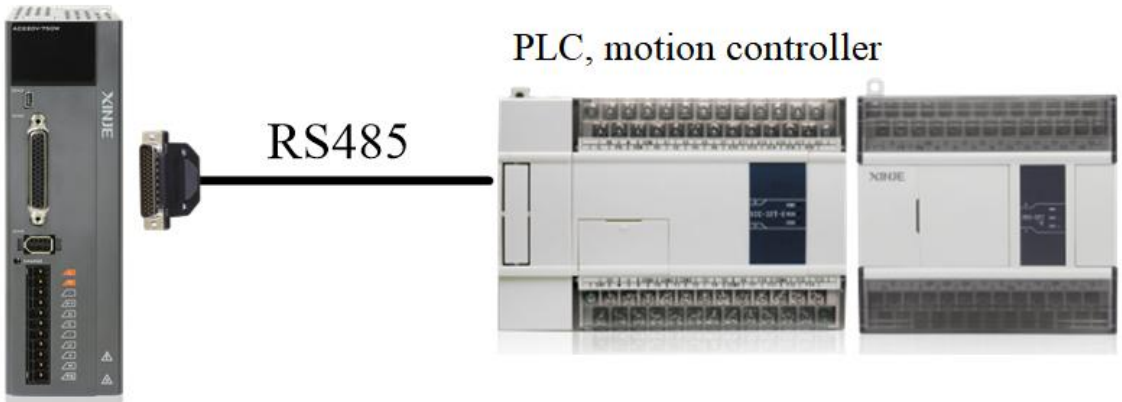
This series of servos supports the RTU mode via the MODBUS communication protocol. The following provides a detailed description of the protocol.

9.1 Communication Wiring

1. RS-232 Communication Wiring

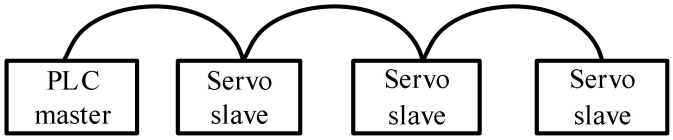


2. RS-485 Communication Wiring

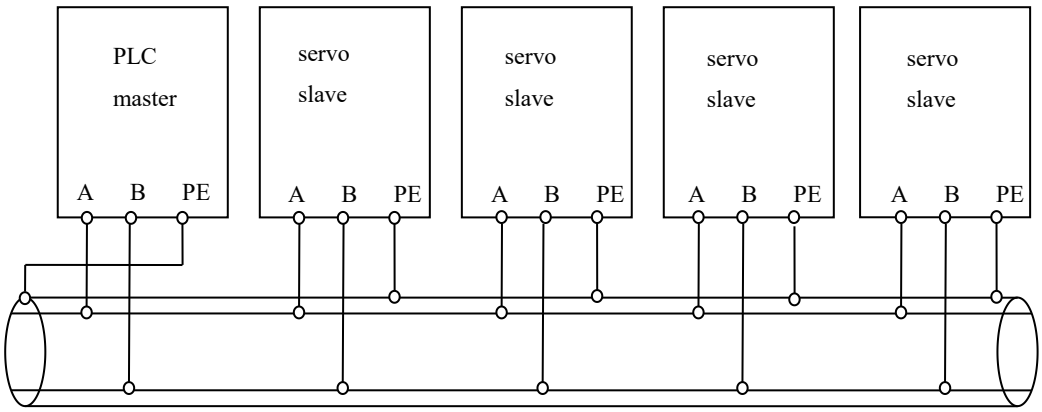


3. Communication between PLC and multiple servo motors (all servo drives and motors are properly grounded)

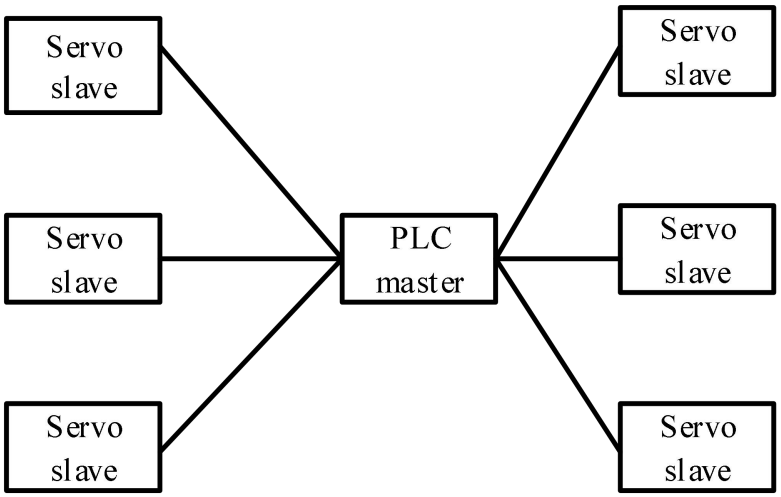
(1) Recommended approach: Hand-in-hand strategy



(2) Generally recommended: Branch structure



(3) Not recommended: Star-shaped connection structure



9.2 Communication Parameter Settings

1. RS485 Communication Parameter Settings

Parameter	Meaning	Factory Settings	Set Range	Revise	Come into force
P7-00	RS485 Station Number	1	0~100	servo bb	immediately

Parameter	Parameter Functions	Set Unit	Factory Settings	Applicable Mode	Revise	Come into force
P7-01	Communication Configuration	-	n.2206	whole	servo bb	immediately
	parameter setting	Functionality Overview	Factory Settings	Set Range		
	n.□xxx	check bit	2	0: No validation 1: Odd Check 2: Parity Check		
	n.x□xx	stop bit	2	2: Position 1		
	n.xx□□	Baud rate	06	00：300 01：600 02：1200 03：2400 04：4800 05：9600 06：19200 07：38400 08：57600 09：115200 0A：192000 0B：256000 0C：288000		

				0D：384000 0E：512000 0F：576000 10：768000 11：1M 12：2M 13：3M 14：4M 15：5M 16：6M

Parameter	Meaning	Factory Settings	Set Range	Revise	Come into force
P7-02	RS485 Communication Protocol	1	1: Modbus RTU Protocol 2: XNet Bus Protocol 3: Read the Xnet bus torque	servo bb	immediately

2. RS232 Communication Parameter Settings

Parameter	Meaning	Factory Settings	Set Range	Revise	Come into force
P7-10	RS232 Station Number	1	0~100	at any time	immediately

Parameter	Parameter Functions	Set Unit	Factory Settings	Applicable Mode	Revise	Come into force
P7-11	Communication Configuration	-	n.2206	whole	at any time	immediately
	parameter setting	Functionality Overview	Factory Settings	Set Range		
	n.□xxx	check bit	0	0: No validation 1: Odd Check 2: Parity Check		
	n.x□xx	stop bit	0	0: 2 digits 2: Position 1		

	n.xx□□	Baud rate	09	00：300 01：600 02：1200 03：2400 04：4800 05：9600 06：19200 07：38400 08：57600 09：115200 0A：192000 0B：256000 0C：288000 0D：384000 0E：512000 0F：576000 10：768000 11：1M 12：2M 13：3M 14：4M 15：5M 16：6M

9.3 Communication Protocols

When communicating over a Modbus network, this protocol requires each controller to know its device address, identify messages received at that address, and determine the appropriate action to take. If a response is needed, the controller generates feedback information and transmits it via the Modbus protocol. On other networks, messages containing Modbus protocol data are converted into frame or packet structures suitable for that network; this conversion also adapts methods for addressing, routing, and error detection to the specific network environment.

9.3.1 Character Structure

(Format 1-8-2, no validation)

Start bit	0	1	2	3	4	5	6	7	Stop bit	Stop bit

(Format 1-8-1, odd parity)

Start bit	0	1	2	3	4	5	6	7	Odd parity	Stop bit

(Format 1-8-1, even parity)

Start bit	0	1	2	3	4	5	6	7	Even parity	Stop bit

(Format 1-8-1, no validation)

Start bit	0	1	2	3	4	5	6	7	Stop bit

The default data format for a servo driver is: 1 start bit, 8 data bits, and 1 stop bit.

9.3.2 Structure of Communication Information

1、RTU pattern

Project	Explain
START	Keep the no-input signal duration greater than or equal to 10 ms
Address	Address: 8-bit binary address
Function	Function Code: 8-bit binary address
DATA（n - 1）	Data content: N × 8-bit data, where N ≤ 8, with a maximum of 8 bytes
.....	
DATA 0	
CRC CHK Low	CRC check code
CRC CHK High	The 16-bit CRC check code consists of two 8-bit binary combinations.

END	Maintain the input/output signal duration to be greater than or equal to 10 ms

2. Mailing Address

The manual provides Modbus addresses; refer to Appendix 4 for the correspondence table.

3. Function Code (Function) and Data Content (DATA)

FC	Explain
03H	Read the contents of registers. You can read multiple register contents, but no more than 31 at a time; each read operation can only target data within the same group.
06H	Write one piece of data to the register

- Function Code 03H: Read register contents

For example: Read the content of register address H1005 (bus voltage) in U0-05.

RTU pattern ：

Request Information Format		Response Message Format	
address	01H	address	01H
FC	03H	FC	03H
Register Address	10H	Byte Count	02H
	05H		
Number of Registers	00H	Data Content	01H
	01H		34H
CRC CHECK Low	90H	CRC CHECK Low	B8H
CRC CHECK High	CBH	CRC CHECK High	03H

- Function Code 06H: Write a piece of data to the register

For example: Set the rotational speed of 300 rpm at the address of the P3-18 register for point-speed control.

RTU pattern ：

Request Information Format		Response Message Format	
address	01H	address	01H
FC	06H	FC	06H
Register Address	03H	Register Address	03H
	12H		12H
Data Content	01H	Data Content	01H
	2CH		2CH
CRC CHECK Low	29H	CRC CHECK Low	29H
CRC CHECK High	C6H	CRC CHECK High	C6H

4. Verification Code

RTU Mode: Two-byte hexadecimal number.

The CRC field is a two-byte value containing a 16-bit binary number. It is computed by the sender and

appended to the message; the low byte is added first, followed by the high byte, making the high byte of the CRC the final byte of the transmitted message. The receiver recalculates the CRC of the received message and compares it with the value in the CRC field. If the values differ, an error is detected, the message frame is discarded without any response, and reception proceeds to the next frame. For detailed CRC calculation methods, refer to the MODBUS protocol specifications.

9.4 Communication Cases

9.4.1 Communication Example with Xinxie PLC

The XINJE PLC communicates with two XINJE drivers via 485 interface to read the motor's rotational speed and set its torque limit.

1. Hardware wiring

When using the AB terminals of the XINJE PLC for 485 communication, simply connect pins 16 and 17 of the driver to the corresponding AB terminals on the PLC.

2. Parameter Settings

Align the communication parameters of both the drive and the PLC, including baud rate, parity, number of data bits, and slave status. Both the XINJE PLC and the servo unit employ the standard Modbus-RTU protocol (19200 bps, 1-8-1 parity).

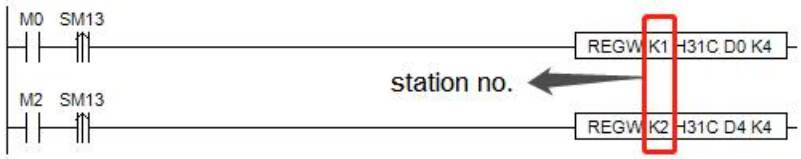
Set the parameters as follows:
P7-00 Station Numbers 1, 2
P7-01.0~1 Port Rate 06
P7-01.2 Stop Level 2
P7-01.3 Check Bit 2

If the communication parameters between the upper computer and the lower computer are inconsistent, communication will fail.

3. Software Programs

In the program, write instructions must specify the station number, communication address, and the register containing the data to be stored.

(1) Station number: Value set for servo driver P7-00. K1 indicates P7-00 set to 1; K2 indicates P7-00 set to 2.



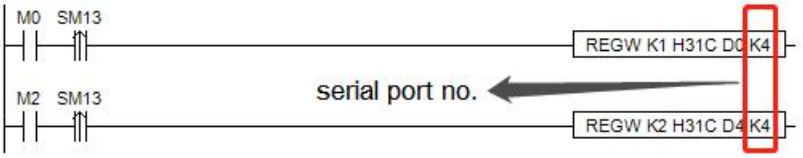
(2) Communication Address: The address of the slave station; for specific register addresses, refer to Appendix 4, the Modbus Address Correspondence Table.



(3) Register: Used to store the parameter value of the write address.



(4) Serial port number: The serial port number of the PLC's RS485 interface.



Appendix

Appendix 1. Overview Table of Functional Parameters for Group P

Modification and Effective Date:

"○" indicates modifications made during server configuration, effective immediately;

"√" values can be changed at any time and take effect immediately.

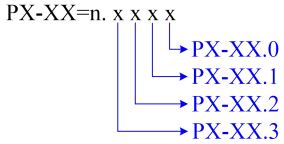
"●" indicates modifications made during servo BB operation, requiring a power cycle to take effect.

"△" indicates that it can be changed at any time and takes effect when the motor is not rotating;

"▲" indicates it can be modified at any time and requires a power cycle to take effect.

For hexadecimal parameters, prefix "n." before the value indicates that it is a hexadecimal number.

Parameter Composition:



P0-XX:

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Refer to chapters and sections
P0-01	**Control Mode 1** 1: Internal Torque Mode 2: External Analog Torque Mode 3: Internal Speed Mode 4: External Analog Speed Mode 5: Internal Position Pattern 6: External Pulse Position Pattern 7: External Pulse Speed	-	6	1~10	○	1|2|3|4|5|6|7	5.1.1

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Refer to chapters and sections
	Mode						
P0-02	Control Mode 2 (same as above)	-	6	1~10	○	1|2|3|4|5|6|7	5.1.1
P0-03	**Enable Mode** 0: Disabled 1: IO Enable 2: Software Enablement 3: Bus Enable	-	1	0~3	○	1|2|3|4|5|6|7	5.2.2
P0-04	Rigidity Level	-	<=20P7：13 >=21P0：11	0~41	▵	1|2|3|4|5|6|7	7.3.3
P0-05	Rotation Direction Definition 0: Normal Mode 1: Anti-pattern	-	0	0~1	●	1|2|3|4|5|6|7	5.2.3
P0-07	First Inertia Ratio	1%	200	0~50000	√	1|2|3|4|5|6|7	7.2.1
P0-09.0	**Enter pulse instruction in positive direction** 0: Forward pulse count 1: Reverse pulse counting	-	0	0~1	●	6|7	5.3.2
P0-09.2	Input Pulse Instruction Filtering Configuration	-	3	0~4	●	6|7	5.3.2
P0-10.0	0：CW/CCW 1: AB (not supported in external pulse speed mode) 2：P+D	-	2	0~2	○	6|7	5.3.2
P0-10.1	**Effective edge of the high-speed pulse signal** 0: Valid for falling edge 1: Valid rising edge	-	0	0~1	○	6|7	5.3.2
P0-11 ~ P0-12	**Number of instruction pulses per cycle** 0: Use electronic gear ratio Non-zero: Number of command pulses required	1 pul	10000	0~99999999	○	5|6	5.3.1.1

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Refer to chapters and sections
	for the motor to complete one rotation						
P0-13	Electronic Gear Molecule	-	1	0~65535	√（pattern 6） ○（pattern 5）	5|6	5.3.1.1
P0-14	Electronic Gear Denominator	-	1	0~65535	○	5|6	5.3.1.1
P0-15	The rated rotational speed corresponds to the pulse frequency.	100Hz	1000	1~10000	○	7	5.4.3.2
P0-16	Speed Command Pulse Filtering Time	0.01ms	100	0~10000	○	7	5.4.3.3
P0-17	Frequency Division Output Enable Switch (-supported in version 4230 and above)	-	1	0~1	○	All	5.8
P0-18	Number of feedback pulses per encoder revolution (low bit)	0	2500	0~9999	○	All	5.8
P0-19	Number of feedback pulses per encoder revolution (high bit)	10000	0	0~9999	○	All	5.8
P0-20	Encoder feedback output pulse frequency division (numerator)	-	1	0~65535	○	All	5.8
P0-21	Encoder feedback output pulse division (denominator)	-	1	0~65535	○	All	5.8
P0-23	Pulse Deviation Limit	0.01 turn	2000	0~65535	√	5|6	5.3.1.6
P0-24	**Power protection method for discharge resistance** 0: Cumulative discharge time 1: Average Power Mode 1	-	0	0~2	○	1|2|3|4|5|6|7	5.2.6

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Refer to chapters and sections
	2: Average Power Mode 2 (Unfinished, not recommended)						
P0-25	Discharge resistance power value	W	According to device model settings	1~65535	○	1|2|3|4|5|6|7	5.2.6
P0-26	Discharge resistance value	Ω	According to device model settings	1~500	○	1|2|3|4|5|6|7	5.2.6
P0-27	**Server Gateway enables shutdown mode** 0: Free stop; maintains free operation after stopping; 1: Stop freely and maintain the DB state after stopping; 2: Reduce speed and stop; after stopping, maintain free operation. 3: Reduce speed and stop; maintain DB status after stopping. 4: DB stops; after stopping, it remains in free-running state. 5: Stop the DB; maintain its state after stopping	-	0	0~5	○	1|2|3|4|5|6|7	5.2.4
P0-28	**Servo Overload Stop Mode (P0-28.0)** 0: Slow down and stop 1 1: Free Stop 2: Slow down and stop 2 3: Alarm stopped **Overload Alarm Shielding Switch (P0-28.1)** 0: Do not block out-of-range alarms 1: Suppress out-of-range alarm	-	2 0	0~3 0~1	○	1|2|3|4|5|6|7	5.2.4
P0-29	**Servo Alarm Stop Mode** 0: Free stop; maintains free operation after stopping; 1: Stop freely and maintain the DB state	-	2	0~2	○	1|2|3|4|5|6|7	5.2.4

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Refer to chapters and sections
	after stopping; 2: DB/Reduce speed and stop; maintain free operation after stopping; 3: DB/Decelerate and stop; maintain DB status after stopping; 4: DB stops; after stopping, it remains in free-running state. 5: Stop the DB; maintain its state after stopping						
P0-30	Stop timeout time	1ms	20000	0~65535	○	1|2|3|4|5|6|7	5.2.3
P0-31	Stop Time of Reduction	1ms	25	0~5000	○	1|2|3|4|5|6|7	5.2.3
P0-33	Motor Code Setting	-	0	0~ffff	●	1|2|3|4|5|6|7	-
P0-53	**Read the alarm shielding position for motor parameters** 0: Do not block alarms 1: Prevent the display of valid motor parameter alarms that have not been read	-	0	0~1	●	1|2|3|4|5|6|7	8.2
P0-55	Open-loop rotation speed	-	0	-6000~6000	●	1|2|3|4|5|6|7	-
P0-56	Number of encoder communication attempts	-	10	1~65535	●	1|2|3|4|5|6|7	8.2
P0-68 xx□□	Number of alarms for sequential errors during encoding data update	-	0x05	0x01~0xFF	●	1|2|3|4|5|6|7	-
P0-68 □□xx	E-241 Alarm Filtering Count	-	0x05	0x01~0xFF	●	1|2|3|4|5|6|7	-
P0-69.0	Fan Switch 0: Turn on the fan when temperature exceeds 45° C; turn it off when temperature drops below	-	1	0~1	√	1|2|3|4|5|6|7	-

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Refer to chapters and sections
	42°C (with a hysteresis range of 3°C). 1: Turn on the fan when enabled; turn it off when disabled						
P0-69.1	Large Motor Thermocouple Wire Break Alarm Shielding Switch (P0-69.1) 0: Do not block the thermocouple wire break alarm 1: Suppress thermocouple wire break alarm	-	0	0~1	√	1|2|3|4|5|6|7	-
P0-69.3	Hide E-112/E-113 alarms (P0-69.3) 0: Do not block E-112/E-113 alarms 1: Suppress E-112/E-113 alarms	-	1	0~1	√	1|2|3|4|5|6|7	-
P0-74	Turn-off alarm time	ms	By Device Model	0~5000	√	1|2|3|4|5|6|7	5.7.1
P0-75	Turn-off alarm speed	rpm	50	5~9999	√	1|2|3|4|5|6|7	5.7.1
P0-79	Absolute Encoder Settings 0: Used as an absolute encoder 1: Used as an incremental encoder 2: When used as an absolute encoder, ignore the multi-turn overflow alarm.	-	1	0~2	●	1|2|3|4|5|6|7	5.6.1
P0-80	Motor Thermal Power Protection Method 0: Current Protection 1: Average Thermal Power Protection 2: Analog Thermal Power Protection	-	2	0~2	●	1|2|3|4|5|6|7	-

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Refer to chapters and sections
P0-87.0	Encoder Feedback Output Direction	-	0	0~1	○	All	5.8
P0-87.1	Encoder feedback output: Z-phase output mode	-	2	0~6	○	All	5.8
P0-88	High-speed Pulse Mode Selection Switch 0-Normal Pulse Mode 1-High-Speed Pulse Mode	-	0	0~1	●	6	5.3.2.2
P0-89	High-Speed Pulse Instruction Filtering Configuration	-	2	0~4	○	6	5.3.2.6
P0-92	32-bit electronic gear ratio molecule The values P0-11 to P0-14 are valid when set to 0. Electronic gear ratio numerator = P0-92*1 + P0-93 *10000	-	1	1~9999	√ (pattern 6) ○ (pattern 5)	5|6	5.3.1.1
P0-93		-	0	0~65535	√ (pattern 6) ○ (pattern 5)	5|6	5.3.1.1
P0-94	The 32-bit electronic gear ratio is determined by its denominator. The values P0-11 to P0-14 are valid when set to 0. Electronic gear ratio = numerator / denominator = P0-94*1 + P0-95 *10000	-	1	1~9999	○	5|6	5.3.1.1
P0-95		-	0	0~65535	○	5|6	5.3.1.1

P1-XX:

Parameter	Functional description	Unit	Factory Default Value	Span	Come into force opportunity	Scope of application	Consult chapters and sections
P1-00	First Speed Loop Gain	0.1Hz	<=20P7: 300 >=21P0: 180	10~20000	√	1|2|3|4|5|6|7	7.5.3
P1-01	First-speed loop integration time constant	0.01ms	<=20P7: 2653 >=21P0: 4421	15~51200	√	1|2|3|4|5|6|7	7.5.3
P1-02	First-position ring gain	0.1/s	<=20P7: 480 >=21P0: 288	10~20000	√	1|2|3|4|5|6|7	7.5.3
P1-05	Second Speed Loop Gain	0.1Hz	200	10~20000	√	1|3|5|6|7|	7.8.4
P1-06	Second speed loop integration time constant	0.01ms	3300	15~51200	√	1|3|5|6|7|	7.8.4
P1-07	Second Position Ring Gain	0.1/s	200	10~20000	√	1|3|5|6|7|	7.8.4
P1-10	Speed Feedforward Gain	1%	0	0~300	√	5|6|7	-
P1-11	Speed feedforward filtering time	0.01ms	50	0~10000	√	5|6|7	-
P1-14	Gain Switching Mode Settings	-	0	0~0x00A2	√	1|2|3|4|5|6|7	7.8.3
P1-15	Gain switching wait time	-	5	0~1000	√	1|2|3|4|5|6|7	7.8.3
P1-16	Gain Switching Level Threshold	-	50	0~20000	√	1|2|3|4|5|6|7	7.8.3
P1-17	Gain switching level hysteresis	-	30	0~20000	√	1|2|3|4|5|6|7	7.8.3
P1-18	Position loop gain switching time	-	3	0~1000	√	1|2|3|4|5|6|7	7.8.3

Parameter	Functional description	Unit	Factory Default Value	Span	Come into force opportunity	Scope of application	Consult chapters and sections
P1-19.0	Gap Compensation Function Direction 0: Positive direction 1: Opposite Direction	-	0	0~1	√	All	-
P1-19.1	Gap Compensation Function Switch 0: Close 1: Enable	-	0	0~1	√	All	-
P1-20	Gap Compensation Quantity	0.1Pref	0	0~65535	√	All	-
P1-21	Gap Compensation Filtering Time	0.01ms	0	0~65535	√	All	-
P1-23	Speed Command Filter Time Parameter	0.1ms	0	0~65535	○	3|4|7	5.4.1.4
P1-24	Position instruction acceleration/deceleration filtering time	0.1ms	0	0~65535	△	5|6	5.3.1.7
P1-25	Position Command Smoothing Filter Time Parameter	0.1ms	0	0~65535	△	5|6	5.3.1.7
P1-26.0	Speed Control Mode Switching Conditions [P-PI changing-over] 0: Do not use mode switching 1: Use the internal torque command as the switching condition 2: Use speed commands as the switching condition 3: Use acceleration as the switching condition 4: Use position deviation as the switching condition	-	<=22P6：1 Others：0	0~4	△	All	7.8.5
P1-26.1	Switching between speed control modes with integral hold selection 0: Clear the integral of 0	-	1	0~1	△	All	7.8.5

Parameter	Functional description	Unit	Factory Default Value	Span	Come into force opportunity	Scope of application	Consult chapters and sections
	Asr 1: Keep points unchanged and stop accumulating them						
P1-27	Mode Switch – Torque Command Threshold	%	200	0~800	△	All	7.8.5
P1-28	Mode Switch – Speed Command Threshold	rpm	0	0~10000	△	All	7.8.5
P1-29	Mode Switch – Acceleration Threshold	rpm/s	0	0~30000	△	All	7.8.5
P1-30	Mode Switch – Position Deviation Threshold	Command Unit	0	0~10000	△	All	7.8.5
P1-31	I-P Control Switching Threshold	%	100	0~100	△	All	7.8.5
P1-74	Encoder Zero Bit Offset Detection Cycle	-	1000	0~65535	√	1|2|3|4|5|6|7	-
P1-75.0~1	Encoder Zero-bit Offset Detection Threshold	-	0A	0~500	√	1|2|3|4|5|6|7	-
P1-75.2~3	Number of filtering steps required for electrical angle deviation detection	-	06	0~500	√	1|2|3|4|5|6|7	-

P2-XX:

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P2-00.0	Disturbance Observer Switch 0: Close 1: Open	-	0	0~1	○	1|2|3|4|5|6|7	7.3.3

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P2-00.1	Speed Observer Selection 0: Close 1：EhVobs 2：Vobs	-	0	0~2	○	All	7.3.3
P2-00.3	Electrical angle compensation switch 0: Close 1: Open	-	1	0~1	○	All	-
P2-01.0	Adaptive Mode Switch 0: Close 1: Open	-	0	0~1	●	1|2|3|4|5|6|7	7.6.3
P2-01.1	Adaptive Level 0: High Response 1: Low Noise	-	By Device Model	0~1	●	1|2|3|4|5|6|7	-
P2-02.0	Self-Calibration Mode 1: Soft 2: Quick Location 3: Rapid localization and overshoot control	-	3	1~3	√	1|2|3|4|5|6|7|	7.3.3
P2-02.2	Load Type (valid only during self-tuning) 1: Synchronization Belt 2: Screw rod 3: Rigid Connection	-	2	1~3	√	1|2|3|4|5|6|7	7.3.3
P2-03.2	Speed Loop IP Control Enablement 0: Close 1: Open	-	0	0~1	●	All	7.8.5
P2-03.3	Adaptive Load Type 0: Low Inertia Mode 1: High Inertia Mode	-	0	0~1	●	1|2|3|4|5|6|7	7.6.4
P2-05	Adaptive Mode Speed Loop Gain （standard）	0.1Hz	<=20P7：400 >=21P5：200	1~65535	○	1|2|3|4|5|6|7	7.6.4
P2-07	Adaptive Mode Inertia Ratio (Standard)	%	0	0~10000	○	1|2|3|4|5|6|7	7.6.4

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P2-08	Adaptive Mode Speed Observer Gain (Standard)	Hz	<=20P7：60 >=21P5：40	10~1000	○	1|2|3|4|5|6|7	7.6.4
P2-12	Adaptive Mode Maximum Inertia Ratio (Standard)	-	30	1~10000	○	1|2|3|4|5|6|7	7.6.4
P2-15	Internal instruction: Set to maximum travel distance	0.01r	100	1~3000	√	1|2|3|4|5|6|7	7.2.4
	Maximum travel distance for inertia recognition			1~300			
P2-16	Adaptive Mode Motor Rotor Inertia Coefficient	-	100	10~1000	○	1|2|3|4|5|6|7	7.2.4
P2-17	Inertia identification and the maximum speed determined through internal command-based self-adjustment	rpm	0	0~65535	√	1|2|3|4|5|6|7	7.2.4
P2-18	Initial inertia ratio for inertia identification	%	500	1~20000	√	1|2|3|4|5|6|7	7.2.4
P2-19	Adaptive Mode Bandwidth	%	20P1：100 20P2，20P4：70 >=20P7：50	1~100	○	1|2|3|4|5|6|7	7.2.4
P2-31	Dead Zone Compensation Time	0.01ms	15	0~65535	√	All	-
P2-35	Torque command filtering time constant 1	0.01ms	<=20P7：66 >=21P0：111	0~65535	√	1|2|3|4|5|6|7	7.5.3
P2-36	Torque command filtering time constant 2	0.01ms	100	0~65535	√	All	7.5.3
P2-39	Disturbance observer gain 1	-	10	10~1000	√	All	7.8.2
P2-40	Disturbance Observer Gain 2	-	100	10~1000	√	All	7.8.2

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P2-41	Disturbance torque compensation coefficient (effective in non-adaptive mode)	%	85	0~100	√	1|2|3|4|5|6|7	7.8.2
P2-42	Cut-off frequency of the disturbance torque low-pass filter	0.1Hz	0	-1000~1000	√	All	7.8.2
P2-43	Inertia coefficient of the disturbance observer	%	100	1~1000	√	All	7.8.2
P2-47.0	Model Loop Switch 0: Close 1: Open	-	0	0~f	√	1|2|3|4|5|6|7	7.3.3
P2-49	Model Ring Gain	0.1Hz	<=20P7：480 >=21P0：288	10~20000	√	3|4|5|6|7	7.5.3
P2-60.0	Active Vibration Suppression Switch 0: Close 1: Open	-	0	0~1	√	3|4|5|6|7	7.4.6
P2-60.1	Active suppression of self-adjusting switch 0: Do not configure active vibration suppression after self-calibration 1: Configure active vibration suppression after self-calibration	-	1	0~1	√	3|4|5|6|7	7.4.6
P2-61	Active vibration suppression frequency	0.1Hz	1000	10~20000	√	1|2|3|4|5|6|7	7.5
P2-62	Active vibration suppression gain	%	100	1~1000	√	1|2|3|4|5|6|7	7.4.6
P2-63	Active vibration suppression damping	%	100	0~300	√	1|2|3|4|5|6|7	7.4.6
P2-64	Active vibration suppression filtering time 1	-	0	-5000~5000	√	1|2|3|4|5|6|7	7.4.6
P2-65	Active vibration suppression filtering time 2	-	0	-5000~5000	√	1|2|3|4|5|6|7	7.4.6

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P2-66	The second group uses active vibration suppression damping techniques.	-	0	0~1000	√	1|2|3|4|5|6|7	7.4.6
P2-67	Second group of active vibration suppression frequencies	Hz	20000	10~50000	√	1|2|3|4|5|6|7	7.4.6
P2-69.0	Sloshing Filter 1 Switch	-	0	0~1	√	1|2|3|4|5|6|7	7.4.6
P2-69.1	Sloshing Filter 2 Switch	-	0	0~1	√	1|2|3|4|5|6|7	7.4.6
P2-69.3	Sloshing Filter 3 Switch	-	0	0~1	√	1|2|3|4|5|6|7	-
P2-70.0	Sloshing Filter 4 Switch	-	0	0~1	√	1|2|3|4|5|6|7	-
P2-70.1	Sloshing Filter 5 Switch	-	0	0~1	√	1|2|3|4|5|6|7	-
P2-71	First notch frequency	Hz	8000	50~8000	√	1|2|3|4|5|6|7	7.7.7
P2-72	First notch attenuation	0.1dB	71	50~1600	√	1|2|3|4|5|6|7	7.7.7
P2-73	First notch bandwidth	Hz	0	0~1000	√	1|2|3|4|5|6|7	7.7.7
P2-74	Second absorption frequency	Hz	8000	50~8000	√	1|2|3|4|5|6|7	7.7.7
P2-75	Second absorption attenuation	0.1dB	71	50~1600	√	1|2|3|4|5|6|7	7.7.7
P2-76	Second absorption band width	Hz	0	0~1000	√	1|2|3|4|5|6|7	7.7.7
P2-77	Third absorption frequency	Hz	8000	50~8000	√	1|2|3|4|5|6|7	7.7.7
P2-78	Third waveguide attenuation	0.1dB	71	50~1600	√	1|2|3|4|5|6|7	7.7.7
P2-79	Third absorption band width	Hz	0	0~1000	√	1|2|3|4|5|6|7	7.7.7
P2-80	Fourth absorption frequency	Hz	8000	50~8000	√	1|2|3|4|5|6|7	7.7.7
P2-81	Fourth absorption wave attenuation	0.1dB	71	50~1600	√	1|2|3|4|5|6|7	7.7.7

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P2-82	Fourth absorption band bandwidth	Hz	0	0~1000	√	1|2|3|4|5|6|7	7.7.7
P2-83	Fifth absorption frequency	Hz	8000	50~8000	√	1|2|3|4|5|6|7	7.7.7
P2-84	Fifth: Waveform attenuation	0.1dB	71	50~1600	√	1|2|3|4|5|6|7	7.7.7
P2-85	Fifth absorption band bandwidth	Hz	0	0~1000	√	1|2|3|4|5|6|7	7.7.7

P3-XX:

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P3-00	**V-REF Function Allocation** 0: V-REF as a speed command input 1: V-REF serves as the external reference value for rotational speed limitation; the actual speed limit is determined by the external analog speed limiter. 2: Speed Feedforward	-	0	0~2	○	1|2|4	5.5
P3-01	The rated speed corresponds to the analog voltage value.	0.001V	10000	1500~30000	○	1|2|4	5.4.4
P3-02	Analog voltage velocity filtering	0.01ms	200	0~10000	√	1|2|4	5.4.4
P3-03	Speed Command Input Dead Zone Voltage	0.001v	0	0~500	√	1|2|4	5.4.4
P3-04	V-REF Analog Speed Direction Conversion	-	0	0~1	√	1|2|4	5.4.4
P3-05	Default Speed 1	rpm	0	-9999~9999	√	3	5.4.2

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P3-06	Default Speed 2	rpm	0	-9999~9999	√	3	5.4.2
P3-07	Default Speed 3	rpm	0	-9999~9999	√	3	5.4.2
P3-09	acceleration time	ms	200	0~65535	√	3|4|7	5.4.1.1
P3-10	deceleration time	ms	200	0~65535	√	3|4|7	5.4.1.1
P3-11	Speed Command Sliding Average Filtering Time	ms	0	0~65535	○	3|4|7	5.4.1.4
P3-12	Zero-speed Clamping Mode	-	0	0~4	○	3|4|7	5.4.1.2
P3-13	Zero-speed clamping speed	rpm	10	0~300	○	3|4|7	5.4.1.2
P3-14	Positive maximum speed command limit	rpm	4000	0~10000	○	1|2|3|4|5|6|7	5.7.3
P3-15	Reverse Maximum Speed Command Limit	rpm	4000	0~10000	○	1|2|3|4|5|6|7	5.7.3
P3-16	Internal forward speed limit during torque control	rpm	2000	5~10000	√	1|2	5.5.1.2
P3-17	Internal reverse speed limit during torque control	rpm	2000	5~10000	√	1|2	5.5.1.2
P3-18	Click Speed	rpm	100	0~1000	○	1|2|3|4|5|6|7	4.4.2
P3-19	Positive Warning Speed	rpm	3000	0~10000	○	1|2|3|4|5|6|7	5.7.5.4
P3-20	Reverse Warning Speed	rpm	3000	0~10000	○	1|2|3|4|5|6|7	5.7.5.4
P3-21	Positive alarm speed	rpm	4000	0~10000	○	1|2|3|4|5|6|7	-
P3-22	Reverse Alarm Speed	rpm	4000	0~10000	○	1|2|3|4|5|6|7	-
P3-23	**T-REF Function Allocation** 0: As torque command input 1: As a necessary	-	0	0~3	○	2|3|4|5|7	5.7.2

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
	condition for external torque limit input, the minimum value is valid when compared with P3-28/P3-29. 2: Torque Feedforward						
P3-24	The numerical value of the analog quantity corresponding to the rated torque	0.001V	10000	1500~30000	○	2|3|4|5|6|7	5.5.3
P3-25	Simulation time for voltage-to-torque filtering	0.01ms	200	0~10000	√	2|3|4|5|6|7	5.5.3
P3-26	Torque command input dead zone voltage	0.001V	0	0~500	√	2|3|4|5|6|7	5.5.3
P3-27	**Analog torque in positive direction** 0: Forward 1: Reverse	-	0	0~1	○	2|3|4|5|6|7	-
P3-28	Internal forward rotation torque limit	%	By Device Model	0 – Motor overload factor	√	1|2|3|4|5|6|7	5.7.2
P3-29	Internal reverse rotation torque limit	%	By Device Model	0 – Motor overload factor	√	1|2|3|4|5|6|7	5.7.2
P3-30	External forward torque limit	%	By Device Model	0 – Motor overload factor	√	1|2|3|4|5|6|7	5.7.2
P3-31	External Reverse Torque Limit	%	By Device Model	0 – Motor overload factor	√	1|2|3|4|5|6|7	5.7.2
P3-32	brake torque	1%	100	0~1000	√	1|2|3|4|5|6|7	5.2.4
P3-33	Default Torque 1	%	0	-1000~1000	√	1	5.5.1.1
P3-34	Default Torque 2	%	0	-1000~1000	√	1	5.5.1.1
P3-35	Default Torque 3	%	0	-1000~1000	√	1	5.5.1.1
P3-37	Torque mode switching delay	ms	40	0~9999	√	1|2	-

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P3-38	Prevention of reverse rotation; limitation of positive rotation torque	%	By Device Model	0 – Motor overload factor	√	1|2|3|4|5|6|7	5.7.1
P3-39	Prevention of reverse rotation; Limitation of reverse rotation torque	%	By Device Model	0 – Motor overload factor	√	1|2|3|4|5|6|7	5.7.1
P3-40.0	Cuffing Compensation Switch	-	0	0~1	√	All	-
P3-40.1	Selection of Friction Compensation Speed Source	-	0	0~2	√	All	-
P3-45	Cuffing Compensation Speed Threshold	0.1rpm	20	0~200	√	All	-
P3-47	V-REF Analog Signal Zero Drift Correction	-	0	-1000~1000	√	2|4	5.4.4.7
P3-48	V-REF Analog Voltage Bias	mV	0	-9999~9999	√	2|4	5.4.4.7
P3-49	T-REF Analog Signal Zero Drift Correction	-	0	-1000~1000	√	2|4	5.5.3.5
P3-50	T-REF Analog Voltage Bias	mV	0	-9999~9999	√	2|4	5.5.3.5
P3-51	Method for determining the internal torque mode 0: Parameter set (use preset torque 1 directly) 1: External Terminal Selection (Supports preset torque values 1– 3)	-	0	0~1	○	1	5.5.1.1

P4-XX:

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P4-00.0	**Z believes the number of signs** Number of Z signals after passing the limit switch (Note: Stop when the n+1th Z signal arrives).	individual	2	0~f	○	5|6	5.3.1.8

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P4-00.1	**Is the Origin Search feature enabled?** 0: Disabled 1: Enabled	-	0	0~1	○	5|6	5.3.1.8
P4-00.2	**Prohibition of exceeding the return-to-zero range** 0: Not prohibited 1-Prohibited	-	0	0~1	○	5|6	5.3.1.8
P4-00.3	**Return to the original state and complete automatic calibration of the encoder zero position** 0: Not automatically calibrated 1: Automatic Calibration	-	0	0-1	○	5|6	5.3.1.8
P4-01	Speed of collision with the proximity sensor	rpm	600	0~65535	○	5|6	5.3.1.8
P4-02	Speed when approaching the proximity sensor	rpm	100	0~65535	○	5|6	5.3.1.8
P4-03.0	Set the positioning mode based on the given internal location pattern 0: Relative Positioning 1: Absolute Positioning (Disables persistence) 2: Absolute Positioning (Disabling/Enabling Maintenance)	-	0	0~2	○	5	5.3.3.1
P4-03.1	Set the step mode based on the given internal location pattern 0: Switch steps when signal ON; can cycle 1: Step by step transition of the signal rising edge, executed sequentially 2: Start on the signal rising edge, execute all steps sequentially without looping 3: Communication Setting Segment Number 4: /CHSTP Bilateral Edge Trigger 5: Select section numbers for terminals/PREFA (P5-57), /PREFB (P5-58), and /PREFC (P5-59); options range from 1 to 3. 6: Terminal selection for/PREFA (P5-57), /PREFB (P5-58), /PREFC	-	0	0~6	○	6	5.3.3.1

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
	(P5-59), and /PREFD (P5-60) terminals – select from segments 1 to 16.						
P4-03.2	Set the internal location to wait mode based on the given pattern 0: Waiting for positioning to complete 1: Do not wait for positioning to complete	-	0	0~1	○	5	5.3.3.1
P4-04	Number of valid segments	-	0	0~35	○	5	5.3.3.2
P4-08	Internal Location Pattern Starting Segment Number	-	1	0~35	○	5	5.3.3.3
P4-10 ~ P4-11	First pulse segment	1pul	0	-327689999 ~327679999	√	5	5.3.3.3
P4-12	First Paragraph Speed	0.1rpm	0	0~65535	√	5	5.3.3.3
P4-13	First acceleration time	1ms	0	0~65535	√	5	5.3.3.3
P4-14	First deceleration period	1ms	0	0~65535	√	5	5.3.3.3
P4-16	adjust the time	1ms	0	0~65535	√	5	5.3.3.3
P4-10+ (n-1) *7 ~ P4-16+ (n-1) *7	Pulse parameters for paragraphs 1 through 35 (where n indicates the position number)	-	-	-	√	5	5.3.3.3

P5-XX:

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P5-00	Positioning completion width/COIN	Command Unit	11	1~65535	√	5|6	5.3.1.2
P5-01	Location Detection Mode Completed	-	0	0~3	√	5|6	5.3.1.2
P5-02	Positioning completion retention time	ms	0	0~65535	√	5|6	5.3.1.2
P5-03	Rotation Detection Speed	rpm	50	0~10000	√	1|2|3|4|5|6|7	5.7.5.2
P5-04	Detection speed at the same speed	rpm	50	0~10000	√	1|2|3|4|5|6|7	5.7.5.3
P5-05	Detection speed reached	Rpm	1000	0~10000	√	1|2|3|4|5|6|7	5.4.1.3
P5-06	Position close to the output width	Command Unit	655	1~65535	√	5|6	5.3.1.3
P5-07	Servo-off delay time	Ms	500	-500~9999	○	1|2|3|4|5|6|7	5.2.5
P5-08	Brake Command Output Speed	Rpm	30	20~10000	○	1|2|3|4|5|6|7	5.2.5
P5-09	Brake Command Wait Time	Ms	500	0~65535	○	1|2|3|4|5|6|7	5.2.5
P5-10	Custom Output 1 Trigger Condition	-	0	0~ffff	√	1|2|3|4|5|6|7	5.7.5.7
P5-11	Value to compare with the trigger condition for Custom Output 1	Related to trigger conditions	0	-9999~9999	√	1|2|3|4|5|6|7	5.7.5.7
P5-12	Select Custom Output 1 Method	-	0	0~3	√	1|2|3|4|5|6|7	5.7.5.7
P5-13	Set Custom Output 1 Hysteresis Loop	Related to trigger conditions	0	0~65535	√	1|2|3|4|5|6|7	5.7.5.7
P5-14	Custom Output 2 Trigger Condition	-	0	0~ffff	√	1|2|3|4|5|6|7	5.7.5.7

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P5-15	Value to compare with the trigger condition for Custom Output 2	Related to trigger conditions	0	-9999~9999	√	1|2|3|4|5|6|7	5.7.5.7
P5-16	Select Custom Output 2 Method	-	0	0~3	√	1|2|3|4|5|6|7	5.7.5.7
P5-17	Set Custom Output 2 Hysteresis Loop	Related to trigger conditions	0	0~65535	√	1|2|3|4|5|6|7	5.7.5.7
P5-18	SI Filter Time Factor	-	1	0~10000	√	1|2|3|4|5|6|7	5.7.4.1
P5-19	Z-phase output hold time	ms	2	1~65535	√	1|2|3|4|5|6|7	5.7.5.6
P5-20.0~1	/S-ON: Servo Signal 00: Set the signal to always "invalid" 01: Input a positive signal from terminal SI1 02: Input a positive signal from the SI2 terminal 03: Input a positive signal from the SI3 terminal 04: Input a positive signal from the SI4 terminal 10: Set the signal to always "active" 11: Input the reverse signal from terminal SI1 12: Input the reverse signal from terminal SI2 13: Apply the reverse signal to terminal SI3 14: Input the reverse signal from terminal SI4	-	01	0~ff	√	1|2|3|4|5|6|7	5.2.2
P5-20.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-21.0~1	/P/ – Proportional Action Command for the P/CON Ratio	-	00	0~ff	√	1|2|3|4|5|6|7	5.7.6.1

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P5-21.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-22.0~1	/P-OT: Forward drive is prohibited	-	03	0~ff	√	1|2|3|4|5|6|7	5.2.4
P5-22.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-23.0~1	-N/OT: Reverse drive is prohibited	-	04	0~ff	√	1|2|3|4|5|6|7	5.2.4
P5-23.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-24.0~1	/ALM-RST: Alert cleared	-	02	0~ff	√	1|2|3|4|5|6|7	5.7.6.2
P5-24.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-25.0~1	/P-CL: External torque limit for forward rotation	-	00	0~ff	√	1|2|3|4|5|6|7	5.7.2
P5-25.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-26.0~1	-N/CL: External torque limit on the reverse side	-	00	0~ff	√	1|2|3|4|5|6|7	5.7.2
P5-26.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-27.0~1	/SPD-D: Internal Speed Direction Selection	-	00	0~ff	√	1|2|3|4|7	5.4.2
P5-27.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|7	5.7.4.1
P5-28.0~1	Speed Mode: /SPD-A: Internal speed selection setting New Original Mode: /SPD-A: Trigger the original action Old Return Mode: /SPD-A: In forward direction, locate the origin	-	00	0~ff	√	3|5	5.4.2
P5-28.2	SI Terminal Filtering Time	ms	0	0~f	√	3|5	5.7.4.1
P5-29.0~1	Speed Mode: /SPD-B: Internal speed	-	00	0~ff	√	3|5	5.4.2

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
	selection setting Old Return Mode: /SPD-B: Reverse direction to find the origin						
P5-29.2	SI Terminal Filtering Time	ms	0	0~f	√	3|5	5.7.4.1
P5-30.0~1	/C-SEL: Control Mode Selection	-	00	0~ff	√	1|2|3|4|5|6|7	5.1.2
P5-30.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-31.0~1	In internal speed mode/external analog speed/external pulse speed mode: /ZCLAMP: Zero Clamping Internal Location Mode: -Z-CLAMP: Skip the current section number	-	00	0~ff	√	Zero Clamping: 3|4|7 Skip current section: 5	5.4.1.2
P5-31.2	SI Terminal Filtering Time	ms	0	0~f	√	3|4|7	5.7.4.1
P5-32.0~1	/INHIBIT: Command pulse prohibition	-	00	0~ff	√	5	5.3.1.4
P5-32.2	SI Terminal Filtering Time	ms	0	0~f	√	5	5.7.4.1
P5-33.0~1	/G-SEL: Gain Switching	-	00	0~ff	√	1|3|5|6|7	6.8.4
P5-33.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	6.8.4
P5-34.0~1	/CLR: Pulse offset clearance	-	00	0~ff	√	5|6	5.3.1.5
P5-34.2	SI Terminal Filtering Time	ms	0	0~f	√	5|6	5.7.4.1
P5-35.0~1	/CHGSTP: Internal Position Pattern Step Change Signal	-	00	0~ff	√	5	5.3.3
P5-35.2	SI Terminal Filtering Time	ms	0	0~f	√	5	5.7.4.1
P5-36.0~1	-I-SEL: Inertia Ratio Switching	-	00	0~ff	√	1|2|3|4|5|6|7	6.6.7

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P5-36.2	SI Terminal Filtering Time	ms	0	0~f	√	1|2|3|4|5|6|7	5.7.4.1
P5-37	/COIN_HD: Positioning completed and maintained 00: Do not output to terminal 01: A positive signal is output from terminal SO1. 02: A positive signal is output from the SO2 terminal. 03: A positive signal is output from the SO3 terminal. 11: Output the reverse signal from terminal SO1 12: Output the reverse signal from the SO2 terminal 13: Output the reverse signal from the SO3 terminal	-	0000	0~ffff	√	5|6	5.3.1.2
P5-38	/COIN: Positioning completed	-	0001	0~ffff	√	5|6	5.3.1.2
P5-39	-V-CMP: Same-speed detection	-	0000	0~ffff	√	3|4|7	5.7.5.3
P5-40	/TGON: Rotation Detection	-	0000	0~ffff	√	1|2|3|4|5|6|7	5.7.5.2
P5-41	/S-RDY: Ready	-	0000	0~ffff	√	1|2|3|4|5|6|7	5.7.5.1
P5-42	/CLT: Torque Limit	-	0000	0~ffff	√	1|2|3|4|5|6|7	5.7.2
P5-43	/VLT: Speed Limit Detection	-	0000	0~ffff	√	1|2	5.5.1.3
P5-44	/BK: Brake Interlock	-	0000	0~ffff	○	1|2|3|4|5|6|7	5.2.5
P5-45	/WARN： warn	-	0000	0~ffff	√	1|2|3|4|5|6|7	5.7.5.4
P5-46	/NEAR： be close to	-	0000	0~ffff	√	5|6	5.3.7

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P5-47	/ALM： report to the police	-	0002	0~ffff	√	1|2|3|4|5|6|7	5.2.6
P5-48	/Z: Encoder Z signal output	-	0000	0~ffff	√	1|2|3|4|5|6|7	5.7.5.6
P5-50	/MRUN: Signal indicating the start of movement based on the internal positioning pattern	-	0000	0~ffff	√	5	5.3.3.6
P5-51	-V/RDY: Speed reached	-	0000	0~ffff	√	3|4|7	5.4.1.3
P5-52	/USER1: Custom Output 1	-	0000	0~ffff	√	1|2|3|4|5|6|7	5.7.5.7
P5-53	/USER2: Custom Output 2	-	0000	0~ffff	√	1|2|3|4|5|6|7	5.7.5.7
P5-54	Return to the origin to complete the signal	-	0	0~ffff	√	5|6	5.3.1.9
P5-57.0~1	/PREFA: Internal Position Selection Signal A	-	00	0~ff	√	5	5.3.3.1
P5-57.2	SI Terminal Filtering Time	ms	0	0~f	√	5	5.7.4.1
P5-58.0~1	/P PREFB: Internal Position Selection Signal B	-	00	0~ff	√	5	5.3.3.1
P5-58.2	SI Terminal Filtering Time	ms	0	0~f	√	5	5.7.4.1
P5-59.0~1	/P PREFC: Internal Position Selection Signal C	-	00	0~ff	√	5	5.3.3.1
P5-59.2	SI Terminal Filtering Time	ms	0	0~f	√	5	5.7.4.1
P5-60.0~1	/P PREFD: Internal Position Selection Signal D	-	00	0~ff	√	5	5.3.3.1
P5-60.2	SI Terminal Filtering Time	ms	0	0~f	√	5	5.7.4.1
P5-61.0~1	/TRAJ-START: Signal that initiates the exercise	-	00	0~ff	√	5	
P5-61.2	SI Terminal Filtering Time	ms	0	0~f	√	5	
P5-65.0~1	Analog Speed Mode Switch	-	0	0~ff	√	4	5.4.4.2

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P5-70	/SRDY: Output Condition Selection 0: After the drive unit is initialized, this terminal becomes conductive 1: This terminal will conduct only after enabling it	-	0	0~1	√	1|2|3|4|5|6|7	5.7.5.1
P5-71	Pulse Velocity Mode Direction Terminal Function Selection	-	0	0~1	○	7	5.4.3.4
P5-72	/JOG-P	-	0000	0~ff	√	5	5.3.3.8
P5-73	/JOG-N	-	0000	0~ff	√	5	5.3.3.8

P6-XX：

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P6-00	Rigid Setting Mode 0: Standard Mode 1: Localization Mode 2: Quick Location Mode	-	0	0~2	○	All	
P6-05	Adaptive Mode Speed Loop Gain (High Inertia)	0.1Hz	200	1~65535	○	1|2|3|4|5|6|7	7.2.4
P6-07	Adaptive Mode Inertia Ratio (High Inertia)	%	50	0~10000	○	1|2|3|4|5|6|7	7.2.4
P6-08	Adaptive Mode Speed Observer Gain (High Inertia)	Hz	40	10~1000	○	1|2|3|4|5|6|7	7.2.4
P6-12	Adaptive Mode Maximum Inertia Ratio (High Inertia)	-	50	1~10000	○	1|2|3|4|5|6|7	7.2.4

P7-XX：

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P7-00	RS485 Station Number	-	1	0~100	○	1|2|3|4|5|6|7	9.2
P7-01.0~1	RS485 baud Rate 00：300 01：600 02：1200 03：2400 04：4800 05：9600 06：19200 07：38400 08：57600 09：115200 0A：192000 0B：256000 0C：288000 0D：384000 0E：512000 0F：576000 10：768000 11：1M	Baud rate	06	0~16	○	1|2|3|4|5|6|7	9.2

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
	12：2M 13：3M 14：4M 15：5M 16：6M						
P7-01.2	RS485 Stop Bit 2: Position 1	stop bit	2	0~2	○	1|2|3|4|5|6|7	9.2
P7-01.3	RS485 Check Bit 2: Parity Check	check bit	2	2	○	1|2|3|4|5|6|7	9.2
P7-02	RS485 Communication Protocol 1: Modbus RTU Protocol	-	1	1~255	○	1|2|3|4|5|6|7	9.2
P7-10	RS232 Station Number	-	1	0~100	√	1|2|3|4|5|6|7	9.2
P7-11.0~1	**RS232 baud Rate** 00：300 01：600 02：1200 03：2400 04：4800 05：9600 06：19200 07：38400 08：57600 09：115200	Baud rate	09	0~16	√	1|2|3|4|5|6|7	9.2

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
	0A：192000 0B：256000 0C：288000 0D：384000 0E：512000 0F：576000 10：768000 11：1M 12：2M 13：3M 14：4M 15：5M 16：6M						
P7-11.2	**RS232 Stop Bit** 0: 2 digits 2: Position 1	stop bit	2	0~2	√	1|2|3|4|5|6|7	9.2
P7-11.3	**RS232 Check Bit** 0: No validation 1: Odd Check 2: Parity Check	check bit	2	0~2	√	1|2|3|4|5|6|7	9.2
P7-30	CAN Bus Communication Station Number	-	1	1~64	●	Bus Mode	6.6
P7-31	CAN Bus baud Rate 00：100000 01：125000	bps	5	0~5	●	Bus Mode	6.6

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
	02：250000 03：500000 04：750000 05：1000000						

P8-XX：

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P8-25	Content settings are displayed immediately when the panel is powered on.	-	0	0~2	▲	1|2|3|4|5|6|7	4.2

P9-XX：

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P9-11.0	Return to the origin to find the number of Z-phase points	-	0	0~f	○	5|6	5.3.1.9
P9-11.1	New Origin Trigger Method 0: Prevent returning to the origin 1: Trigger the return to origin via the SI terminal 2: In this original mode, upon first power-on activation, it immediately returns to the starting state.	-	0	0~2	○	5|6	5.3.1.9

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P9-11.2	New Origin Point Mode 0: Return to Origin Mode 0 1: Return to Origin Mode 1 2: Return to Origin Mode 2 3: Return to Origin Mode 3 4: Return to Origin Mode 4 5: Return to Origin Mode 5 6: Return to Origin Mode 6 7: Return to Origin Mode 7	-	0	0~7	○	5|6	5.3.1.9
P9-11.3	Deceleration method when encountering an out-of-range signal	-	0	0~1	○	5|6	5.3.1.9
P9-12	Return to the original high-speed speed	-	200	0~3000	○	5|6	5.3.1.9
P9-13	Return to the starting point at low speed	-	20	0~1000	○	5|6	5.3.1.9
P9-14	Return to Origin Acceleration and Deceleration Time	-	1000	0~5000	○	5|6	5.3.1.9
P9-15	Return to Origin Timeout Time	-	0	0~12000	○	5|6	5.3.1.9
P9-16	Touch-to-Return-to-Origin Speed Threshold	-	2	0~1000	○	5|6	5.3.1.9
P9-17	Touch-to-revert-to-origin torque threshold	-	100	0~300	○	5|6	5.3.1.9
P9-18	Touch-to-Return-to-Origin Time Threshold	-	500	10~1500	○	5|6	5.3.1.9
P9-19	Low-bit value of quantized pulse count	1 Instruction Pulse	0	-9999~9999	○	5|6	5.3.1.9
P9-20	High-value number of quantitative pulses	1 Instruction Pulse	0	-9999~9999	○	5|6	5.3.1.9
P9-21	Return to Origin Selection	-	0	0~1	●	5|6	5.3.1.9
P9-22	Return to origin to end filtering time	-	500	50~10000	○	5|6	5.3.1.9
P9-26	Enable interrupt fixed length	-	0	0~0x1111	●	5|6	5.3.1.10

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P9-27	Interrupt fixed-length displacement bit	1 Instruction Pulse	0	0~9999	√	5|6	5.3.1.10
P9-28	Interrupt for fixed-length displacement at high level	1 Instruction Pulse	0	0~32760	√	5|6	5.3.1.10
P9-29	Maximum speed with fixed-length interruption	rpm	300	1~6000	√	5|6	5.3.1.10
P9-30	Intermittent fixed-length acceleration and deceleration time	ms	100	1~1000	√	5|6	5.3.1.10
P9-31	Interrupt Fixed Length Function Configuration	-	0x0001	0~0x1111	√	5|6	5.3.1.10
P9-32	Intermittent fixed-length delay time	-	1000	10~3000	○	5|6	5.3.1.10
P9-33	Absolute rotation mode pulse count per revolution (0–65535)	Encoder Pulse	0	0~65535	○	5|6	5.6.8
P9-34	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 2^16	Encoder Pulse	0	0~65535	○	5|6	5.6.8
P9-35	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 2^32	Encoder Pulse	0	0~65535	○	5|6	5.6.8
P9-36	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 248	Encoder Pulse	0	0~65535	○	5|6	5.6.8
P9-37	Absolute Position Rotation Mode Gear Ratio Fraction	-	65535	0~65535	○	5|6	5.6.8
P9-38	Absolute Position Rotation Mode Gear Ratio (numerator/denominator)	-	1	0~65535	○	5|6	5.6.8

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process scope	Come into force opportunity	Suit scope	Consult chapters and sections
P9-39	Enable brake protection detection 0: Disabled 1: Enable	-	0	0~1	√	1|3|5|6|7	5.2.5
P9-40	Gravity Load Detection Value	%	0	0~300	√	1|3|5|6|7	5.2.5
P9-41	Gravity load identification enables functionality.	-	0	0~1	√	1|3|5|6|7	5.2.5
P9-42	Abnormal opening of the brake mechanism during rotation displacement	0.01 turn	200	25~65535	√	1|3|5|6|7	5.2.5

PE-XX: (Supported in version 4230 and above)

Parameter	Functional description	Unit	Factory Value	Set Range	Effectiveness Time	Scope of application	Reference Chapter
PE-01.3	Weak Magnetic Control Switch	—	0	0-1	√	All	5.9.2
PE-80	Weak magnetic control gain Kv	Hz	30	10-1000	√	All	5.9.2
PE-81	Integrating time constant Ti for weak magnetic control	%	16	10-1000	√	All	5.9.2
PE-82	Weak magnetic control integrated limiting	%	60	0-200	√	All	5.9.2
PE-83	Voltage Command Limit Threshold	%	115	50-150	√	All	5.9.2
PE-84	IdRef amplitude limiting	%	95	50-150	√	All	5.9.2
PE-85	Main Loop Voltage Smoothing Filter Time	0.1ms	20	0-1000	√	All	5.9.2

Appendix 2. Content of the UX-XX Monitoring Status

U0-XX:

Monitoring Number	Content		Unit
U0-00	Servo motor speed		Rpm
U0-01	Input speed command		Rpm
U0-02	Torque Command		% specified
U0-03	Mechanical Angle		1°
U0-04	electric degress		1°
U0-05	busbar voltage		V
U0-06	IPM temperature		0.1℃
U0-07	Torque Feedback		% specified
U0-08	Pulse Deviation Value	(-9999～9999) *1	command pulse
U0-09		(-32768～32767) *10000	
U0-10	Encoder Feedback Value	(0000～9999) *1	Encoder Pulse
U0-11		(0000～65535) *10000	
U0-12	Enter the number of instruction pulses	(-9999～9999) *1	command pulse
U0-13		(-32768～32767) *10000	
U0-14	position feedback	(-9999～9999) *1	command pulse
U0-15		(-32768～32767) *10000	
U0-18	torque current		0.01A
U0-19	Analog input V-REF value		0.001V
U0-20	Analog Input T-REF Value		0.001V
U0-21	Input Signal State 1		-
U0-22	Input Signal Status 2		-
U0-23	Output Signal State 1		-
U0-24	Output Signal Status 2		-
U0-25	Input Pulse Frequency	(0000～9999) *1	1Hz

Monitoring Number	Content		Unit
U0-26		(0000 ~ 9999) *10000	
U0-37	VREF AD Original Value		-
U0-38	TREF AD Original Value		-
U0-41	Instantaneous output power		1W
U0-42	Average Output Power		1W
U0-43	Instantaneous thermal power		1W
U0-44	Average Thermal Power		1W
U0-49	Position Feedforward		1 Instruction Unit
U0-50	Speed Feedforward		rpm
U0-51	Torque Feedforward		% specified
U0-52	Instantaneous bus capacitor power		1W
U0-53	Average busbar capacitive power		1W
U0-54	Encoder Error Count		-
U0-55	Instantaneous regenerative braking discharge power		1W
U0-56	Average regenerative braking discharge power		1W
U0-57	Absolute encoder current position feedback: 32-bit low	(0000 ~ 65535) *1	Encoder Pulse
U0-58		(0000 ~ 65535) *216	
U0-59	Absolute encoder current position feedback: 32-bit high	(0000 ~ 65535) *232	Encoder Pulse
U0-60 (Direction Sign)		(-32768 ~ 32767) *248	
U0-79	Encoder CRC Error Count		--
U0-88	Motor Code Reading Status		-
U0-89	High-precision speed feedback (display range: -99.99 to 99.99 rpm)		0.01rpm
U0-91	Number of turns in the absolute value motor circuit		-
U0-94	Total value of encoder position feedback after calibration	(0000 ~ 65535) *1	Encoder Pulse
U0-95		(0000 ~ 65535) *216	
U0-96		(0000 ~ 65535) *232	
U0-97 (Direction Sign)		(-32768 ~ 32767) *248	
U0-98	Temperature of high-power motors		0.1

U1-XX:

Monitoring Number	Content	Unit
U1-00	Current Alarm Code	-
U1-01	Current Warning Code	-
U1-02	The U-phase current at the time of the alarm occurrence	0.01A
U1-03	The V-phase current at the time of the alarm occurrence	0.01A
U1-04	Bus voltage at the time of the alarm occurrence	V
U1-05	IGBT temperature at the time of alarm occurrence	℃
U1-06	Torque current at the time of alarm occurrence	0.01A
U1-07	The excitation current at the time of the alarm occurrence	A
U1-08	Position deviation at the time of the alarm occurrence	command pulse
U1-09	Speed value at the time of the alarm occurrence	rpm
U1-10	Number of seconds since the alarm was triggered (low 16 bits), accumulated from the first power-on	s
U1-11	Number of seconds since the alarm was triggered (16-bit integer), accumulated from the first power-on	s
U1-12	The number of runtime errors is calculated after this power-on	-
U1-13	The number of operation warnings is calculated from the last power-on	-
U1-14	Total Number of Historical Alarms	-
U1-15	Total Number of Historical Warnings	-
U1-16	Recent Second Alarm Code	-
U1-17	Recent third alarm code	-
U1-18	The latest alarm code is the fourth one.	-
U1-19	The latest alarm code (for the 5th time)	-
U1-20	The latest alarm code is the 6th one.	-
U1-21	The latest alarm code (for the 7th time)	-
U1-22	The latest alarm code is the 8th one.	-
U1-23	The latest alarm code is the 9th one.	-
U1-24	The latest alarm code (10th occurrence)	-
U1-25	The latest alarm code is the 11th one.	-
U1-26	The latest alarm code is the 12th one.	-
U1-27	The latest alarm code is the 13th one.	-
U1-28	The latest alarm code is the 14th one.	-
U1-29	The latest alarm code (15th occurrence)	-
U1-30	The latest 16th alarm code	-
U1-31	The latest alarm code for the 17th occurrence	-
U1-32	Second warning code recently	-
U1-33	Recent Third Warning Code	-
U1-34	Fourth warning code recently	-
U1-35	Recent fifth warning code	-

Monitoring Number	Content	Unit
U1-36	Recent Sixth Warning Code	-
U1-37	Recent 7th warning code	-
U1-38	Recent 8th warning code	-
U1-39	Recent 9th warning code	-
U1-40	Latest Warning Code (10th Time)	-
U1-41	Latest 11th warning code	-
U1-42	Latest 12th warning code	-
U1-43	Latest 13th warning code	-
U1-44	Latest 14th warning code	-
U1-45	Latest 15th warning code	-
U1-46	Latest 16th warning code	-
U1-47	Latest 17th warning code	-

U2-XX：

Monitoring Number	Content	Unit
U2-00	Power On Times	-
U2-01	series	-
U2-02	Model (Low 16-bit)	-
U2-03	Model (16-bit height)	-
U2-04	Production Date: Year	-
U2-05	Production Date: Month	-
U2-06	Production Date: Day	-
U2-07	Firmware Version	-
U2-08	Hardware Version	-
U2-09	Total runtime (from the first power-up)	hour
U2-10	Total runtime (from the first power-up)	minute
U2-11	Total runtime (from the first power-up)	second
U2-12	Current runtime (from the last power-on)	hour
U2-13	Current runtime (from the last power-on)	minute
U2-14	Current runtime (from the last power-on)	second
U2-15	Average output power (average power during the enabling process from the first enable)	1W
U2-16	Average heating power (average power during the activation process from the first activation)	1W
U2-17	Average bus capacitor filtering power (average power during the power-on period starting from the first power-up)	1W
U2-20	Device serial number: 16-bit (not supported)	-
U2-21	Device serial number: 16-digit (not supported)	-
U2-22	Firmware generation date: Year	-
U2-23	Firmware generation date: Month/Day	-

Monitoring Number	Content	Unit
U2-24	Firmware generation time: hours/minutes	-
U2-33	Historical maximum bus voltage (supported in versions 4230 and above)	V
U2-34	Torque current at the historical maximum bus voltage (supported in versions 4230 and above)	0.01A
U2-35	Maximum bus voltage duration in history (supported in versions 4230 and above)	hour
U2-36	Maximum bus voltage duration in history (supported in versions 4230 and above)	minute
U2-37	Maximum bus voltage duration in history (supported in versions 4230 and above)	second
U2-38	Motor code for the most recent connection (supported in version 4230 and above)	-
U2-39	Motor code for the most recent second connection (supported in version 4230 and above)	-
U2-40	Motor code for the most recent third connection (supported in version 4230 and above)	-
U2-41	Running time of the motor code during the last connection (supported in versions 4230 and above)	hour
U2-42	Running time of the motor code during the most recent second connection (supported in versions 4230 and above)	hour
U2-43	Running time of the motor code for the most recent third connection (supported in versions 4230 and above)	hour
U2-44	Historically highest IPM temperature (supported in versions 4230 and above)	0.1℃
U2-45	Torque current at the highest IPM temperature recorded in history (supported in versions 4230 and above)	0.01A
U2-46	Historical maximum IPM temperature duration (supported in versions 4230 and above)	hour
U2-47	Historical maximum IPM temperature duration (supported in versions 4230 and above)	minute
U2-48	Historical maximum IPM temperature duration (supported in versions 4230 and above)	second
U2-49	Historically highest torque current (supported in versions 4230 and above)	0.01A
U2-50	Maximum torque current duration in history (supported in versions 4230 and above)	hour
U2-51	Maximum torque current duration in history (supported in versions 4230 and above)	minute
U2-52	Maximum torque current duration in history (supported in versions 4230 and above)	second

U3-XX：

Monitoring Number	Content	Unit
U3-00	Motor code for automatic reading (including thermal power parameters)	-
U3-01	Motor Version	-
U3-02	Encoder Version	-
U3-70	Automatically reads the motor code from the encoder in motor parameters (relates only to the motor code)	-

U4-XX：

Monitoring Number	Content	Unit
U4-10	Resonance frequencies detected by fast FFT	Hz
U4-11	Grating scale raw data	1 Grating scale feedback pulse
U4-12	Grating scale raw data	1 Grating scale feedback pulse
U4-13	Original number of Z-axis phases in the grating scale	-
U4-16	Cumulative value of continuous overload operation under thermal power protection	-
U4-17	Cumulative value of instantaneous overload operations under thermal power protection	-
U4-18	SI Terminal Active Status	-
U4-19	SO Terminal Active Status	-

Appendix 3. Content of the FX-XX Auxiliary Functions

Function Code	Explain	Effectiveness Time	Refer to the chapter
F0-00	Clear Alert	servo OFF	4.4.1
F0-01	Restore Factory Settings	servo OFF	4.4.1
F0-02	Clear Position Deviation	servo OFF	4.4.1
F0-07	Panel Inertia Identification	servo OFF	7.3.4
F0-08	Panel External Instructions from Calibration Process	servo OFF	7.4.5
F0-09	Internal instructions within the panel are automatically configured during setup.	servo OFF	7.4.4
F0-10	Panel Vibration Suppression 1	servo OFF	7.7.3
F0-11	Panel Vibration Suppression 2	servo OFF	7.7.3
F0-12	Panel vibration suppression (fast FFT)	servo OFF	7.7.6
F1-00	Click	servo OFF	4.4.2
F1-01	pilot run	servo OFF	4.4.2
F1-02	Current Sampling Zeroing	servo OFF	4.4.2
F1-03	Vref (Speed Analog Signal) Zero Adjustment	servo OFF	5.4.4.6
F1-04	Tref (Torque Analog Signal) Zero Adjustment	servo OFF	5.5.3.4
F1-05	Software Enablement	servo OFF	4.4.2
F1-06	Absolute encoder position reset	servo OFF	5.6.5

Appendix 4. Modbus Address Correspondence Table

Parameter group	Modbus Start/End Address	Explain
P0-00~P0-xx	0x0000~0x0063	The Modbus addresses start from 0x0000 and increase sequentially; for example, the Modbus address corresponding to P0-23 is 0x0017.
P1-00~P1-xx	0x0100~0x0163	The Modbus addresses start at 0x0100 and increase sequentially by 1; for example, the Modbus address corresponding to P1−10 is 0x010A.
P2-15~P2-xx	0x020F~0x0263	The Modbus addresses start at 0x020F and increase sequentially; for example, the Modbus address corresponding to P2-16 is 0x0210.
P3-00~P3-xx	0x0300~0x0363	The Modbus addresses start at 0x0300 and increase sequentially by one; for example, the Modbus address corresponding to P3-13 is 0x030D.
P4-00~P4-xx	0x0400~0x0463	The Modbus addresses start at 0x0400 and increase sequentially; for example, the Modbus address corresponding to P4-25 is 0x0419.
P5-00~P5-xx	0x0500~0x0563	The Modbus addresses start at 0x0500 and increase sequentially; for

Parameter group	Modbus Start/End Address	Explain
		example, the Modbus address corresponding to P5-20 is 0x0514.
P6-00~P6-xx	0x0600~0x0663	The Modbus addresses start at 0x0600 and increase sequentially; for example, the Modbus address corresponding to P6-05 is 0x0605.
P7-00~P7-xx	0x0700~0x0763	The Modbus addresses start at 0x0700 and increase sequentially by one; for example, the Modbus address corresponding to P7－11 is 0x070B.
P8-00~P8-xx	0x800~0x0863	The Modbus addresses start at 0x0800 and increase sequentially by one; for example, the Modbus address corresponding to P8-25 is 0x0819.
P9-00~P9-xx	0x900~0x0963	The Modbus addresses start at 0x0900 and increase sequentially by one; for example, the Modbus address corresponding to P9－12 is 0x090C.
U0-00~U0-xx	0x1000~0x1063	The Modbus addresses start at 0x1000 and increase sequentially by one; for example, the Modbus address corresponding to U0-05 is 0x1005.
U1-00~U1-xx	0x1100~0x1163	The Modbus addresses start at 0x1100 and increase sequentially by one; for example, the Modbus address corresponding to U1-14 is 0x110E.
U2-00~U2-xx	0x1200~0x1263	The Modbus addresses start at 0x1200 and increase sequentially; for example, the Modbus address corresponding to U2-08 is 0x1208.
U4-00~U4-xx	0x1400~0x1463	The Modbus addresses start at 0x1400 and increase sequentially; for example, the Modbus address corresponding to U4-11 is 0x140B.
F0-00~F0-xx	0x2000~0x2063	The Modbus addresses start at 0x2000 and increase sequentially; for example, the Modbus address corresponding to F0-01 is 0x2001.
F1-00~F1-xx	0x2100~0x2163	The Modbus addresses start at 0x2100 and increase sequentially; for example, the Modbus address corresponding to F1-03 is 0x2103.

Parameters not listed in the following Modbus address table shall follow the address rules specified in the aforementioned table.

- Group P Parameter Address

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P0-00	0x0000	0	P0-17	0x0011	17
P0-01	0x0001	1	P0-18	0x0012	18
P0-02	0x0002	2	P0-19	0x0013	19
P0-03	0x0003	3	P0-20	0x0014	20
P0-04	0x0004	4	P0-21	0x0015	21

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P0-05	0x0005	5	P0-22	0x0016	22
P0-06	0x0006	6	P0-23	0x0017	23
P0-07	0x0007	7	P0-24	0x0018	24
P0-08	0x0008	8	P0-25	0x0019	25
P0-09	0x0009	9	P0-26	0x001A	26
P0-10	0x000A	10	P0-27	0x001B	27
P0-11	0x000B	11	P0-28	0x001C	28
P0-12	0x000C	12	P0-29	0x001D	29
P0-13	0x000D	13	P0-30	0x001E	30
P0-14	0x000E	14	P0-31	0x001F	31
P0-15	0x000F	15	P0-32	0x0020	32
P0-16	0x0010	16	P0-33	0x0021	33

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P1-00	0x0100	256	P1-15	0x010F	271
P1-01	0x0101	257	P1-16	0x0110	272
P1-02	0x0102	258	P1-17	0x0111	273
P1-03	0x0103	259	P1-18	0x0112	274
P1-04	0x0104	260	P1-19	0x0113	275
P1-05	0x0105	261	P1-20	0x0114	276
P1-06	0x0106	262	P1-21	0x0115	277
P1-07	0x0107	263	P1-22	0x0116	278
P1-08	0x0108	264	P1-23	0x0117	279
P1-09	0x0109	265	P1-24	0x0118	280
P1-10	0x010A	266	P1-25	0x0119	281
P1-11	0x010B	267	P1-26	0x011A	282
P1-12	0x010C	268	P1-27	0x011B	283
P1-13	0x010D	269	P1-28	0x011C	284
P1-14	0x010E	270			

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P2-00	0x0200	512	P2-15	0x20F	527
P2-01	0x0201	513	P2-16	0x210	528

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

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P4-00	0x0400	1024	P4-15	0x040F	1039
P4-01	0x0401	1025	P4-16	0x0410	1040

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

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P6-00	0x0600	1536	P6-10	0x060A	1546
P6-01	0x0601	1537	P6-11	0x060B	1547

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P7-00	0x0700	1792	P7-10	0x070A	1802
P7-01	0x0701	1793			

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P8-25	0x0819	2073			

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
P9-11	0x090B	2315	P9-17	0x0911	2321
P9-12	0x090C	2316	P9-18	0x0912	2322
P9-13	0x090D	2317	P9-19	0x0913	2323
P9-14	0x090E	2318	P9-20	0x0914	2324
P9-15	0x090F	2319	P9-21	0x0915	2325
P9-16	0x0910	2320	P9-22	0x0916	2326

- Monitoring Status Address Group U

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
U0-00	0x1000	4096	U0-32	0x1020	4128
U0-01	0x1001	4097	U0-33	0x1021	4129
U0-02	0x1002	4098	U0-34	0x1022	4130
U0-03	0x1003	4099	U0-35	0x1023	4131
U0-04	0x1004	4100	U0-36	0x1024	4132
U0-05	0x1005	4101	U0-37	0x1025	4133
U0-06	0x1006	4102	U0-38	0x1026	4134
U0-07	0x1007	4103	U0-39	0x1027	4135
U0-08	0x1008	4104	U0-40	0x1028	4136
U0-09	0x1009	4105	U0-41	0x1029	4137
U0-10	0x100A	4106	U0-42	0x102A	4138
U0-11	0x100B	4107	U0-43	0x102B	4139
U0-12	0x100C	4108	U0-44	0x102C	4140
U0-13	0x100D	4109	U0-45	0x102D	4141
U0-14	0x100E	4110	U0-46	0x102E	4142
U0-15	0x100F	4111	U0-47	0x102F	4143
U0-16	0x1010	4112	U0-48	0x1030	4144

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
U0-17	0x1011	4113	U0-49	0x1031	4145
U0-18	0x1012	4114	U0-50	0x1032	4146
U0-19	0x1013	4115	U0-51	0x1033	4147
U0-20	0x1014	4116	U0-52	0x1034	4148
U0-21	0x1015	4117	U0-53	0x1035	4149
U0-22	0x1016	4118	U0-57	0x1039	4153
U0-23	0x1017	4119	U0-58	0x103A	4154
U0-24	0x1018	4120	U0-59	0x103B	4155
U0-25	0x1019	4121	U0-60	0x103C	4156
U0-26	0x101A	4122	U0-91	0x105B	4187
U0-27	0x101B	4123	U0-94	0x105E	4190
U0-28	0x101C	4124	U0-95	0x105F	4191
U0-29	0x101D	4125	U0-96	0x1060	4192
U0-30	0x101E	4126	U0-97	0x1061	4193
U0-31	0x101F	4127			

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
U1-00	0x1100	4352	U2-00	0x1200	4608
U1-01	0x1101	4353	U2-01	0x1201	4609
U1-02	0x1102	4354	U2-02	0x1202	4610
U1-03	0x1103	4355	U2-03	0x1203	4611
U1-04	0x1104	4356	U2-04	0x1204	4612
U1-05	0x1105	4357	U2-05	0x1205	4613
U1-06	0x1106	4358	U2-06	0x1206	4614
U1-07	0x1107	4359	U2-07	0x1207	4615
U1-08	0x1108	4360	U2-08	0x1208	4616
U1-09	0x1109	4361	U2-09	0x1209	4617
U1-10	0x110A	4362	U2-10	0x120A	4618
U1-11	0x110B	4363	U2-11	0x120B	4619
U1-12	0x110C	4364	U2-12	0x120C	4620
U1-13	0x110D	4365	U2-13	0x120D	4621
U1-14	0x110E	4366	U2-14	0x120E	4622
U1-15	0x110F	4367	U2-15	0x120F	4623
U1-16	0x1110	4368	U2-16	0x1210	4624
U1-17	0x1111	4369	U2-17	0x1211	4625

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
U1-18	0x1112	4370	U2-20	0x1214	4628
U1-19	0x1113	4371	U4-11	0x140B	5131
U1-20	0x1114	4372	U4-12	0x140C	5132
U1-21	0x1115	4373	U4-13	0x140D	5133
U1-22	0x1116	4374	U4-14	0x140E	5134
U1-23	0x1117	4375	U4-15	0x140F	5135
U1-24	0x1118	4376			
U1-25	0x1119	4377			

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

Appendix 5. Analysis of Common Usage Issues

Q1: What does the panel indicate regarding bb and run?

1. When the device is in standby mode, the enable function is not activated, and the motor remains powered off.
2. Run status: When enabled, the motor is powered on.

Q2: How do I view/configure parameters?

Refer to 4.6.

Q3: How to change the enable status parameter?

For P5-20, setting it to 0000 disables enable functionality; setting it to 0010 enables enable upon power-on without requiring a restart and takes effect immediately. The default value is 0001, requiring an external high-level signal on SI1 (SI1 connected to low level, +24 connected to high level; refer to 3.2.2).

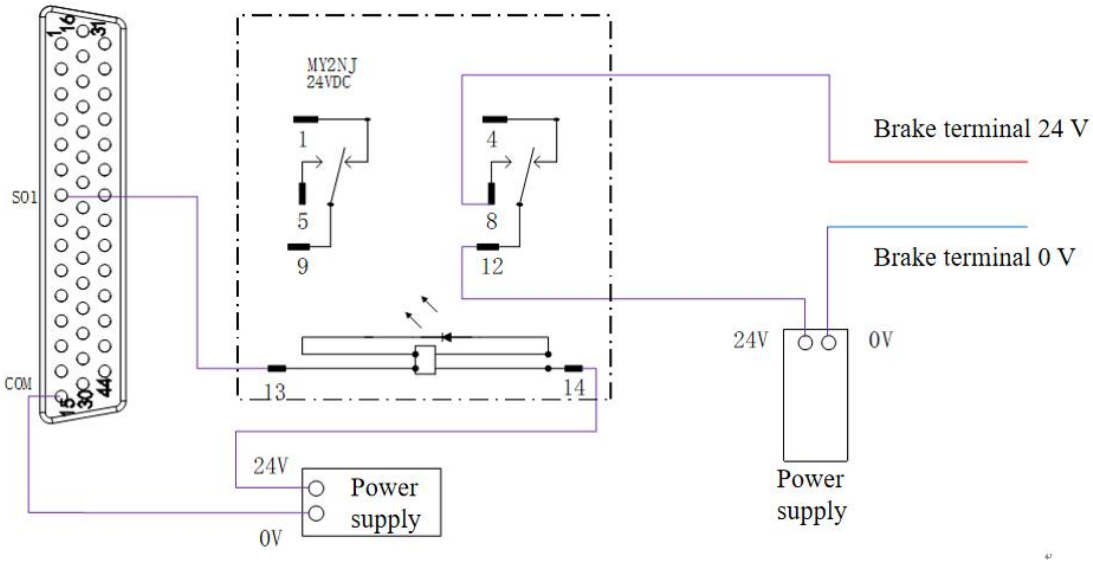
Q4: How to restore initialization?

First disable the enable option (set P5-20 to 0000 to disable it), then set F0-01 to 1 to restore factory settings, and finally enable it again.

Q5: Which drivers currently support bus mode?

1. The DS5E series supports XNet communication, with maximum support for 20 axes.
2. The DS5C supports EtherCAT communication, supporting up to 64 axes.

Q6: How should the brake motor be wired? If slight slippage occurs after power disconnection, how should the parameters be adjusted?



1. P5-44 defines the terminal for the brake engagement output signal; as shown in the figure above, SO1 is used to control the brake engagement, i.e., P5-44 = 0001.
2. Extend the servo OFF delay time P5-07 (default: 500 ms) as needed; set the brake engagement command wait time P5-09 to 0 for immediate response.

Q7: The initial orientation isn't what I want; how can I change it using the servo driver?

Change the initial direction by modifying P0-05, set it to 0 or 1, and the change will take effect after power-on. For speed (Mode 3/4) or torque mode (Mode 1/2), you can also adjust the positive or negative values of speed and torque settings.

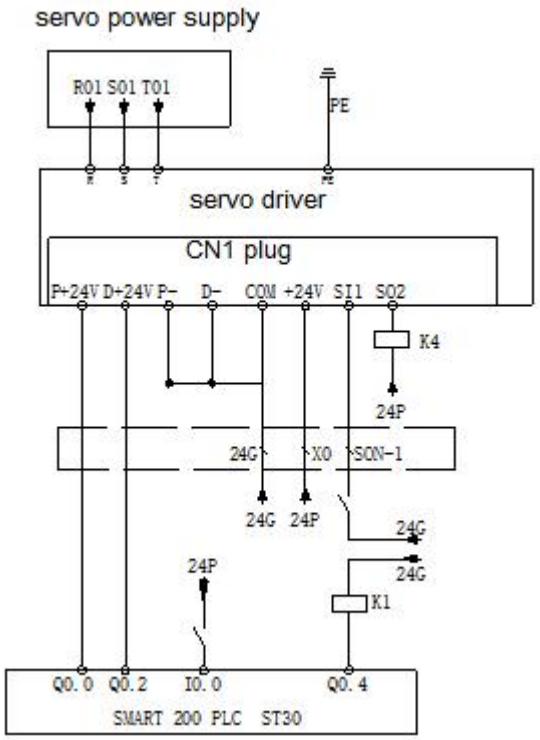
Q8: How do the two operating modes switch between each other?

Both the main mode P0-01 and sub-mode P0-02 are configured with the required settings, with P5-30 set to 0002 and SI2 designated as the mode switching terminals. When no signal is received at SI2, the system operates according to the configuration in main mode P0-01; when a signal is present at SI2, it operates according to the configuration in sub-mode P0-02.

The SI2 terminal signal must be set to the ON state for switching to occur.

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

NPN low-level output PLC: Connect the Y0 pulse to P-, the Y1 terminal to D-, and apply +24 V to both P+24 and D+24 (using a XINJE PLC as example).
PNP high-level output PLC: Pulse pin Q0.0 connects to P+24; direction pin Q0.2 connects to D+24; 0 V connects to P-and D-. (Using a Siemens PLC as an example) As shown in the figure below:



Q10: What are the external connection methods and parameter settings for the braking resistor?

The servo interface features P+, D, and C terminals, with a shorting strip connecting P+ and C (using an internal resistor). If the internal resistor specification is insufficient, replace it with an external braking resistor as specified in 1.4.1. Remove the shorting strip between P+ and D, then connect the external braking resistor to both P+ and C.

Q11: What is the service life of the tank chain line?

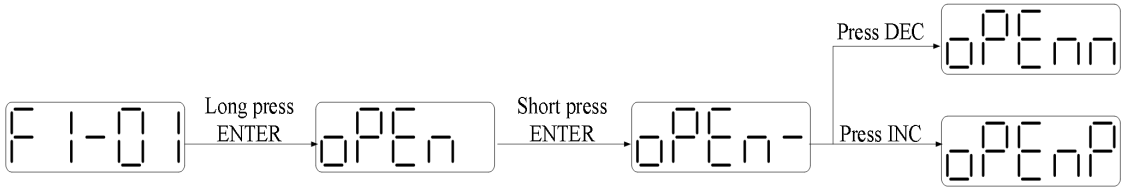
The number of bending cycles is 5 million, with a roundness radius of 50 mm.

Appendix 6. General Debugging Steps

1. Motor shaft is empty; perform initial debugging

A. Connect the cables correctly, ensuring that each U, V, W, and PE terminal is paired individually without crossing phase sequences.

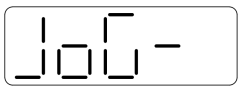
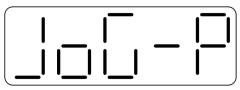
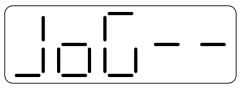
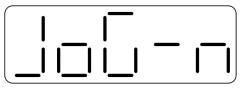
B. Open-loop trial run: This phase primarily checks the power lines and encoder feedback circuits to verify proper connectivity. Following these steps, the motor should operate normally in both forward and reverse directions. If shaft vibration occurs or an alarm is triggered, immediately disconnect the power supply and recheck the wiring connections.



C. Spot-run test: Select parameter F1-00.

Press and hold the ENTER key to enable the motor. When enabled, press INC for forward jogging or DEC for reverse jogging. Press STATUS/ESC to disable enable mode, exit jogging mode, and enter sequence switching mode.

The four states during a tap are displayed as follows:

state	panel display	state	panel display
Idle Status Display		Forward Display	
Enable Display		Reverse Display	

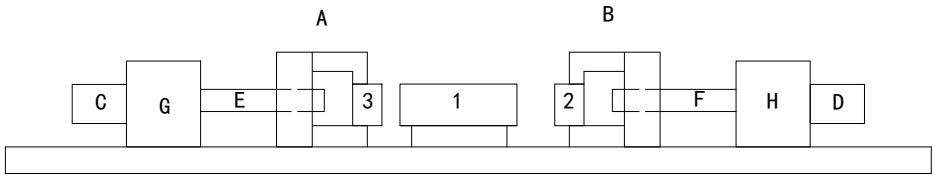
2. Integrate the motor with the mechanical components and perform debugging

A. Check the aircraft's heading direction; if it differs from required, turn off the servo unit, set parameter P0-05 to 1, then power on again to apply the changes.

B. During operation, monitor the system's stability and responsiveness, and adjust the servo control parameters as needed.

Appendix 7. Application Cases

Mode 6: Pulse Instruction Position Mode



Device Overview

This is a schematic diagram of a welding machine. In the diagram, components 1, 2, and 3 represent the workpieces: Workpiece 2 and Workpiece 3 are mounted on Head B and Head A respectively, with Heads A and B being movable as a whole and driven by ball screws E and F (with a lead of 5 mm). Components C and D are 17-bit resolution servo motors, while G and H are reducers with a reduction ratio of 10.

Before using the equipment, calibrate it with standard-sized workpieces to determine the origin points of Head A and Head B.

Workpiece 1 is placed flat on the workbench and can be slid horizontally left or right. Its dimensions adhere to positive tolerances and must not be shorter than those of the standard workpiece. While the placement process may be arbitrary, it must ensure that when welding begins, both workpieces are positioned symmetrically relative to each other. Once placed, motors A and B drive Workpieces 3 and 2 toward Workpiece 1 at identical speeds. Regardless of their initial positions, one workpiece will always strike Workpiece 1 first, then push it to the opposite side until both Workpieces 2 and 3 have contacted Workpiece 1. This mutual pushing action increases the motor's output torque, ultimately ensuring Workpiece 1 remains in a symmetrical position.

After one welding operation is completed, Head A and Head B return to their original positions.

I. Analysis

1. Determine the working mode: 6

2. When identifying symmetrical points for the first time, verify whether all points have been contacted; this is indicated by an increase in the servo's output torque, which requires utilizing torque limits (P3-28, P3-29) and the torque upper limit output signal (CLT).

3. Since the dimensions of workpiece 1 are greater than or equal to the standard dimensions, for workpieces exceeding this standard size, residual deviation pulses will inevitably remain in the servo system when identifying symmetrical points; these pulses must be eliminated using the /CLR signal. Additionally, the pulse amplitude transmitted by the PLC differs from the actual travel distance of the servo motor. To determine the precise travel distance, encoder feedback signals (A+, A-, B+, B-) should be utilized for high-speed counting of the AB phases.

4. Operating directions of Heads A and B.

II. Determination of Signals and Terminals

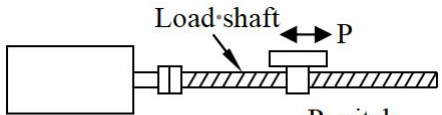
/COIN positioning completes output signal: SO1

/When CLT torque reaches the upper limit, output signal: SO2

/CLR Pulse Bias Clear Input Signal: SI1

Encoder feedback signals: /A+, /A-, /B+, /B-

III. Calculation of Electronic Gear Ratios

Step	Explain	Ball screw
	 $1\ \text{rotation} = \frac{P}{\text{instruction unit}}$	
1	Confirm Mechanical Specifications	Ball screw pitch: 5 mm Reduction Ratio: 10/1
2	Confirm encoder pulse count	131072
3	Decision Instruction Unit	1 Instruction Unit: 0.001 mm
4	Number of instructions required to rotate the load shaft one full revolution	5mm/0.001mm=5000
5	Calculate the number of pulses for one rotation of the motor shaft	5000/10=500
6	Computational Gear Ratio	$\frac{B}{A} = \frac{2^{17}}{500} = \frac{32768}{125}$
7	Set User Parameters	P0-13=32768 P0-14=125

IV. Parameter Settings

running mode ：	P0-01=6
Pulse Instruction Format:	P0-10=2
Electronic Gear Ratio:	P0-11=0 P0-12=0 P0-13=32768 P0-14=125
Forward rotation torque limit:	P3-28=150
Reverse Torque	P3-29=150

Limit:	
Positioning completion width:	P5-00=7
/S-ON Signal Settings:	P5-20=0010
/CLR Signal Settings:	P5-34=0001
/COIN Signal Settings:	P5-38=0001
/CLT Signal Settings:	P5-42=0002

Appendix 8. Common Servo Mode Parameters

Appendix 8.1 Basic General Parameters

Basic General Parameters	
Parameter	Essentials
P0-03 Enable Mode P5-20 Servo ON Signal/S-ON	Enable method selection: typically P0-03 is the default; set P5-20 to n.0010 for immediate enablement upon power-on.
P0-04 Rigidness Grade	Adjust the servo gain in the fast adjustment mode after calibration
P0-05 Rotation Direction Definition	Determine the motor direction, usually set to 0 by default
P0-25 Discharge resistance power value P0-26 Discharge Resistance Value	Set the external brake resistor specifications to match the actual values.
P3-28 Internal forward rotation torque limit P3-29 Internal reversal torque limit P3-30 External forward torque limit P3-31 External reversal torque limit	Set the source and value of the servo torque limit. The default value is expressed as a percentage of the servo torque.
P5-44 Power Failure Brake/BK P5-07 Servo OFF Delay Time P5-08 Brake Command Output Speed P5-09 Brake Command Wait Time	The brake-equipped motor uses servo SO terminals to control the brake setting parameters.
P5-47 Alarm Output/ALM	By configuring the alarm function on the SO terminal output, the SO2 terminal defaults to output a normally closed signal.
P7-00 RS485 Station Number P7-01 Communication Configuration P7-02 RS485 Communication Protocol	Set Communication Parameters

Appendix 8.2 Common Parameters for External Pulse Position Patterns

Common Parameters for External Pulse Position Modes	
Parameter	Essentials
P0-01 Control Method Selection	Set to 6: External Pulse Mode
P0-10 Pulse Instruction Format	Set Pulse Shape 0：CW/CCW 1：AB 2：P+D
P0-11 Set the number of pulses per	Number of command pulses required for the motor to

motor revolution *1 P0-12 Sets the number of pulses per motor revolution * 10,000 P0-13 Electronic Gear Ratio (Molecular) P0-14 Electronic Gear Ratio (Denominator) P0-92 ~ P0-93: A 32-bit electronic gear ratio module P0-94 ~ P0-95: A 32-bit electronic gear ratio with a denominator	complete one full rotation Both P0-11 and P0-12 are valid at midnight; P0-13 and P0-14 take effect thereafter. The values for P0-11 to P0-14 are all zero, while those for P0-92 to P0-95 are valid. 32-bit gear ratio numerator: P0-92*1 + P0-93*10000 32-bit gear ratio denominator: P0-94*1 + P0-95*10000
P0-09 Pulse Instruction Settings	Each device can set the direction of low-speed pulse commands and the filtering time for low-speed pulses.

Appendix 8.3 Common Parameters for Internal Position Patterns

Common Parameters for Internal Location Mode	
Parameter	Essentials
P0-01 Control Method Selection	Set to 5: Internal Position Mode
P4-03 Internal Position Given Mode P4-04 Number of Valid Segments P4-10~P4-254: Internal parameter settings for positions 1 to 35	The control parameters for the internal positioning mode are specified, including step change method, positioning method, and adjustment time. Configuration of pulse displacement, velocity, acceleration/deceleration time, etc., for each section position
P5-35 Step-change Signal/GHGSTP P5-32 Pause the current segment signal/INHIBIT P5-31 Skip current section number / Z-CLAMP	Common Terminal Function Allocation
The number of Z signals after P4-00 passes the departure limit switch P4-01 Speed of Impact on the Proximity Sensor P4-02 Speed of Departure from the Proximity Sensor P5-28: In position mode, rotate forward to locate the reference origin/SPD-A P5-29: In position mode, rotate forward to locate the reference origin/SPD-B	Internal Position Return to Origin Settings Parameters
Any setting for position F2-09 35	Number of Communication Settings Sections

Appendix 8.4 Common Parameters for Internal Torque Control

Internal Torque Control	
Parameter	Essentials
P0-01 Control Method Selection	Set to 1: Internal Torque Mode
P3-33 Internal Torque Instruction Given	Given a percentage value of the rated torque
P3-16 Internal forward speed limit during torque control P3-17 Internal reverse speed limit during torque control P3-14 Forward Maximum Speed Limit (MAX Speed) P3-15 Reverse Maximum Speed Limit (MAX Speed)	Speed Limitation under Torque Mode
P5-27 Speed Direction Switching/SPD-D	Switch direction, default is n.0000 By applying a commutation signal via terminal SI2, P5-27 can be set to n.0002.

Appendix 8.5 Common Parameters for External Analog Torque Control

External Analog Torque Control	
Parameter	Essentials
P0-01 Control Method Selection	Set to 2: External Analog Torque Mode
P3-24: The rated torque corresponds to the analog voltage value.	Set the speed command voltage required for the servo motor to operate at its rated torque, in units of 0.001 V
P3-25 Analog Voltage to Torque Command Filter Simulation	Unit: 0.01 ms
P3-26 Torque Command Input Dead Zone Voltage	Unit: 0.001 V

Appendix 8.6 Common Parameters for Internal Speed Control

Internal Speed Control	
Parameter	Essentials
P0-01 Control Method Selection	Set to 3: Internal Speed Control Mode
P3-05 Internal Set Speed 1 P3-06 Internal Set Speed 2 P3-07 Internal Set Speed 3	Speed value setting for the internal 3-speed stage, in rpm
P5-28 Internal Speed Selection/SPD-A P5-29 Internal Speed Selection/SPD-B	The combination of terminals determines the corresponding section speed.
P5-27 Internal Speed Direction	Switch direction, default is n.0000

Internal Speed Control	
Parameter	Essentials
Selection/SPD-D	By applying a commutation signal via terminal SI2, P5-27 can be set to n.0002.
P3-09 Soft-start acceleration time P3-10 Soft-start deceleration time	Set acceleration and deceleration times in ms

Appendix 8.7 Common Parameters for External Pulse Speed Control

External Pulse Speed Control	
Parameter	Essentials
P0-01 Control Method Selection	Set to 7: External Pulse Speed Mode
P0-10 Pulse Instruction Format	Set Pulse Shape 0：CW/CCW 2：P+D
P0-15 Instruction pulse frequency at rated speed	Determine the linear relationship between the pulse frequency and rotational speed.
P0-16 Speed Command Pulse Filtering Time	When the instruction pulse frequency is relatively low, appropriately setting this parameter can reduce speed fluctuations.

Appendix 8.8 Common Parameters for External Analog Speed Control

External Analog Speed Control	
Parameter	Essentials
P0-01 Control Method Selection	Set to 4: External Analog Speed Mode
P3-01: The rated rotational speed corresponds to the analog voltage value.	Set the speed command voltage required for the servo motor to operate at its rated speed, in units of 0.001 V
P3-09 Soft-start acceleration time P3-10 Soft-start deceleration time	Set acceleration and deceleration times in ms
P3-02 Analog Voltage and Speed Signal Filtering	Unit: 0.01 ms
P3-03: Dead Zone Voltage for Speed Command Input	Unit: 0.001 V
P3-04 Analog Signal Speed Direction Switching	Switch the input direction of the analog speed control command

Appendix 9: Certification and Standard Requirements



Overview of the CE Mark

- The CE mark is a symbol used in European commercial activities (production, import, and sale) to indicate that a product complies with safety (LVD), electromagnetic compatibility (EMC), and other relevant directives.
- The CE marking indicates that the manufacturer declares the product fully complies with the fundamental requirements of the EU's series of laws and regulations concerning safety, health, environmental protection, and consumer protection (i.e., "directives" or "regulations").
- All products falling under the CE directive must bear this mark before entering the EU market, regardless of their place of production worldwide.

The product complies with the directive table and relevant standards.

Certification Name	Command Name		Meet a criterion
CE attestation	EMC instruct	2014/30/EU	EN IEC 61000-6-4:2019 EN IEC 61000-6-2:2019 EN IEC 61800-3:2023
	LVD instruct	2014/35/EU	EN 61800-5-1:2007/A11:2021

Appendix 9.1 EU Directives and Compliance Standards Applicable to This Product

(1) Complies with EMC directives and standards

This product complies with the requirements of EMC Directive 2014/30/EU and has been tested in accordance with EN IEC 61800-3.
The EMC standard is a technical specification system designed to ensure that electronic devices operate stably in electromagnetic environments without interfering with other devices. Its core requirements encompass two main aspects:

① Electromagnetic interference (EMI): Control the electromagnetic disturbance energy emitted by the device itself.

② Electromagnetic Compatibility (EMS): The equipment must be capable of resisting external electromagnetic interference.

(2) Complies with LVD low-voltage directives and standards

This product complies with the requirements of Directive 2014/35/EU when operated within its specified application range. Tested in accordance with EN 61800-5-1:2007/A11:2021, it meets all fundamental safety requirements for electrical equipment across a wide voltage range of 50 V to 1000 V AC and 75 V

to 1500 V DC, with the primary objective of protecting personnel, livestock, and property from risks such as electric shocks, fires, and mechanical hazards associated with the use of electrical equipment.

(3) Description of Key Safety and EMC Characteristics

1. Security Section (derived from LVD):

1) Installation Requirements:
Must be operated by a qualified electrician; must have reliable grounding (PE); torque requirements for power terminals must be observed.
2) Installation Environment and Protection Requirements
For installation site requirements, please refer to Section 34.1.1 Installation Site on page 34.
For installation environment requirements, please refer to Section 2.1.2 Environmental Conditions on page 34.
For installation standards, refer to Section 2.1.3 on page 34.
3) Requirements for protective devices

To comply with the EU safety standard EN 61800-5-1, 반드시 install a circuit breaker and fuse on the drive's power input side to prevent hazardous incidents caused by internal short circuits.
For specification requirements of circuit breakers and fuses (insurance wires), refer to Section 1.5 "Selection of Peripheral Components" on page 30.
4) Warning Sign
High-pressure and burn hazards are indicated; please refer to the Safety Precautions section in the preface of this manual or the warning labels on the drive housing.

2. EMC Section (based on the EMC Directive):

To ensure compliance with EMC directives and standards, an EMC filter must be installed on the drive's input side, and a recommended shielded cable should be used at the output end. The filter must be reliably grounded, and shielded cables (for motor power lines and encoder lines) are mandatory. The shielding layer must be terminated at a grounded metal clamp/EMC connector in a 360° configuration; encoder lines must be separated from power lines, and the cabinet must be properly grounded.
For filter selection requirements, refer to Chapter 30, Section 1.5 "Selection of Peripheral Components".

Appendix 9.2 Information on Manufacturers and EU Authorized Representatives

(1) Manufacturer Information

Name: Wuxi XINJE Electric Co., Ltd.
Address: No.816, Jianzhu West Road, Binhu District, Wuxi City, Jiangsu Province 214026

(2) Information about the German branch

Name: XINJE ELECTRONIC GMBH.
Address: Koblenzer Str. 71,56626 Andernach, Germany
Contact Person: Ms.Lili-Iven Phone: 015234531220

Manual Update Log

Information regarding the revision of this document is recorded together with its number in the lower right corner of the cover.

NO.	File Number	chapters and sections	Update Content
1	SC5 17 20240327 1.0	-	The first edition of the manual has been released.
2	SC5 17 20240716 1.1	-	1. Amend the content of Chapters 1.3.2, 3.2.4, 5.2.4, 5.2.5, and 5.7.1; 2. Added content for Chapter 1.1.4; 3. Amend P3-28~31, P3-38~39, P4-03.1, P5-28.0~1, P5-29.0~1, P5-60.0~1, P5-60.2, and U0-06; 4. Other incorrect modifications.
3	SC5 17 20250108 1.1.2	-	1、Update the parameter descriptions for P0-01, P0-27, P5-31, F2-09, U0-60, U0-97, etc.; 2、Modify the content of Chapter 2 in Appendix 2; 3. Other incorrect modifications.
4	SC5 17 20250729 1.2	-	1、New chapters 4.6.1, 4.6.2, and 5.9 have been added; 2、New parameters P0-17, P2-36, U2-33 to U2-52; 3、Detailed descriptions of each component of the motor, installation specifications, and operating environment requirements; 4、Add E-083 alarm; 5、Increase the size of the TH motor; 6. Other incorrect modifications.
5	SC5 17 20251230 1.3	-	1、Add Chapter 1.5 and Chapter 6; 2、New parameters P7-30 and P7-31; 3、Increase the motor size by 1.8 kW and add corresponding shaft diameter specifications for the servo motor. 4、New models of 22 kW and 32 kW have been added, along with detailed descriptions of each component, performance specifications, electrical parameters, and dimensional drawings. 5、Optimize the description of operating environment conditions for drive usage; 6、New E-114/115/116/117 alarm indicators added; 7、Add CE certification declaration; 8、Other manual entries were corrected.

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