XINJE

DS5L2 series servo driver
User manual

WUXI XINJE ELECTRIC CO., LTD
Data No.　SC5 14 20251230 1.2.1

XINJE ELECTRIC

DS5L2 series servo driver

User manual

Basic explanation

- Thank you for purchasing Xinje DS5L2 series servo driver products.
- This manual mainly introduces the product information of DS5L2 series servo driver and MS series servo motor.
- Before using the product, please read this manual carefully and connect the wires on the premise of fully understanding the contents of the manual.
- Please deliver this manual to the end user.

This manual is suitable for the following users

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

Get the manual

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

Declaration of liability

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

Contact information

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- Postcode: 214072

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 be sure to comply with the safety labels attached to the equipment. Do not damage or remove these labels. The explanations are as follows:

Danger	Never fail to connect Protective Earth(PE) terminal.Readthe 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.

Potential issues that may arise during product usage are primarily covered in the "Safety Precautions" section. For all other matters, please adhere to fundamental electrical operation procedures.

Attention to Product Confirmation

1. Don't install damaged drives, drives that lack spare parts, or drives whose models don't meet the requirements.
2. If not used properly, the product poses a risk of moderate personal injury and property damage

Installation Notes

1. Before installing wiring, be sure to disconnect the power supply to prevent electric shock.
2. It is forbidden to expose the product to water, corrosive gases, flammable gases and other substances, causing electric shock and fire hazards.
3. Don't touch the conductive part of the product directly, which may cause misoperation and malfunction.
4. Misuse may lead to severe injury, death, or substantial property damage.

Cautions for wiring

1. Please connect AC power to LN or L1/L2/L3 or R/S/T on the dedicated power terminal of the driver. Don't connect the output terminals U, V, W of the driver to the Three-phase power supply.
2. Please connect the ground wire correctly. Poor grounding may cause electric shock. Please use $2mm^2$ wire to ground the ground terminal of the driver.
3. Please lock the fixed screw of the terminal, otherwise it may cause fire.
4. Be sure to disconnect all external power supply before wiring the driver.
5. Wiring, please ensure that the encode line, power line is loose, don't tighten, lest cable damage.

Operation Cautions

1. Don't touch the rotating part of the motor after the driver is running. There is a danger of injury.
2. Please pay attention to the test run of the motor once, don't connect the motor with the machine, there is the possibility of injury.
3. After connecting the machine, please set the appropriate parameters before running, otherwise it may cause the machine out of control or failure.
4. In operation, don't touch the radiator, there is a risk of scald.
5. Under power-on condition, don't change the wiring, there is a risk of injury.
6. Don't switch power frequently. If you need to switch power many times, please control it once in 2 minutes.

Maintenance and inspection

1. Don't touch the inside of servo driver and servo motor, otherwise it may cause electric shock.
2. When the power is started, it is forbidden to remove the driver panel, otherwise it may cause electric shock.
3. Within 10 minutes of power off, the terminal should not be contacted. Otherwise, the residual voltage may cause electric shock.

Wiring attention

1. Don't cross the power line and the control signal line from the same pipeline, nor tie them together. The power line and the control signal line are separated by more than 30 centimeters.
2. For signal line and encoder (PG) feedback line, please use multi-stranded wire and multi-core stranded integral shielding line. For wiring length, the longest signal input line is 3 meters and the longest PG feedback line is 20 meters.

Catalog

►► Confirmation on product arrival

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

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

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

1. Selection of Servo Systems

1.1 Selection of Servo Drive

1.1.1 Model Naming

DS5 L2-2 □P□ - PTA

Name	Product name
DS5	Servo Drive

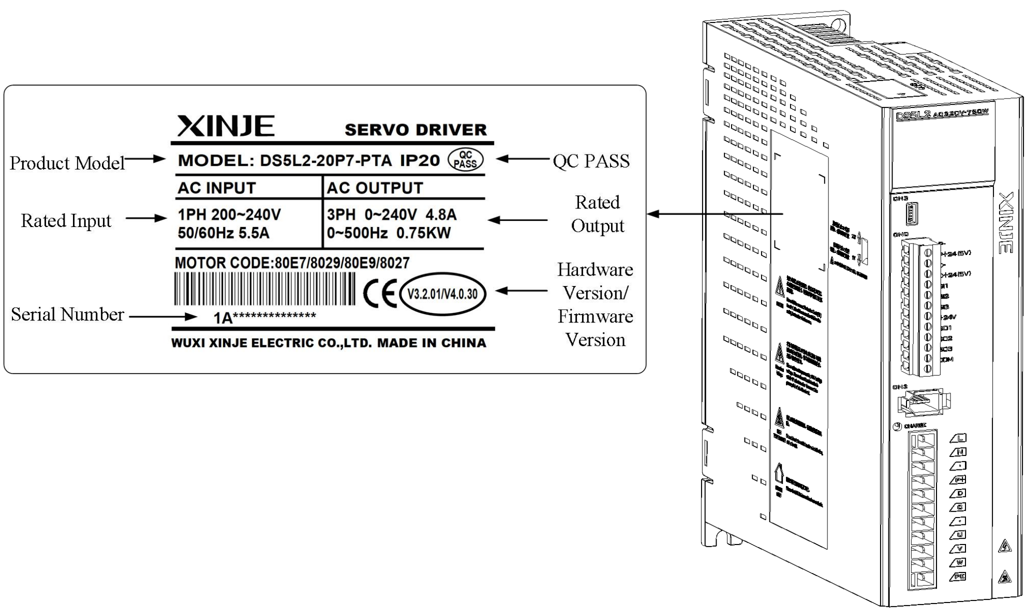
Name	Product series
L2	Pulse Enhanced Version

Name	Rated input voltage
2	AC220V
4	AC380V

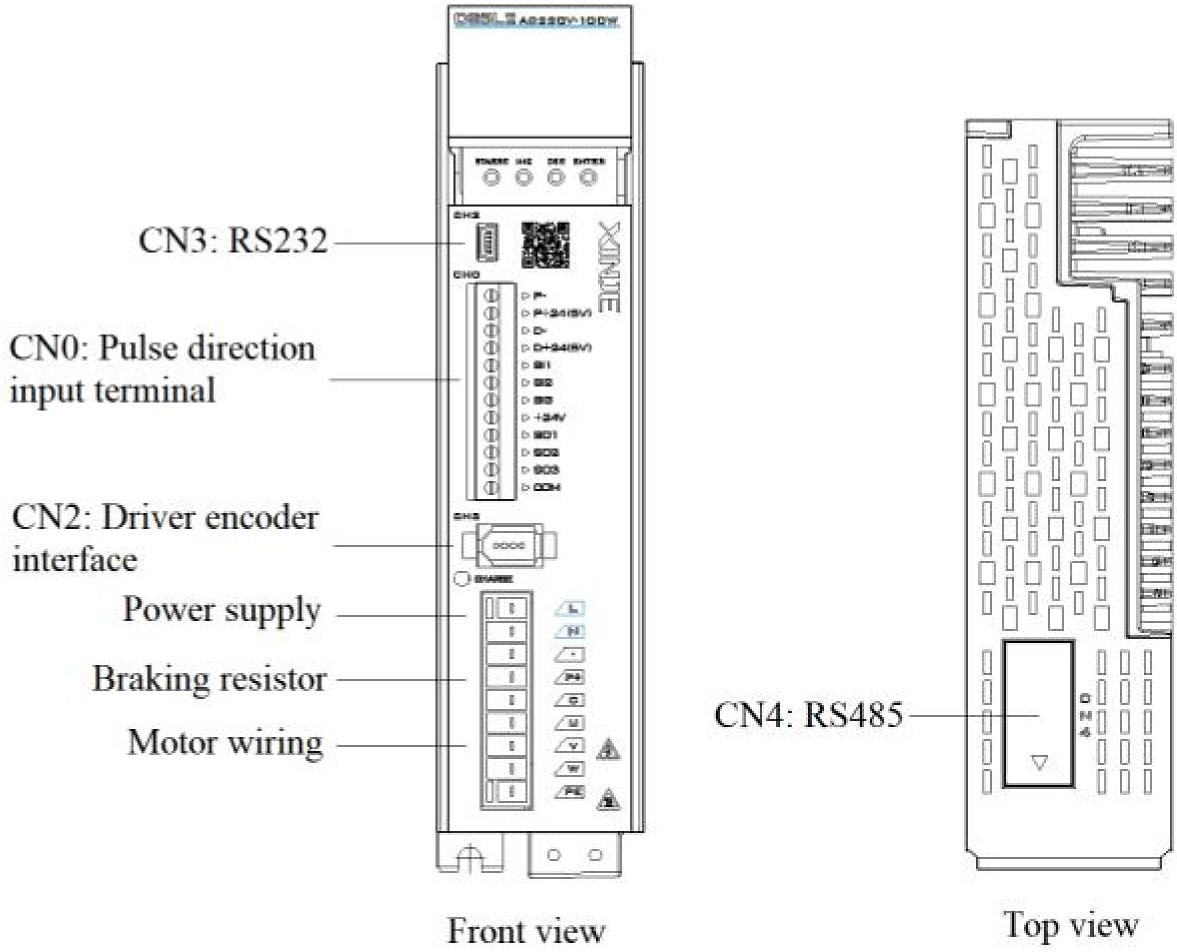
Name	Encoder type
T	Communication-type Encoder

Name	Rated output power
0P1	100W
0P2	200W
0P4	400W
0P7	750W
1P0	1000W
1P5	1500W
2P3	2300W
2P6	2600W
3P0	3000W

1.1.2 Label Description



1.1.3 Description of Each Section



1.1.4 Performance Specifications

<table>
<tr><td colspan="2">Service Unit</td><td>DS5L2 Series Servo Drivers</td></tr>
<tr><td colspan="2">Apply Encoder</td><td>Standard: 17-bit/19-bit/23-bit communication encoder (version 4030 and above supports motors with CS/CM/TL encoder types)</td></tr>
<tr><td colspan="2">Power Input</td><td>DS5L2-2□P□-PTA: Single-phase/Three-phase AC 200–240 V, 50/60 Hz

DS5L2-4□P□-PTA: Three-phase AC 380–440 V, 50/60 Hz</td></tr>
<tr><td colspan="2">Control method</td><td>Three-phase full-wave rectification IPM PWM control using sine wave current drive method</td></tr>
<tr><td colspan="2">The product meets the standards.</td><td>EN 61800-5-1:2007/A11:2021</td></tr>
<tr><td colspan="2">Protection level</td><td>Class I</td></tr>
<tr><td colspan="2">Connect to the power grid system</td><td>TN/TT</td></tr>
<tr><td>Service condition</td><td>End-use temperature</td><td>-10°C to +55°C (No performance reduction required for temperatures</td></tr>
</table>

		between-10°C and 45°C; performance reduction is required when temperatures exceed 45°C, with a 2% decrease per 1°C increase)
	Storage Temperature	-20～+60 ℃
	ambient humidity	Below 90% RH (no condensation)
	vibration resistance	4.9m/s^2
	above sea level	Maximum height: 2000 m. Use at a reduced rate above 1000 m (reduced by 1% for every additional 100 m).
	IP grade	IP20

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
DS5L2-20P1-PTA	0.1	0.9	3.15	1.3	Single-phase AC200～240V，50/60Hz	Self-cooling
DS5L2-20P2-PTA	0.2	1.9	6.65	2.7		Self-cooling
DS5L2-20P4-PTA	0.4	2.8	9.8	4		Self-cooling
DS5L2-20P7-PTA	0.75	4.8	16.8	5.5		forced air cooling
DS5L2-21P0-PTA	1.0	6	18	6(1PH) 4.4(3PH)	Single-phase/Three-phase AC 200–240 V, 50/60 Hz	forced air cooling
DS5L2-21P5-PTA	1.5	8	20	7.4(1PH) 5.1(3PH)		forced air cooling
DS5L2-22P3-PTA	2.3	9	18	8(1PH) 7.4(3PH)		forced air cooling
DS5L2-22P6-PTA	2.6	10.5	29.93	8(1PH) 7.4(3PH)		forced air cooling
DS5L2-41P0-PTA	1.0	3.2	9.6	4	Three-phase AC380～440V，50/60Hz	forced air cooling
DS5L2-41P5-PTA	1.5	5.5	13.75	4		forced air cooling
DS5L2-42P3-PTA	2.3	8.5	21.25	6.8		forced air cooling
DS5L2-43P0-PTA	3.0	11	29.7	8		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	Inertia
MS6S	Low Inertia
MS6H	High Inertia
MS6G	Medium Inertia

Name	Frame Size
40	40 Flange
60	60 Flange
80	80 Flange
130	130 Flange
180	180 Flange

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 Body
Empty	None

Name	Rated Output Power
0P1	100W
0P2	200W
0P4	400W
0P7	750W
1P0	1kW
1P5	1.5kW
2P3	2.3kW
2P6	2.6kW
3P0	3kW
4P4	4.4kW
5P5	5.5kW
7P5	7.5kW

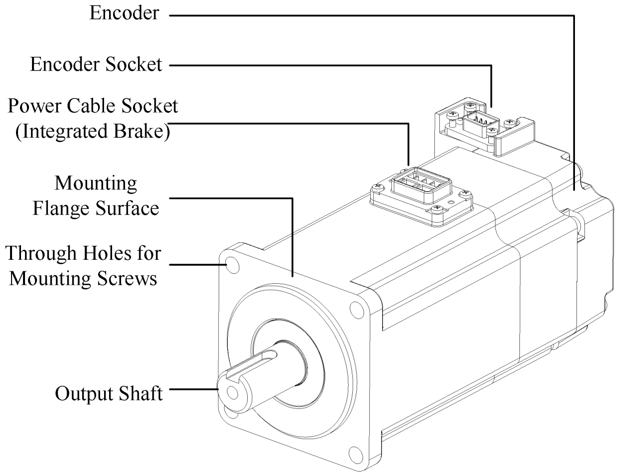
Name	Voltage Class
2	220V
4	380V

Name	Motor Connector Type
2	Aviation Connector
3	Waterproof Connector
4	Waterproof Connector to AMP Connector Adapter

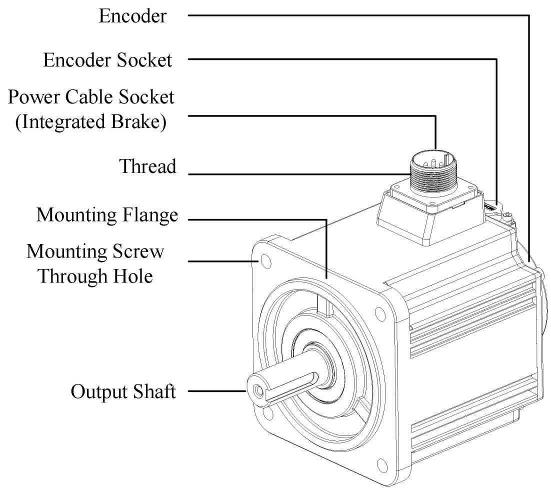
Name	Brake system
Empty	Without

1.2.2 Description of Each Section

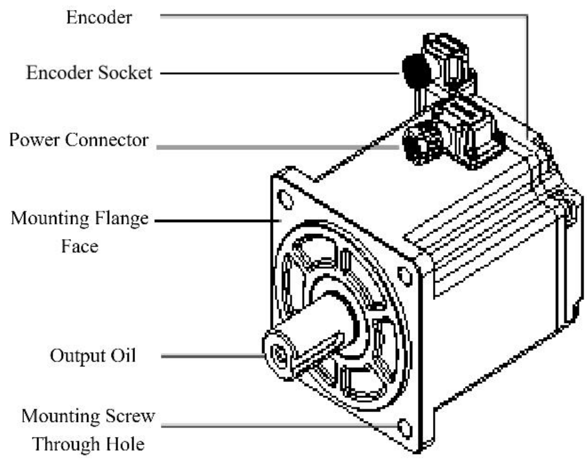
■ Motor with B3 plug type



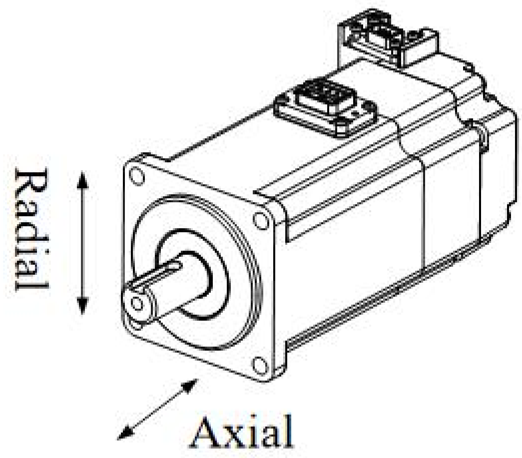
■ B2 plug-type motor



■ B4 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	Plug type
T	Threaded buckle type
Empty	Buckle type

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

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

■ Power cable model

CM T - E 05 A - 03

Name	Cable type
CM	Power line - no brake
CMB	Power line - with brake

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

Name	Plug type
E	B3 positive outlet plug
F	B3 reverse wire plug
L	4-core small aviation plug
XL	4-core medium-sized aviation plug

Name	Wire diameter (mm ²)
03	0.3
05	0.5
15	1.5
20	2.0
60	6.0

Name	Terminal
Empty	U-shaped terminal (driver side)
A	Pin terminal (driver side)
T	Thread protection type (motor side)

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

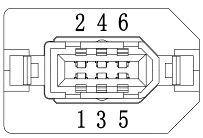
■ Brake Line Cable Specifications

- For motors with a suffix of S01 and chassis numbers up to 80, the recommended brake cable model is CB-P03 with specified length.
- The standard wiring lengths of Xinje are 3 meters, 5 meters, 8 meters, 10 meters, 12 meters, 16 meters, and 20 meters.

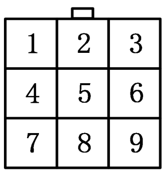
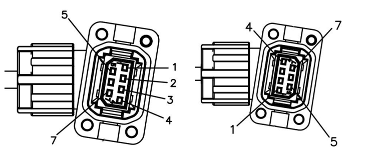
1.3.2 Explanation of Cable Pin Definitions

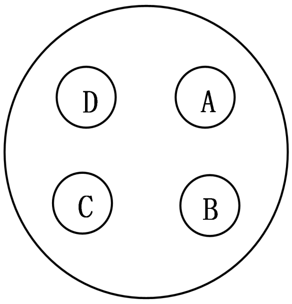
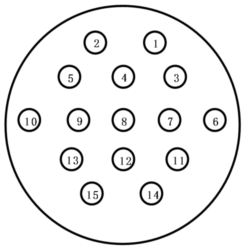
■ Encoder Cable

(1) Encoder Pin Definitions on the Servo Driver Side

Connector Appearance	Interface Pin Definitions	
	Order number	Definition
	1	5V
	2	GND
	3	/
	4	/
	5	485-A
	6	485-B

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

Motor Model	Connector Pin	Interface Pin Definitions	
MS6-40,60,80 base models with B4 motor		Order number	Definition
		1	cell +
		2	cell -
		3	shield line
		4	485-A
		5	485-B
		6	/
		7	5V
		8	GND
		9	/
MS6-40,60,80 base models with B3 motor	 Correct exit route; incorrect exit route (View)	Order number	Definition
		1	5V
		2	GND
		3	cell +
		4	cell -
		5	485-A
		6	485-B
		7	shield line

Motor Model	Connector Pin	Interface Pin Definitions	
MS6-110 and MS6-130 base-mounted motors		Order number	Definition
		1	/
		2	5V
		3	GND
		4	485-A
		5	485-B
		6	cell +
		7	cell -
		8	/
		9	/
		10	shield line
MS6-180 Machine Base B2 Motor		Order number	Definition
		1	shield line
		2	/
		3	485-B
		4	485-A
		5	/
		6	GND
		7	cell -
		8	5V
		9	cell +
		10-15	/

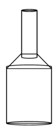
Battery Case Specifications:

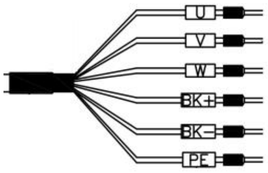
1) The cable with pin Definitions for Battery+ and Battery– in the aforementioned encoder is designed for absolute motors; non-absolutely controlled motors do not have these pins on their cables.
2) Only absolute value motors require an externally mounted battery box with a built-in 3.6 V/2.7 Ah high-capacity battery and power-off battery replacement capability, designed for use ≥2 years; battery replacement procedures follow Section 5.7.2.

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

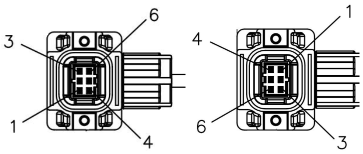
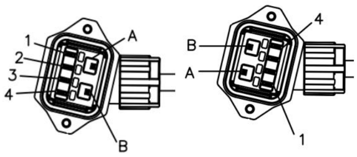
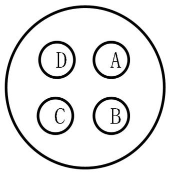
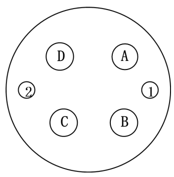
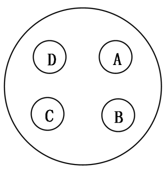
- Power cable

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

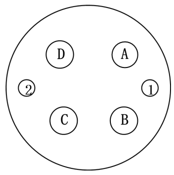
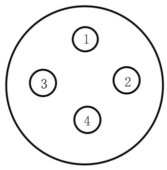
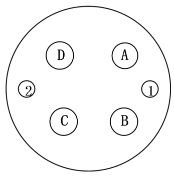
Connector Appearance	Interface Pin Definitions	
	pigment	Definition
	Brown	U
	black	V
	Lan	W
	Greenish-yellow	PE

Connector Appearance	Interface Pin Definitions	
	pigment	Definition
	red	U
	white	V
	black	W
	Greenish-yellow	PE
	Lan	BK+
	Brown	BK-

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

Motor Model	Connector Pin	Interface Pin Definitions	
MS6-40 Base Unit B3 Motor	 Correct exit route; incorrect exit route (View)	Order number	Definition
		1	W
		2	V
		3	U
		4	PE
		5	BK+
		6	BK-
MS6-60 and MS6-80 machine bases with B3 motors	 Correct exit route; incorrect exit route (View)	Order number	Definition
		1	U
		2	V
		3	W
		4	PE
		A	BK+
		B	BK-
MS6G-130 Machine Base Non-braked Motor		Order number	Definition
		A	W
		B	V
		C	U
		D	PE
MS6G-130 Base Brake Motor		Order number	Definition
		A	W
		B	V
		C	U
		D	PE
		1	BK+
		2	BK-
MS6G-180 Machine Base Non-braked Motor		Order number	Definition
		A	PE
		B	W

<table>
<tr><th>Motor Model</th><th>Connector Pin</th><th colspan="2">Interface Pin Definitions</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>C</td><td>V</td></tr>
<tr><td>D</td><td>U</td></tr>
</table>

<table>
<tr><th>Motor Model</th><th>Connector Pin</th><th colspan="2">Interface Pin Definitions</th></tr>
<tr><td rowspan="7">MS6G-180 Base Brake Motor</td><td rowspan="7"></td><td>Order number</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 Machine Base Non-braked Motor</td><td rowspan="5"></td><td>Order number</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="7">MS6H-180 Base Brake Motor</td><td rowspan="7"></td><td>Order number</td><td>Definition</td></tr>
<tr><td>A</td><td>U</td></tr>
<tr><td>B</td><td>V</td></tr>
<tr><td>C</td><td>W</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>
</table>

Brake engagement pin description:

The cable with pin Definitions including BK+ and BK-is designed for brake-equipped motors; non-brake-equipped motors use cables without these pins, featuring standard terminals instead.

1.4 Selection of Brake Resistance

When the servo motor operates in generator mode, electric power flows back to the servo amplifier. This power is defined as regenerative power. Regenerative power is first absorbed by charging the smoothing capacitor inside the servo amplifier. Once the energy exceeds the capacitor’s charge capacity, the excess regenerative power is dissipated via the braking resistor.

The process by which the server generates renewable electricity 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
DS5L2-□□P□-PTA	1) Use the built-in braking resistor by shorting terminals P+ and D, and disconnecting P+ from terminal C. 2) Use an external braking resistor by connecting it to terminals P+ and C, then disconnect the shorting wires between P+ and D. P0-25 represents the power value, while P0-26 represents the resistance value.

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

<table>
<tr><th>Servo Driver Model</th><th>Built-in resistance for braking</th><th>Minimum Resistance Value (Not less than this value)</th><th>External braking resistor (Recommended Resistance Value)</th><th>External braking resistor (Recommended Power Value)</th></tr>
<tr><td>DS5L2-20P1-PTA</td><td>/</td><td rowspan="3">80Ω</td><td rowspan="3">80Ω-100Ω</td><td rowspan="3">Over 200W</td></tr>
<tr><td>DS5L2-20P2-PTA</td><td>/</td></tr>
<tr><td>DS5L2-20P4-PTA</td><td>/</td></tr>
<tr><td>DS5L2-20P7-PTA</td><td>80W50Ω</td><td>50Ω</td><td>50Ω-100Ω</td><td>Over 600W</td></tr>
<tr><td>DS5L2-21P0-PTA</td><td>80W45Ω</td><td>35Ω</td><td>35Ω-75Ω</td><td>Above 800W</td></tr>
<tr><td>DS5L2-21P5-PTA</td><td>80W50Ω</td><td rowspan="2">30Ω</td><td rowspan="2">30Ω-50Ω</td><td rowspan="3">Over 1000W</td></tr>
<tr><td>DS5L2-22P3-PTA</td><td>80W50Ω</td></tr>
<tr><td>DS5L2-22P6-PTA</td><td>80W50Ω</td><td>25Ω</td><td>25Ω-50Ω</td></tr>
<tr><td>DS5L2-41P0-PTA</td><td>80W100Ω</td><td>120Ω</td><td>120Ω-150Ω</td><td>Above 800W</td></tr>
<tr><td>DS5L2-41P5-PTA</td><td>80W100Ω</td><td>75Ω</td><td>75Ω-120Ω</td><td>Over 1000W</td></tr>
<tr><td>DS5L2-42P3-PTA</td><td>80W60Ω</td><td>55Ω</td><td>55Ω-75Ω</td><td>Over 1000W</td></tr>
</table>

DS5L2-43P0-PTA	80W60Ω	50Ω	50Ω-75Ω	Above 1200W

- 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 Activatecontact with the cable.

1.5 Selection of Peripheral Components

Peripheral Components	Compatible Models	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 scenarios 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)
DS5L2-20P1-PTA	0.1	0.9	3.15	Bussmann	FWP-5B	5
DS5L2-20P2-PTA	0.2	1.9	6.65		FWP-10B	10
DS5L2-20P4-PTA	0.4	2.8	9.8		FWP-10B	10
DS5L2-20P7-PTA	0.75	4.8	16.8		FWP-20B	20
DS5L2-21P0-PTA	1.0	6	18		FWP-20B	20
DS5L2-21P5-PTA	1.5	8	20		FWP-20B	20
DS5L2-22P3-PTA	2.3	9	18		FWP-20B	20
DS5L2-22P6-PTA	2.6	10.5	29.93		FWP-20B	20
DS5L2-41P0-PTA	1.0	3.2	9.6		FWP-10B	10
DS5L2-41P5-PTA	1.5	5.5	13.75		FWP-10B	10
DS5L2-42P3-PTA	2.3	8.5	21.25		FWP-15B	15
DS5L2-43P0-PTA	3.0	11	29.7		FWP-20B	20

1.5.2 Circuit Breaker

Servo Driver Model	Drive Power (kW)	Rated current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	model	Rated current (A)
DS5L2-20P1-PTA	0.1	0.9	3.15	Chint	NXB-63 2P C6	6
DS5L2-20P2-PTA	0.2	1.9	6.65		NXB-63 2P C10	10
DS5L2-20P4-PTA	0.4	2.8	9.8		NXB-63 2P C10	10
DS5L2-20P7-PTA	0.75	4.8	16.8		NXB-63 2P C16	16
DS5L2-21P0-PTA	1.0	6	18		NXB-63 3P C20	20
DS5L2-21P5-PTA	1.5	8	20		NXB-63 3P C20	20
DS5L2-22P3-PTA	2.3	9	18		NXB-63 3P C20	20
DS5L2-22P6-PTA	2.6	10.5	29.93		NXB-63 3P C20	20
DS5L2-41P0-PTA	1.0	3.2	9.6		NXB-63 3P C10	10
DS5L2-41P5-PTA	1.5	5.5	13.75		NXB-63 3P C10	10
DS5L2-42P3-PTA	2.3	8.5	21.25		NXB-63 3P C16	16
DS5L2-43P0-PTA	3.0	11	29.7		NXB-63 3P C16	16

1.5.3 Electromagnetic Contactor

Servo Driver Model	Drive Power (kW)	Rated current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	model	Rated current (A)
DS5L2-20P1-PTA	0.1	0.9	3.15	Schneider	LC1 D09	9
DS5L2-20P2-PTA	0.2	1.9	6.65		LC1 D09	9
DS5L2-20P4-PTA	0.4	2.8	9.8		LC1 D09	9
DS5L2-20P7-PTA	0.75	4.8	16.8		LC1 D012	12
DS5L2-21P0-PTA	1.0	6	18		LC1 D018	18
DS5L2-21P5-PTA	1.5	8	20		LC1 D025	25
DS5L2-22P3-PTA	2.3	9	18		LC1 D025	25
DS5L2-22P6-PTA	2.6	10.5	29.93		LC1 D032	32
DS5L2-41P0-PTA	1.0	3.2	9.6		LC1 D09	9
DS5L2-41P5-PTA	1.5	5.5	13.75		LC1 D09	9
DS5L2-42P3-PTA	2.3	8.5	21.25		LC1 D012	12
DS5L2-43P0-PTA	3.0	11	29.7		LC1 D018	18

1.5.4 EMC filter

- Shawerner

Servo Driver Model	Drive Power (kW)	Rated current (A)	Maximum current (A)	Recommended Specifications		
				Manufacturer	model	Rated current (A)
DS5L2-20P1-PTA	0.1	0.9	3.15	Shawerner	FN 2090-8-06	6
DS5L2-20P2-PTA	0.2	1.9	6.65		FN 2090-10-06	10
DS5L2-20P4-PTA	0.4	2.8	9.8		FN 2090-10-06	10
DS5L2-20P7-PTA	0.75	4.8	16.8		FN 2090-16-06	16
DS5L2-21P0-PTA	1.0	6	18		FN3287-16-44-C33-R65	20
DS5L2-21P5-PTA	1.5	8	20		FN3287-16-44-C33-R65	20
DS5L2-22P3-PTA	2.3	9	18		FN3287-16-44-C33-R65	20
DS5L2-22P6-PTA	2.6	10.5	29.93		FN3287-16-44-C33-R65	20
DS5L2-41P0-PTA	1.0	3.2	9.6		FN3287-10-44-C28-R65	10
DS5L2-41P5-PTA	1.5	5.5	13.75		FN3287-10-44-C28-R65	10
DS5L2-42P3-PTA	2.3	8.5	21.25		FN3287-16-44-C33-R65	16
DS5L2-43P0-PTA	3.0	11	29.7		FN3287-16-44-C33-R65	16

- 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)
DS5L2-20P1-PTA	0.1	0.9	3.15	Fiott	FT130-6	6
DS5L2-20P2-PTA	0.2	1.9	6.65		FT130-10	10
DS5L2-20P4-PTA	0.4	2.8	9.8		FT130-10	10
DS5L2-20P7-PTA	0.75	4.8	16.8		FT130-10	20
DS5L2-21P0-PTA	1.0	6	18		FT430-20	20
DS5L2-21P5-PTA	1.5	8	20		FT430-25	25
DS5L2-22P3-PTA	2.3	9	18		FT430-25	25
DS5L2-22P6-PTA	2.6	10.5	29.93		FT430-30	30
DS5L2-41P0-PTA	1.0	3.2	9.6		FT430-10	10
DS5L2-41P5-PTA	1.5	5.5	13.75		FT430-10	10
DS5L2-42P3-PTA	2.3	8.5	21.25		FT430-20	20
DS5L2-43P0-PTA	3.0	11	29.7		FT430-20	20

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 the power supply circuit; 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

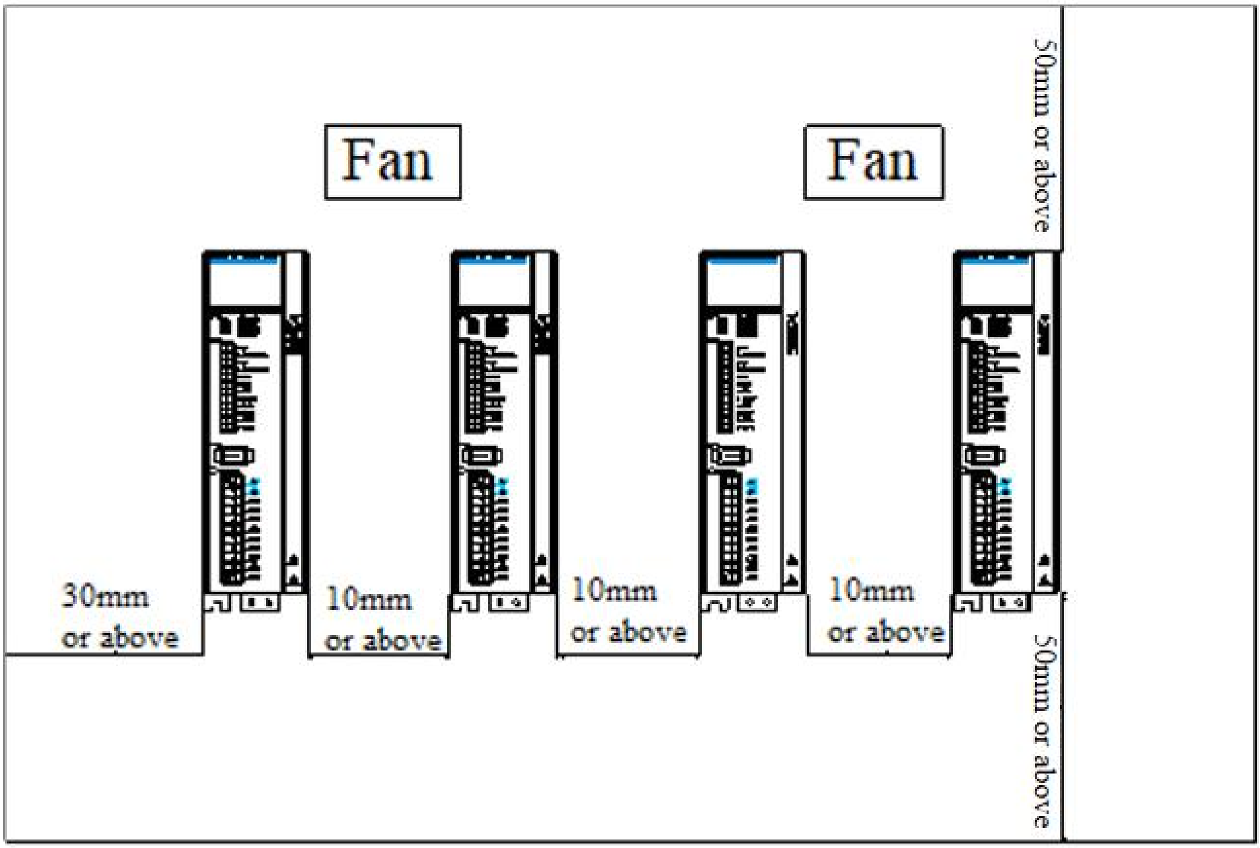
- Install in a cabinet protected from sunlight and rain.
- Do not use this product in environments containing corrosive or flammable gases such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gases, acids, alkalis, or salts, or near combustible materials.
- Do not install in environments with high temperatures, humidity, dust, or metal particles.
- No vibration required.

2.1.2 Environmental Conditions

Project	Description
Use ambient temperature	-10°C to +55°C (No performance reduction required for temperatures between-10°C and 45°C; performance reduction is required when temperatures exceed 45°C, with a 2% decrease per 1°C increase)
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
Above sea level	Maximum height: 2000 m. Use at a reduced rate above 1000 m (reduced by 1% for every additional 100 m).

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 within the cabinet (hereinafter referred to as "side-by-side installation").



■ 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.

■ When installed side by side

As shown in the figure above, maintain a clearance of at least 10 mm on each lateral side and 50 mm on each longitudinal side. Additionally, install cooling fans at the top of the servo driver. To prevent localized overheating of the servo driver, ensure uniform temperature distribution within the control cabinet.

■ Environmental conditions inside the control cabinet

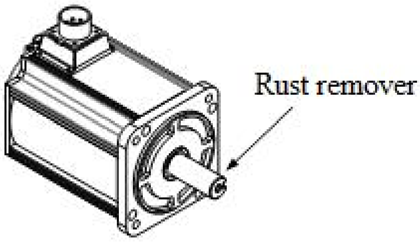
- Operating temperature range for the servo driver: -10°C to +55°C (no performance reduction required at-10°C to 45°C; performance reduction is required when temperatures exceed 45°C, with a 2% reduction per 1°C increase).
- Humidity: below 90% RH (relative humidity).

- Vibration: 4.9 m/s^2.
- 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

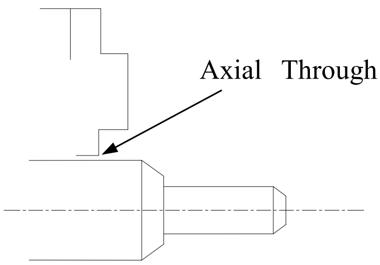
MS5/MS6 series servo motors can be installed horizontally or vertically. However, incorrect installation or placement in inappropriate locations may shorten the motor's lifespan or cause unexpected accidents. Follow the instructions below for proper installation.

Note
1. A rust inhibitor has been applied to the shaft end. Before installing the motor, wipe off the inhibitor using a cloth soaked in the diluent. 2. When applying the rust inhibitor, avoid letting the diluent Activatecontact 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.



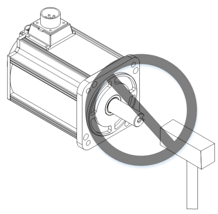
The MS series servo motors are designed for indoor use. Please operate them in environments that meet the following installation requirements:

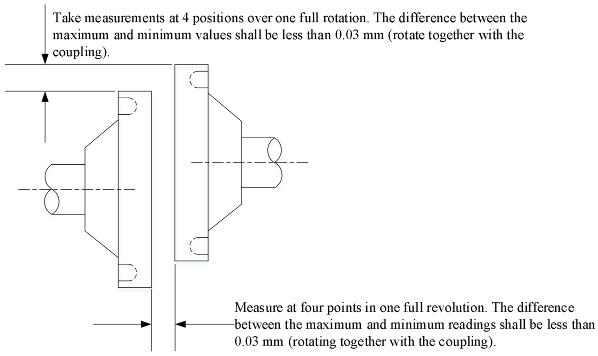
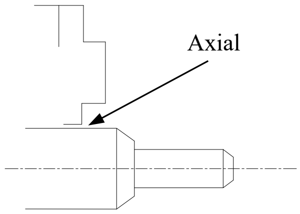
Project	Description
Use ambient temperature	-10 to 40°C (no condensation)
Environmental Humidity	20–90% RH (no condensation)
Storage temperature	-20°C to 60°C (Maximum temperature guaranteed: 80°C for 72 hours)

Storage humidity	20–90% RH (no condensation)
Vibration-resistant (vibration acceleration)	Radial: 49 m/s² Axial: 24.5 m/s²
Impact resistance	98 m/s²; Number of impacts: 2
Above sea level	Maximum height: 2000 m. Use at a reduced rate above 1000 m (reduced by 1% for every additional 100 m).
Cooling-down method	Air cooling/Liquid cooling/Natural cooling
Levels of protection	IP67/IP66/IP65/IP54 (Please confirm according to the motor's model name on the label)

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 install 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. ◆ To ensure safety, install a protective cover or similar device in the rotating area,

Project	Description
	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 vibrations 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 side of the load shaft. 
Installation Direction	◆ The servo motor can be installed either 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 Activatecontact with oil splashes, use a servo motor equipped with an oil seal; the oil seal comes with factory-applied lubricating grease and should 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, do not pull them too tightly.
Connector Section 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. ◆ 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

Project	Description
	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, or salts, or near combustible materials.
- In environments containing grinding fluids, oil mist, iron dust, or cutting materials, select models equipped with oil seals.
- Keep away from heat sources such as stoves;
- 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 Cable Installation Instructions

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 at the 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 pulse command signal cable should be routed for distances of no more than 3 meters.
- Encoder cables should be limited to 20 meters; for lengths exceeding this, specialized cables are recommended. The cable diameter depends on the actual usage length—longer cables exhibit higher resistance, greater voltage attenuation, and more severe signal distortion, potentially leading to pulse loss or signal failure. Therefore, custom-made specialized cables are typically required 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 Maximum current. For example, a 6 mm^2 wire is recommended for a motor with a Maximum current of 60 A.
- 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 for servo drives and servo motors. 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 galvanized 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 issues such as poor solder joints, bridging, miswelding, or missed welds. After welding is complete, test the conductivity at both ends of the cable.

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 should only be connected at the two fixed ends of the cables on the chain.

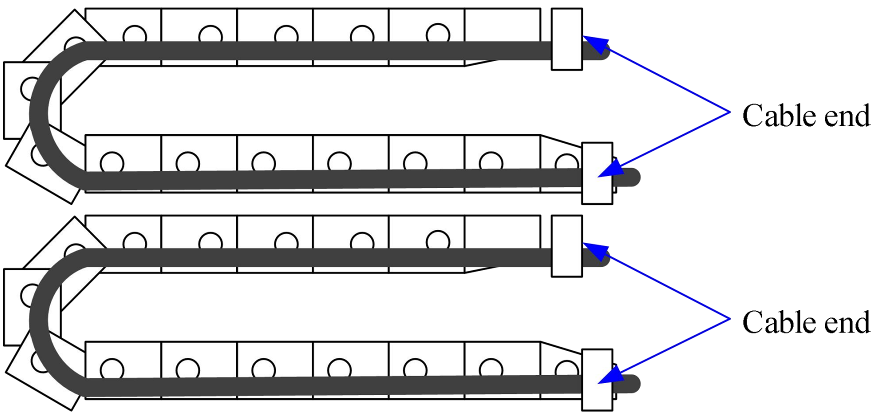
Fix the bundles;

③ Avoid winding or twisting the cable;

④ The duty cycle within the cable protection chain must remain below 60%.

⑤ Do not mix cables with significant physical differences for wiring to prevent the thick wire from breaking the thin one; if mixing is unavoidable, ensure proper separation within the cable.

Install partition devices between them.



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 measures (such as applying silicone sealant or wrapping with insulating fabric).
- 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.

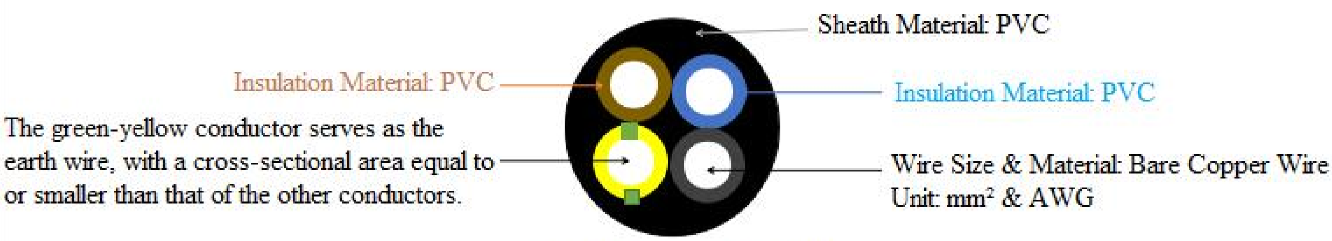
4) Low-temperature/high-temperature environments

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

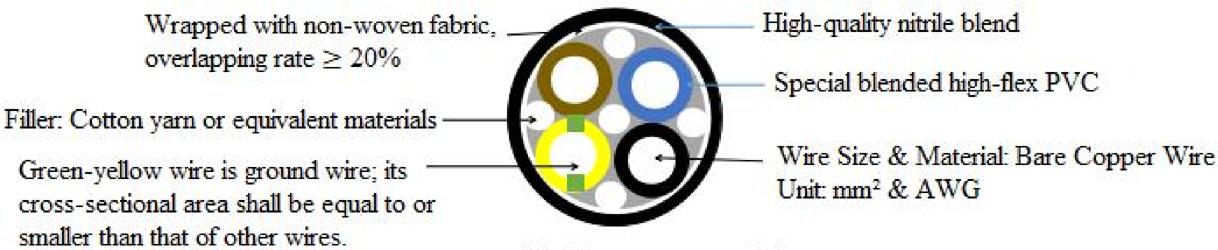
2.3.2 Specifications of Xinje Cable

1. Material Composition of Xinje Cable

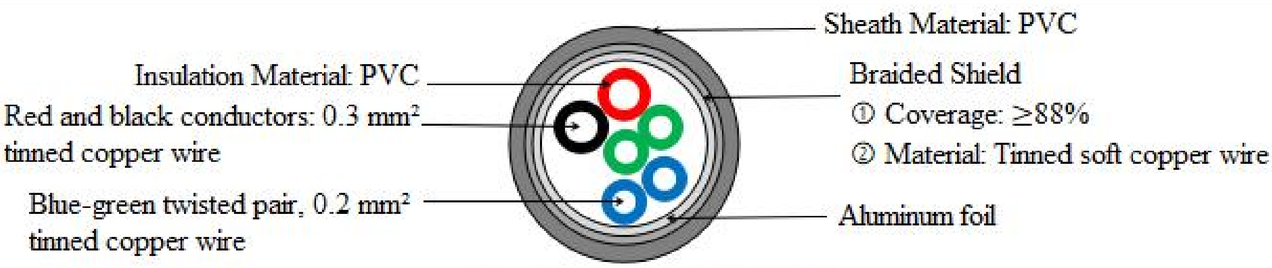
Cross-sectional diagram of cables (encoder cables, power cables), with detailed specifications for the insulation material, wire diameter, core material, and shielding layer material in the internal view.



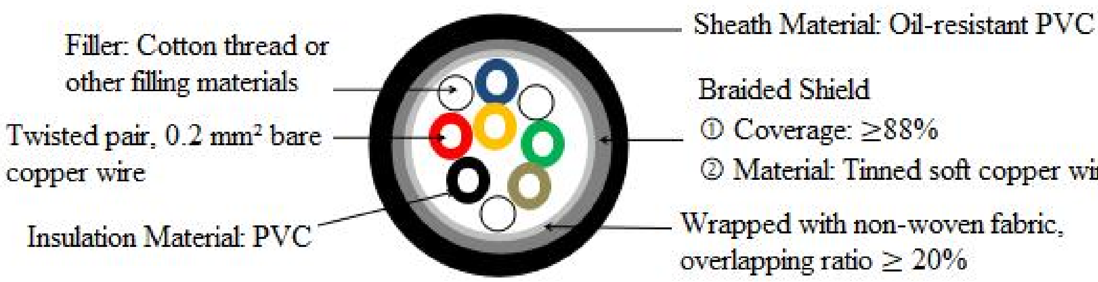
Standard Power Cable



High-flex Power Cable



Standard Encoder Cable



High-flex Encoder Cable

2. Wire Diameter Specifications

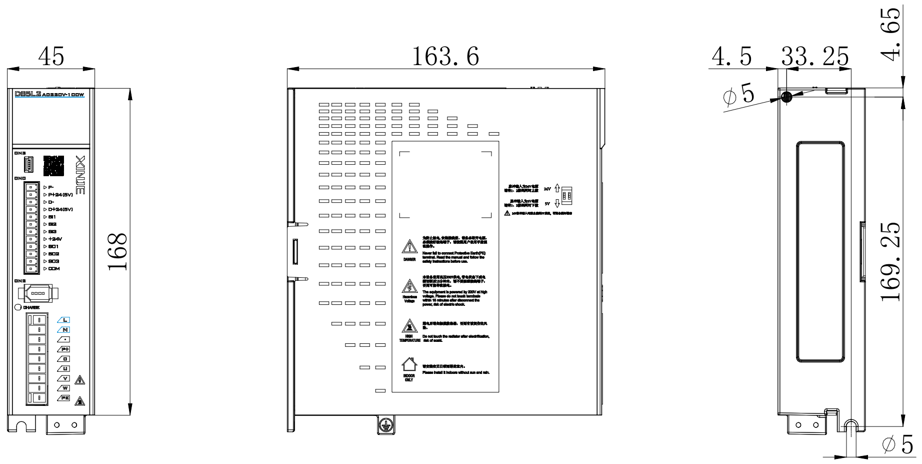
Length	Base	Encoder Wire Diameter			Power Cable Diameter		
		Type	Overall Cable Diameter (Mm)	Single Cable Wire Diameter Classification (Mm^2)	Type	Overall Cable Wire Diameter (Mm)	Single Cable Wire Diameter Classification (Mm^2)
20 meters and below	Model 80 and below	The standard version does not come with a battery case. /With battery compartment	5.8/6.4	3P*0.2mm^2	common / High Flexibility	7.2/7.0	4*0.75mm^2
	110,130 Machine Bases		6.2/6.2		common / High Flexibility	9.4/9.6	4*1mm^2
	180-unit base, 2.9 kW, 3 kW	High Flexibility	6.2		common / High Flexibility	11.4/11.9	4*2mm^2
	180-inch chassis, capacity above 3 kW				common / High Flexibility	14.5/15.6	4*6mm^2
	220-watt base unit, rated power of 22 kW or below	High Flexibility	7.9	4P*0.2mm^2	common	19.8	4*10mm^2
	32KW				common	20	3*12mm^2+1*4mm^2
	45KW				common	29	3*30mm^2+1*16mm^2
25 meters, 30 meters	Model 180 and below	common / High Flexibility	7.8/6.8	2P*0.2mm^2 +1P*0.34mm^2	/	/	/
	220 Machine Base	High Flexibility	7.9	3P*0.2mm^2+1P*0.4mm^2	/	/	/

3. Cable Technical Specifications

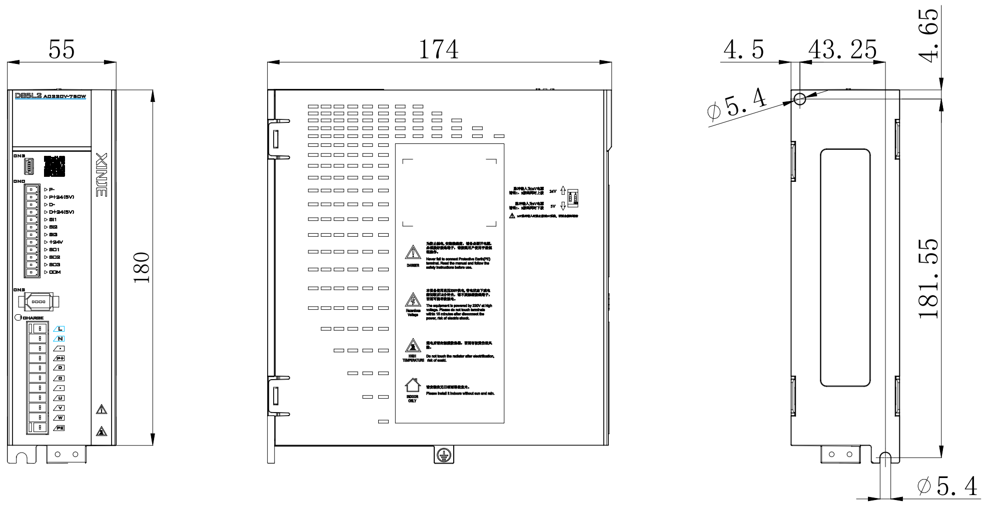
<table>
<tr><th rowspan="2">Cable Type</th><th colspan="2">Cable Performance Specifications</th><th colspan="2">Cable Installation Specifications</th></tr>
<tr><th>Temperature Resistance</th><th>Withstand Voltage</th><th>Fixed Installation</th><th>Mobile Installation</th></tr>
<tr><td>Standard Cable</td><td>-20℃~80℃</td><td>2000V/min</td><td rowspan="2">≥5*D</td><td>/</td></tr>
<tr><td>Gaorou Cable</td><td>-20℃~80℃</td><td>2000V/min</td><td>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.</td></tr>
<tr><td colspan="5">Note: D represents the finished wire diameter, R represents the bending radius, and N represents the number of bending cycles.</td></tr>
</table>

2.4 External Dimensions of the Servo Driver

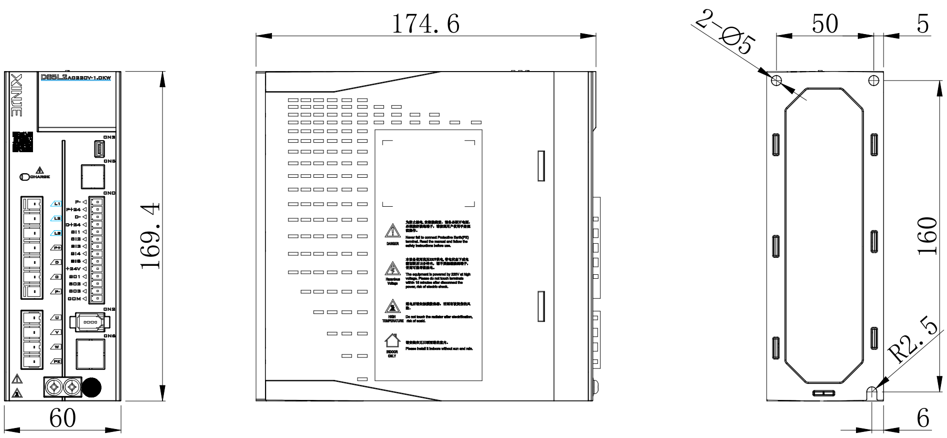
■ DS5L2-20P1-PTA, DS5L2-20P2-PTA, DS5L2-20P4-PTA Unit: mm



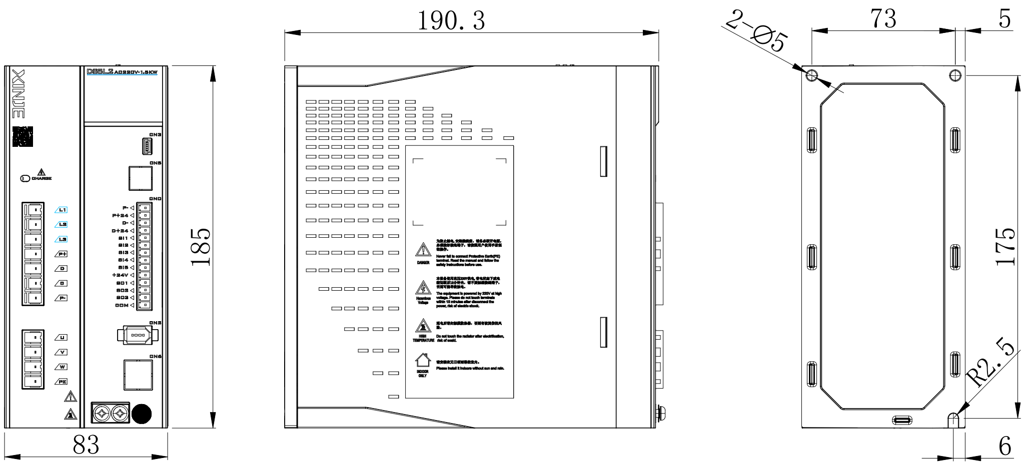
■ DS5L2-20P7-PTA Unit: mm



■ DS5L2-21P0-PTA, DS5L2-41P0-PTA, DS5L2-41P5-PTA Unit: mm

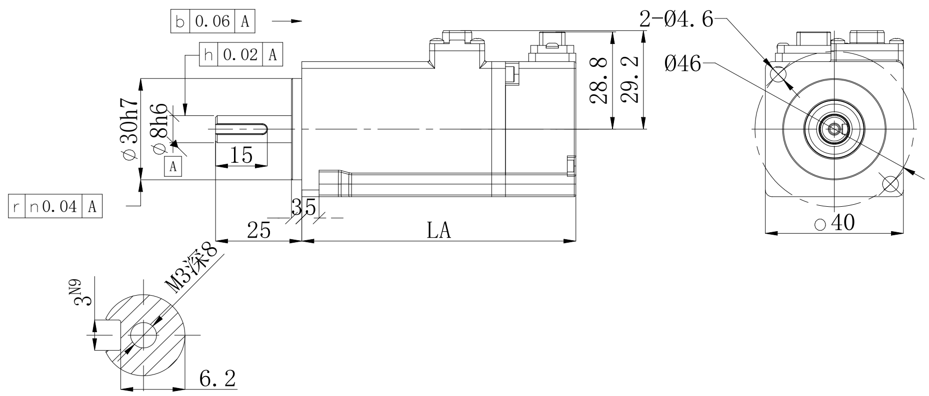


■ DS5L2-21P5-PTA 、 DS5L2-22P3-PTA 、 DS5L2-22P6-PTA 、 DS5L2-42P3-PTA, DS5L2-43P0-PTA Unit: mm


190.3
73
5
2-Ø5
185
175
R2.5
83
6

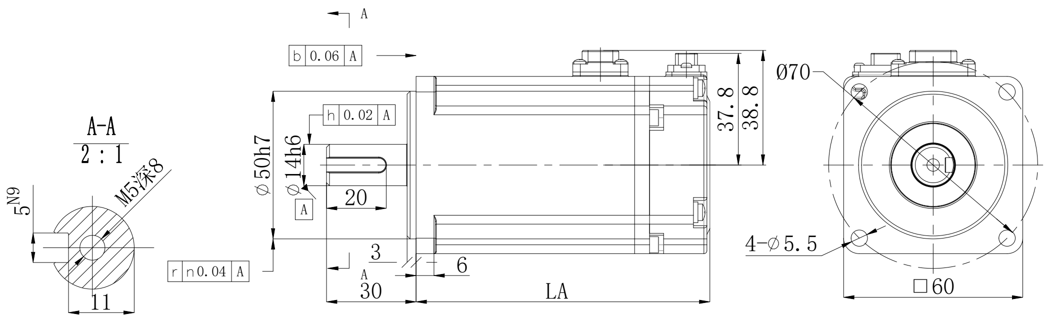
2.5 External Dimensions of the Servo Motor

■ 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		

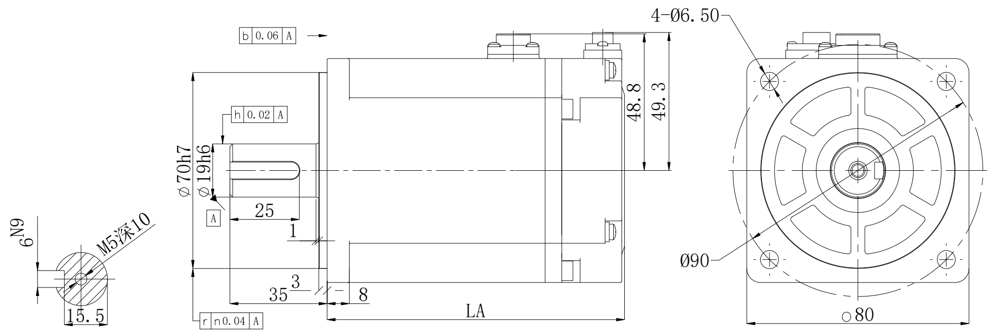
■ Installation dimensions for 60-watt base motor Unit: mm



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		

MS6H-60TH30B□3-20P2(-S)	75.4	99.2		
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		

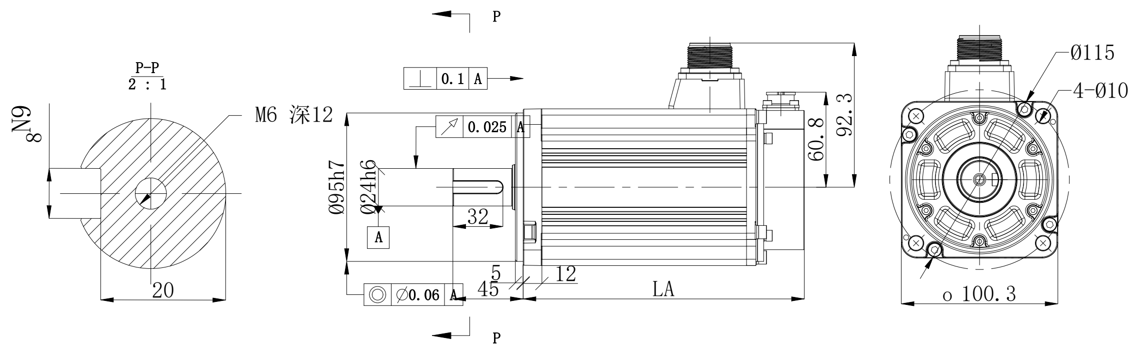
■ Installation dimensions for 80-watt base motor Unit: mm



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		

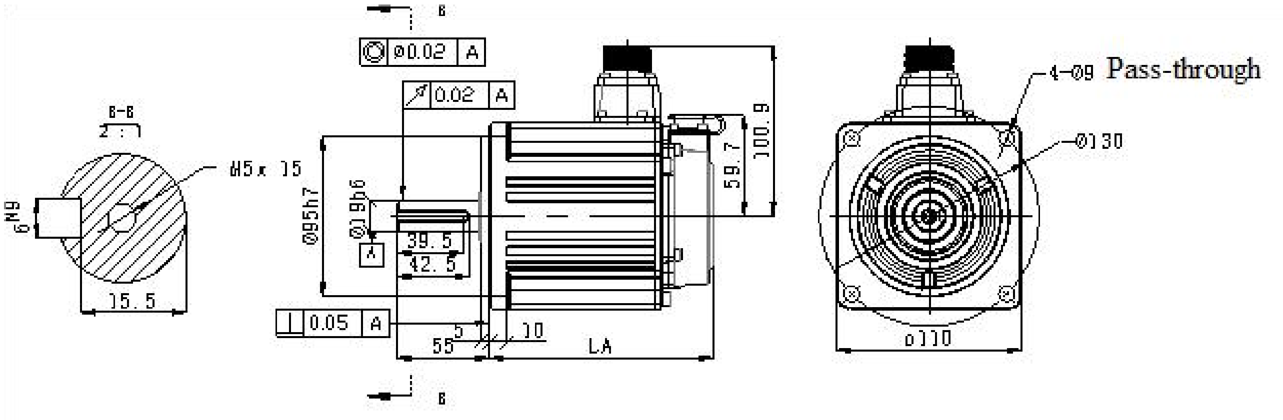
MS6H-80TH30B□3-20P7	107.1	132.1		
MS6H-80TH30B□3-20P7-S	100.3	132.2		
MS6S-80CN30B□3-21P0	117.6	142.6		Low inertia
MS6S-80TH30B□3-21P0	117.6	142.6		
MS6H-80CN30B□3-21P0	134	159		High Inertia
MS6H-80CN30B□3-21P0-S	112.5	144.4		
MS6H-80TH30B□3-21P0	134	159		
MS6H-80TH30B□3-21P0-S	123.6	155.5		

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



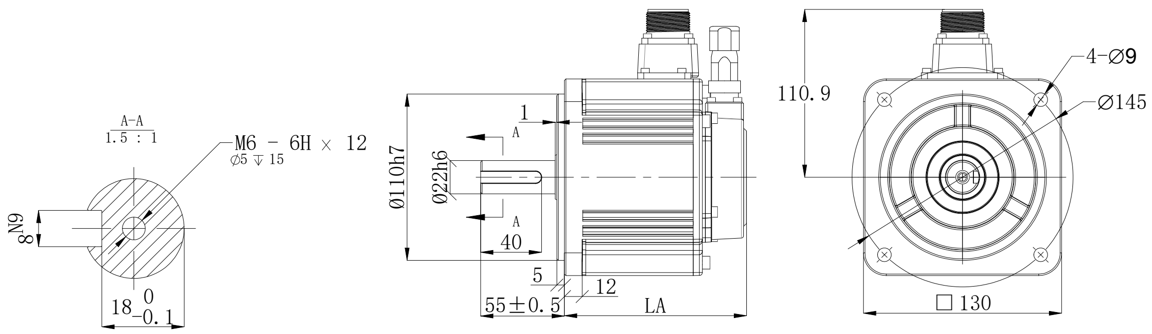
Motor Model	LA±1		diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6L-100CN30B□2-□1P5	180	205	24	Ultra-low inertia
MS6L-100TH30B□2-□1P5	193	218		
MS6L-100CN30B□2-42P5	228	253		
MS6L-100TH30B□2-42P5	241	266		

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



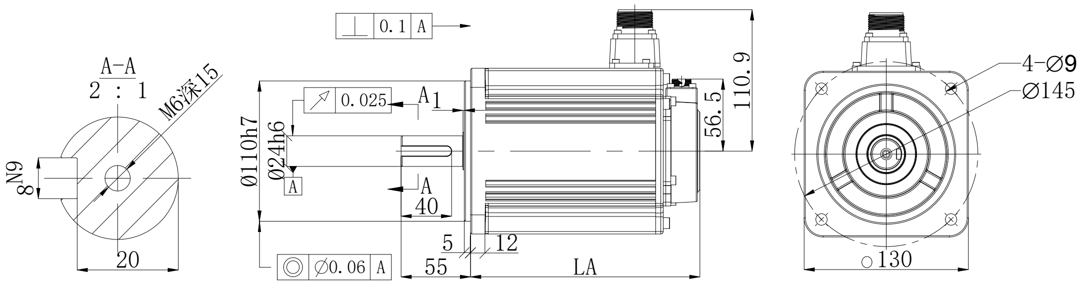
Motor Model	LA±1		diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-110CN30B□2-□1P5	132.5	163.5	19	Central Inertia
MS6G-110TH30B□2-□1P5	149	180		

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

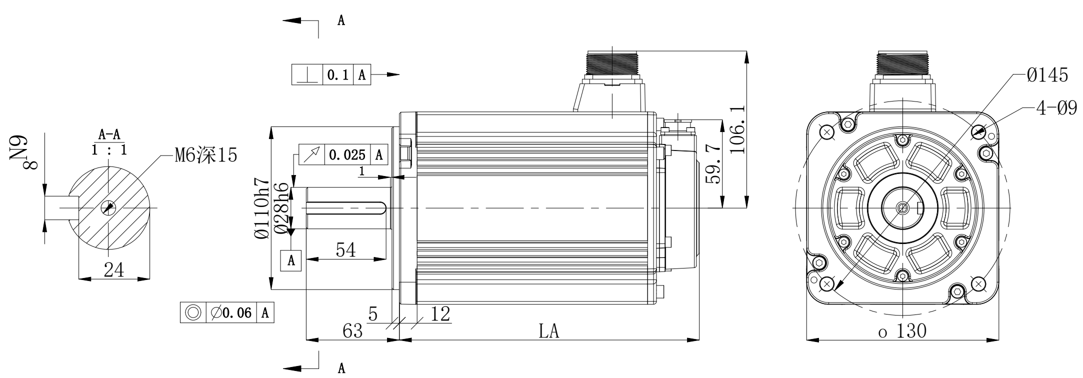


Motor Model	LA±1		diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-130CN15B□2-□0P8	133.5	162.5	22	Central Inertia
MS6G-130TH15B□2-□0P8	150	179		
MS6G-130CN25B□2-□1P0	119.5	148.5		
MS6G-130TH25B□2-□1P0	136	165		
MS6G-130CN20B□2-□1P5	133.5	162.5		

Motor Model	LA±1		diameter of axle	Inertia Level
	Regular	With brake engaged		
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		



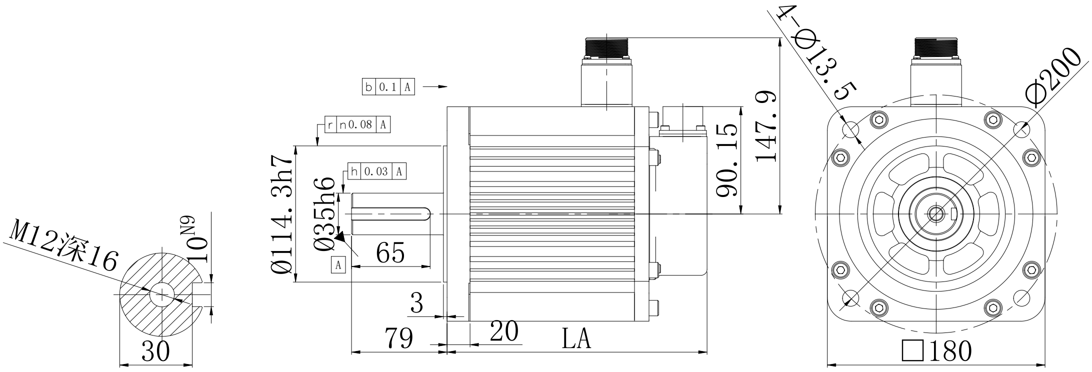
Motor Model	LA±1		diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-130CN15B□2-□2P3	181.5	210.5	24	Central Inertia
MS6G-130TH15B□2-□2P3	198	227		



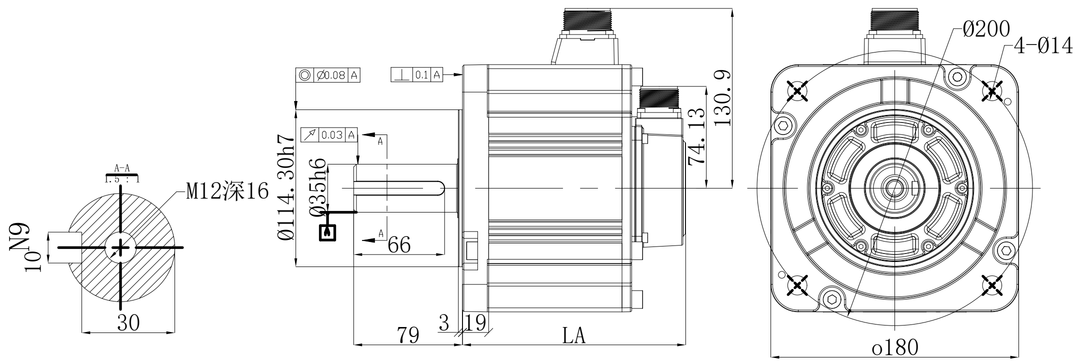
Motor Model	LA±1	diameter of axle	Inertia Level

	Regular	With brake engaged		
MS6S-130CN30B□2-43P0	202.8	231.8	28	Low inertia
MS6S-130TH30B□2-43P0	219.3	248.3		

■ Installation dimensions for the 180-base 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



Motor Model	LA±1		diameter of axle	Inertia Level
	Regular	With brake engaged		
MS6G-180CN15B□2-43P0	162	206.5	35	Central Inertia
MS6G-180TH15B□2-43P0	176.5	221		

3. Cabling of the servo system

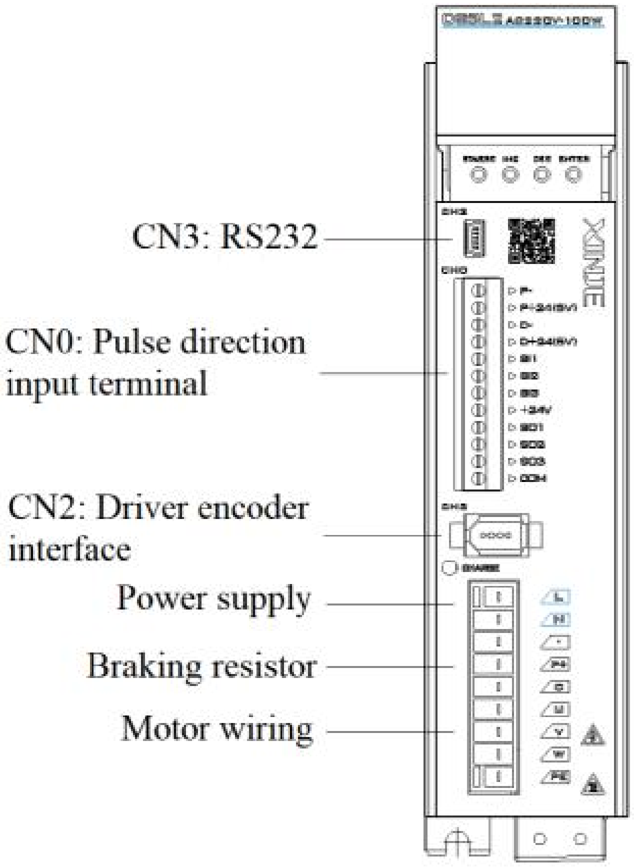
The recommended wiring materials for each interface of the servo driver are listed in the table below:

Drive Model	Power Cable – Wire Diameter mm²	UVW Power Cable – Cross-sectional Area (mm²)	Encoder wire – Wire diameter (mm²)	Ground ⏚Wire – Diameter (mm²)	Grounding screw specification : mm	Recommended grounding torque: N·m
DS5L2-20P1-PTA	0.75	0.75	0.2 (7 cores)	0.75	M3	0.54
DS5L2-20P2-PTA	0.75	0.75	0.2 (7 cores)	0.75	M3	0.54
DS5L2-20P4-PTA	0.75	0.75	0.2 (7 cores)	0.75	M3	0.54
DS5L2-20P7-PTA	0.75	0.75	0.2 (7 cores)	0.75	M3	0.54
DS5L2-21P0-PTA	2.0	1.5	0.2 (7 cores)	1.5	M4	0.54
DS5L2-21P5-PTA	2.0	1.5	0.2 (7 cores)	1.5	M4	0.54
DS5L2-22P3-PTA	2.0	1.5	0.2 (7 cores)	1.5	M4	0.54
DS5L2-22P6-PTA	2.0	1.5	0.2 (7 cores)	1.5	M4	0.54
DS5L2-41P0-PTA	2.0	1.5	0.2 (7 cores)	1.5	M4	0.54
DS5L2-41P5-PTA	2.0	1.5	0.2 (7 cores)	1.5	M4	0.54
DS5L2-42P3-PTA	2.0	1.5	0.2 (7 cores)	1.5	M4	0.54
DS5L2-43P0-PTA	2.0	2.5	0.2 (7 cores)	2.5	M4	0.54

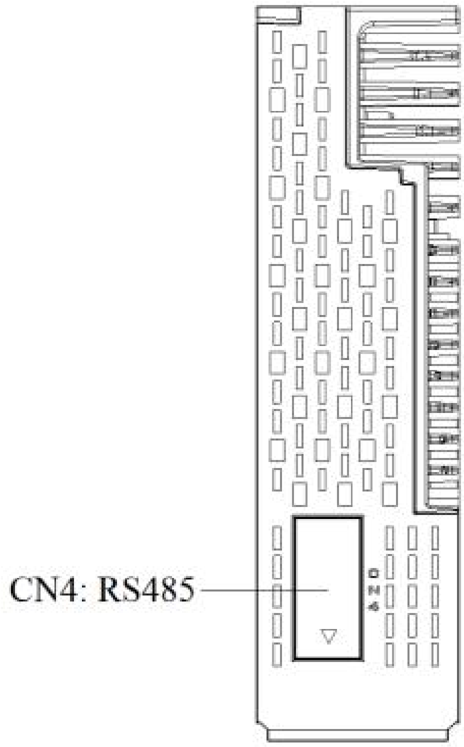
- Do not run power and signal cables through the same conduit or bundle them together. During wiring, maintain a distance of at least 30 cm between power and signal cables.
- For signal lines and encoder (PG) feedback lines, use multi-strand twisted pairs and multi-core twisted-pair shielded cables.
- Regarding wiring length, the maximum length for command input lines is 3 m, while that for PG feedback lines is 20 m.
- Even when the power is turned off, high voltage may still remain inside the servo unit. Avoid touching the power terminals for 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 Main Circuit Wiring

3.1.1 Terminal Layout of the Servo Driver



Front view

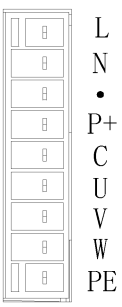


Top view

3.1.2 Main Circuit Terminals and Description

■ DS5L2-20P1-PTA、DS5L2-20P2-PTA、DS5L2-20P4-PTA

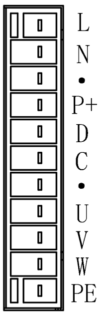
In top-down order, the functions of the main circuit terminals are as follows:



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、PE	Motor Connection Terminal	Connected to the motor **Note: The ground wire is connected to the terminal. Check it before powering on.**

■ DS5L2-20P7-PTA

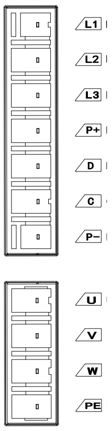
In top-down order, the functions of the main circuit terminals are as follows:



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; set P0-25 as the power value and P0-26 as the resistance value.
U、V、W、PE	Motor Connection Terminal	Connected to the motor **Note: The ground wire is connected to the terminal. Check it before powering on.**

■ DS5L2-21P0-PTA, DS5L2-21P5-PTA, DS5L2-22P3-PTA, DS5L2-22P6-PTA

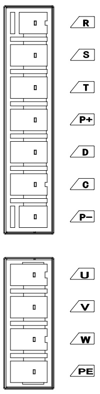
In top-down order, the functions of the main circuit terminals are as follows:



Terminal	Function	Explain
L1、L2、L3	Main circuit power input terminal	Single-phase or Three-phase AC, 200–240 V, 50/60 Hz Use a single-phase 220V power supply connected to L1 and L3; otherwise, parameter settings may be affected during power loss.
P+、D、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 as the power value and P0-26 as the resistance value.
P+、P-	Busbar Terminal	The real-time voltage of the busbar can be measured. Note: This is hazardous.
U、V、W、PE	Motor Connection Terminal	Connected to the motor

■ DS5L2-41P0-PTA、DS5L2-41P5-PTA、DS5L2-42P3-PTA、DS5L2-43P0-PTA

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



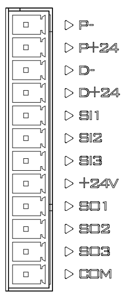
Terminal	Function	Explain
R、S、T	Main circuit power input terminal	Three-phase AC, 380–440 V, 50/60 Hz
P+、D、C	Use an external braking resistor	Connect the braking resistor to terminals P+ and C, then disconnect the shorting wire between P+ and D; set P0-25 as the power value and P0-26 as the resistance value.
P+、P-	Busbar Terminal	The real-time voltage of the busbar can be

		measured. Note: This is hazardous.
U、V、W、PE	Motor Connection Terminal	Connected to the motor

3.1.3 Description of CN0 and CN2 terminals

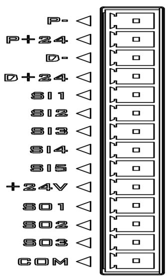
3.1.3.1 Description of CN0 Terminal

- CN0 Terminal Specifications (for models with power ratings of 750 W or lower, featuring a 3-in/3-out configuration):



Name	Explain	Name	Explain
P-	impulse input PUL-	SI3	Input Terminal 3
P+24	The collector is connected in an open circuit.	+24V	Input +24V
D-	Direction Input DIR-	SO1	Output Terminal 1
D+24	The collector is connected in an open circuit.	SO2	Output Terminal 2
SI1	Input Terminal 1	SO3	Output Terminal 3
SI2	Input Terminal 2	COM	Output Terminal Ground

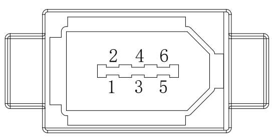
- CN0 Terminal Specifications (for 1 kW and above models, with 5 input ports and 3 output ports)



Name	Explain	Name	Explain
P-	impulse input PUL-	SI4	Input Terminal 4
P+24	The collector is connected in an open circuit.	SI5	Input Terminal 5
D-	Direction Input DIR-	+24V	Input +24V
D+24	The collector is connected in an open circuit.	SO1	Output Terminal 1
SI1	Input Terminal 1	SO2	Output Terminal 2
SI2	Input Terminal 2	SO3	Output Terminal 3
SI3	Input Terminal 3	COM	Output Terminal Ground

3.1.3.2 Description of CN2 Terminal

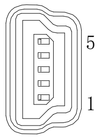
The terminal arrangement on the encoder socket side of the CN2 driver body is as follows:



Order number	Definition
1	5V
2	GND
3	/
4	/
5	485-A
6	485-B

3.1.4 Description of Communication Ports

■ CN3 (RS-232 communication)



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. RS232 communication is full-duplex: connect TXD (pin 1) of the driver's RS232 port to the RX pin of the USB-to-Serial converter, and connect RXD (pin 2) to the TX pin.

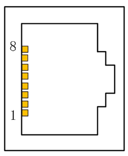
Default RS232 communication parameters: baud rate 19200 bps; 8-bit data bits; 1 stop bit; parity check.

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	Activate
P7-10	Modbus Station Number Configuration	1	1 ~ 255	servo OFF	immediately

■ CN4 (RS-485 Communication)



LAN Port (on the Drive)

Pin Number	name
4	485-A
5	485-B
6	485-GND
other	Reserve

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

The Modbus station number can be freely specified and is set by P7-00:

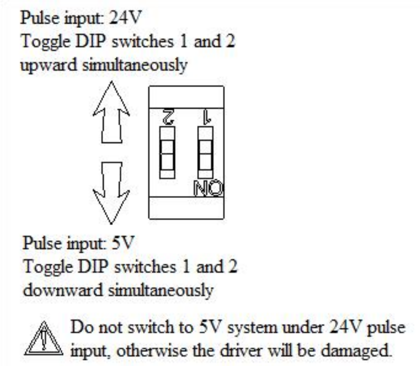
Parameter Number	function	Factory Settings	Set Range	revise	Activate
P7-00	Modbus Station Number Configuration	1	0 ~ 100	servo OFF	immediately

- Supports the standard Modbus RTU protocol and functions as a Modbus RTU slave device.
- The RS232 and RS485 communication ports can be used simultaneously.

3.2 Classification and Functions of Signal Terminals

3.2.1 Code Selection Switch

A driver with a digital code switch that supports 24V collector voltage and 5V differential voltage.



Code 1 represents pulse input voltage switching;
Code 2 represents voltage switching for pulse direction.
By default, both Dial Code 1 and Dial Code 2 are set to OFF, with the corresponding input pulse being 24 V at the collector.
Both dial codes 1 and 2 are set to ON, with the corresponding input pulse being a differential 5 V.

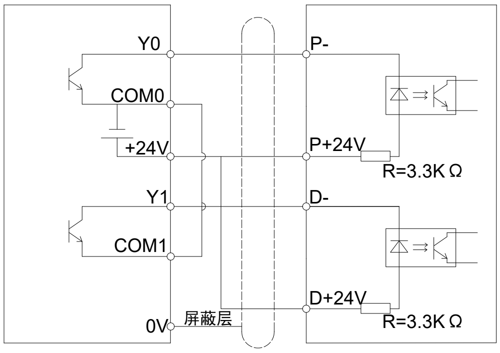
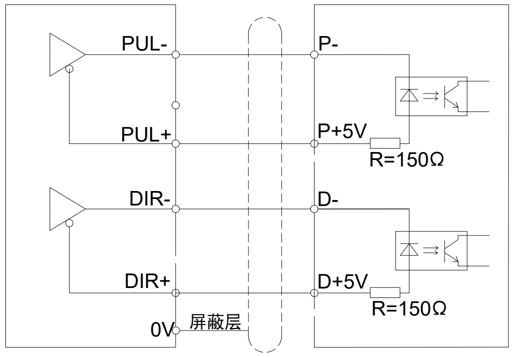
- When both code switches 1 and 2 are set to ON, it indicates a 5V input; supplying 24V at this point will burn out the current-limiting resistor.
- When both code switches 1 and 2 are set to OFF, it indicates a 24V input; providing a 5V input will prevent pulse reception.

3.2.2 Pulse Signal

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	5.4.2.2
	1	AB Phase Mode (not supported in External Pulse Speed Mode)	A Xiang	B Xiang	
	2	Pulse + Direction Mode	impulse	direction	
For the collector-open-circuit type (24 V voltage), the positive input signal is P + 24 V / D + 24 V. The differential method (5 V voltage) uses the input signal as P + 5 V / D + 5 V.					

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)	Differential method (5V voltage)

<table>
<tr><td>PLC, CNC, microcontroller-based servo drivers

</td><td>PLC, CNC, microcontroller-based servo drivers

</td></tr>
<tr><td colspan="2">Use the dip switch to adjust the pulse signal voltage; the factory default is a 24V system. To switch to a 5V system, set both switches 1 and 2 to ON simultaneously.
When switching the dial switch to the 5V system, terminal P+24V becomes P+5V, and D+24V becomes D+5V.</td></tr>
</table>

- The P-/P+24 and D-/D+24 models operate within a voltage range of 18V–25V, while the P-/P+5V and D-/D+5V models operate within 3.3V–5V; voltages below 18V or 3.3V may result in pulse abnormalities or directional issues.
- For interference resistance, use twisted-pair shielded cables and keep command signal lines within 3 meters. Connect the shielding layer to the controller's 0V terminal and ensure proper grounding of the controller.
- 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.
- If the pulse frequency of P+D signals sent by the controller exceeds 100 kHz, a 500 Ω/2 W pull-up resistor must be connected in parallel at the PLC pulse output terminal, or a 2 KΩ/1 W pull-up resistor should be connected at the servo pulse reception terminal.

3.2.3 SI Input Signals

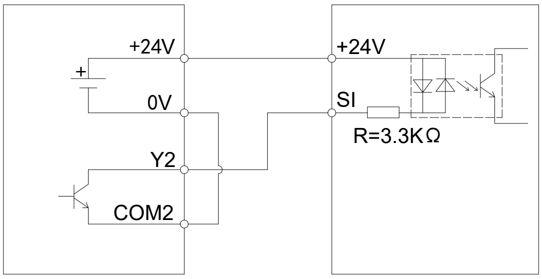
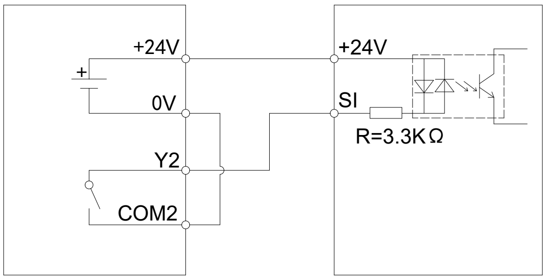
Connect using a relay or a transistor circuit with an open collector. When using a relay, select one designed for low current. Failure to use a low-current relay may result in poor contact.

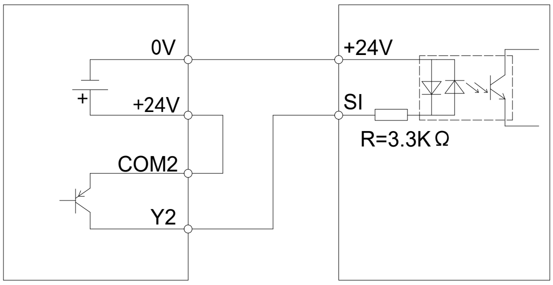
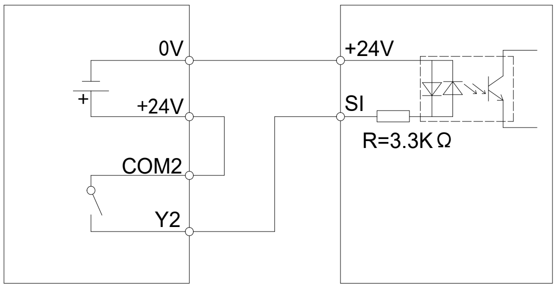
Classify	Input terminal	Function
on-off input	SI1~SI5	Multi-functional Input Signal Terminal

Factory allocation of input terminals

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

Collector open-circuit type (24V power supply,	Relay type (24V power supply, NPN type)

NPN type)	
Upper Device (NPN) Servo Driver Upper Device (NPN) Servo Driver  	Upper Device (NPN) Servo Driver Upper Device (NPN) Servo Driver 

Open-collector type (24V power supply, PNP type)	Relay type (24V power supply, PNP type)
Upper Device (PNP) Servo Driver Upper Device (PNP) Servo Driver  	Upper Device (PNP) Servo Driver Upper Device (PNP) Servo Driver 

- The maximum allowable voltage and current capacity for the collector open-circuit output circuit are as follows:
  Voltage: DC 30V (maximum)
  Current: DC 50 mA (maximum)
- All SI terminals support both NPN and PNP connections, but only one connection method can be used at a time.
- The SI terminal supports 24 V DC, with a minimum recommended voltage of at least 18 V and a maximum recommended voltage not exceeding 28 V.

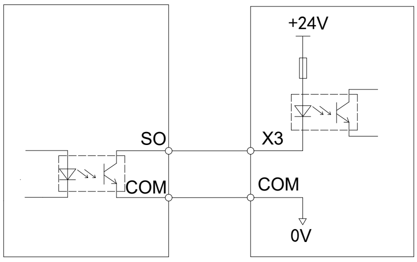
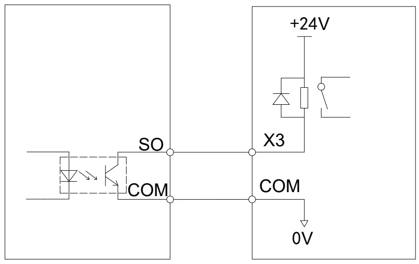
3.2.4 SO Output Signal

Classify	Input terminal	Function
Switching Output	SO1~SO3	Multifunctional output signal terminal

Factory allocation of output terminals

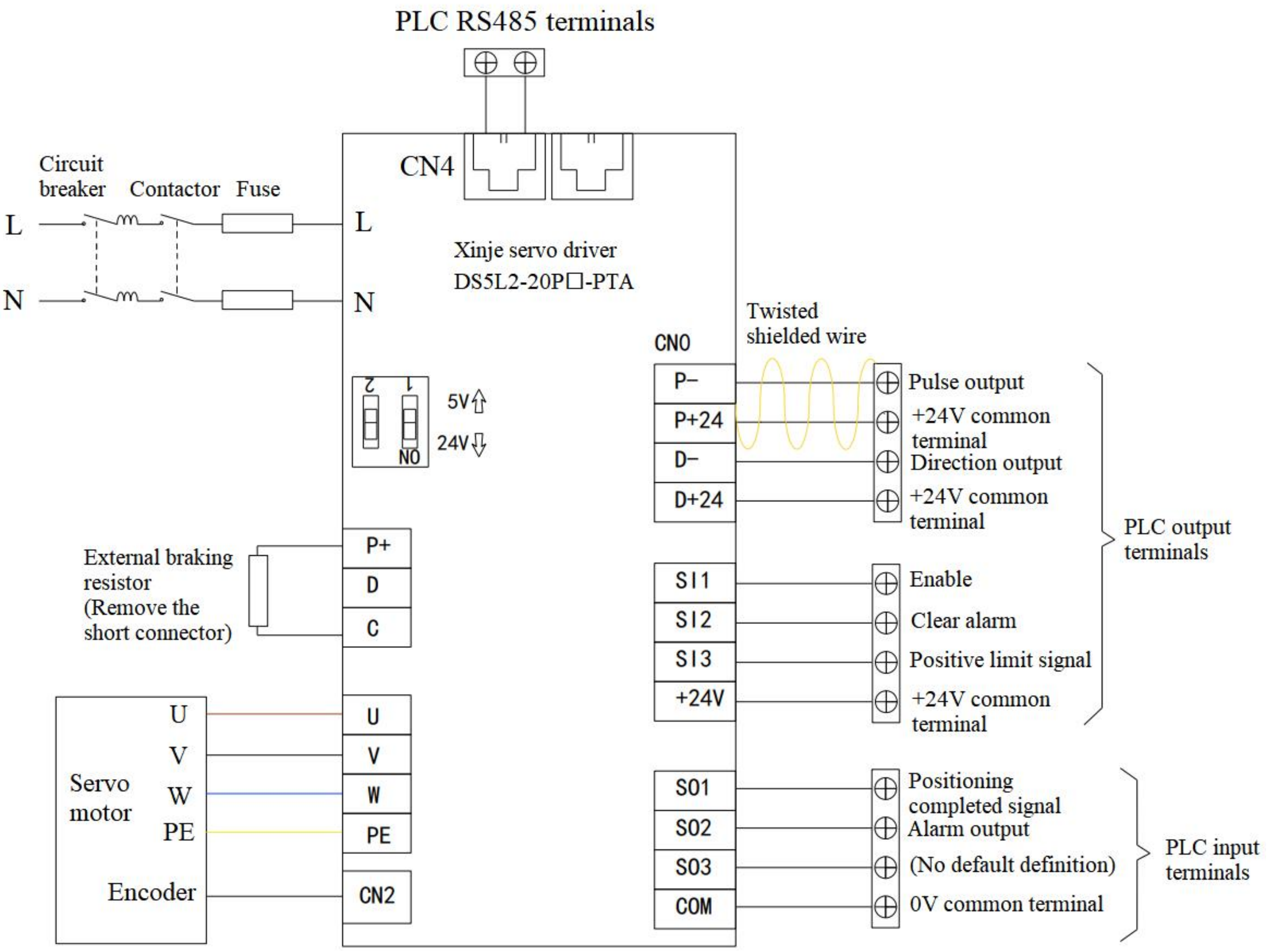
Terminal	SO1	SO2	SO3
Function	COIN/Positioning Complete	ALM/ report to the police	unabsorbed

Optocoupler type	relay-type

Servo Driver Upper Device Servo Driver Upper Device 	Servo Driver Upper Device Servo Driver Upper Device 

- Maximum Load Current:
  - For devices up to 400 W: SO1 provides DC 500 mA (maximum), while SO (other) provides DC 50 mA (maximum). Due to the high current required for brake engagement, control the brake motor via SO1 terminal and set the brake parameter P5-44 to n.0001.
  - For outputs of 750 W or higher: Use SO (for all applications) with DC current up to 50 mA and maximum voltage not exceeding 30 V DC. Due to the high current required for brake engagement, employ an intermediate relay when controlling the brake motor via SO.
- Maximum allowable voltage: DC 30 V.
- All SO terminals support only NPN connection.

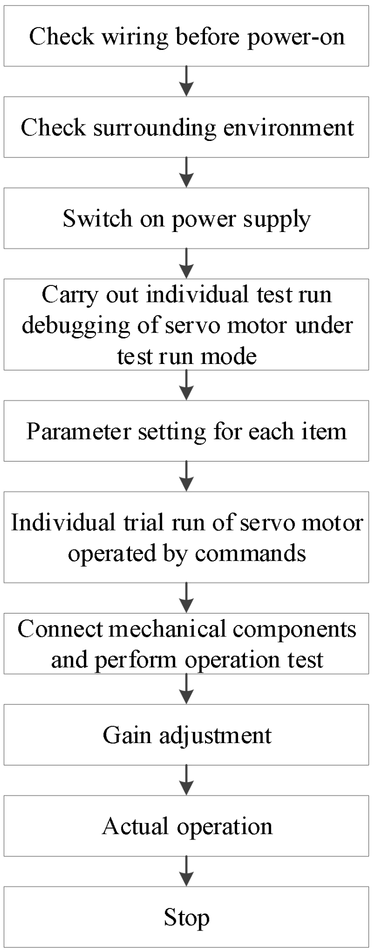
3.3 Standard Electrical Wiring Diagram for the Servo System



4. Operation Debugging and Panel Operations

4.1 New Machine Commissioning Procedure

The new device debugging sequence is shown in the flowchart below:



4.1.1 Wire connection inspection and surrounding environment verification before power-on

1. Verify that the power cables between the servo driver and servo motor, the encoder cable, and the motor are properly connected, and check for any short circuits or other abnormalities in the power supply section. The cables should not have been subjected to excessive external force, and their bending degree must fall within acceptable limits.
2. Is the motor installed correctly?
3. Whether there is any displacement between the motor and the mechanical components;
4. The on-site environment contains no foreign objects such as metal debris that could cause short circuits between signal lines and power lines.

4.1.2 Power On

Check whether the servo power supply voltage falls within the specified range:

The specified voltage range for 220V is 200V to 240V.

The specified voltage range for 380V is 380 V to 440 V.

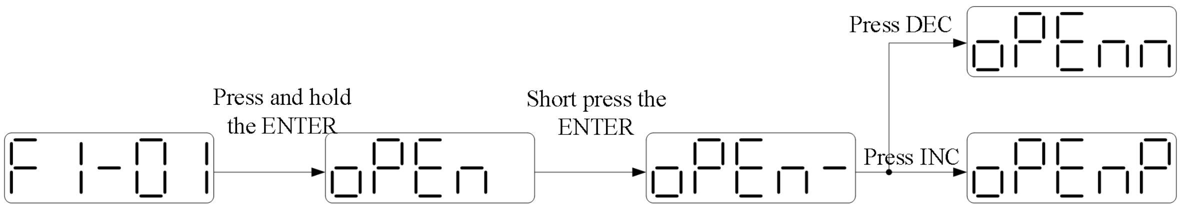
4.1.3 Empty Shaft Test Operation and Commissioning

When the servo motor is disconnected from the mechanical system, use trial run mode at low speeds to verify proper rotation. This can be achieved via open-loop or closed-loop jogging settings on the control panel, or through jogging commands using the Xinje Servo Tuner software.

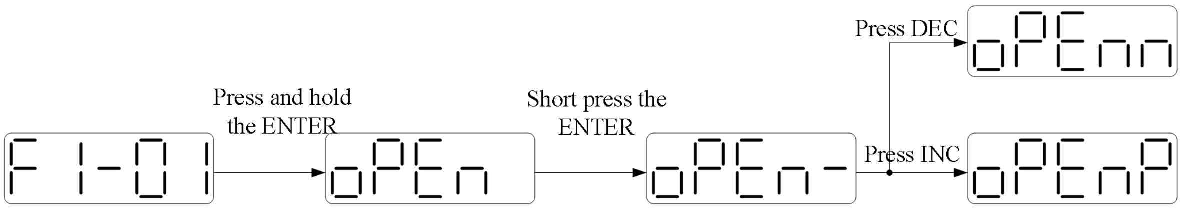
1. Panel speed jogging

The following functions only when the servo is in disabled state (i.e., panel set to bb).

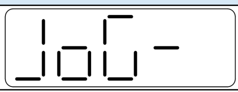
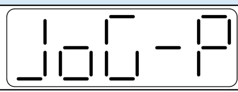
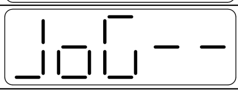
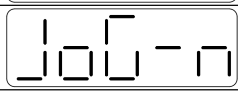
First, perform the F1-01 open-loop test run via the panel:



Similarly, the F1-00 can be operated via the panel using a point-and-click method.



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 it and exit jogging mode.

State	Panel display	State	Panel display
Idle Status Display		Forward Display	
Enable Display		Reverse Display	

- Relevant parameter

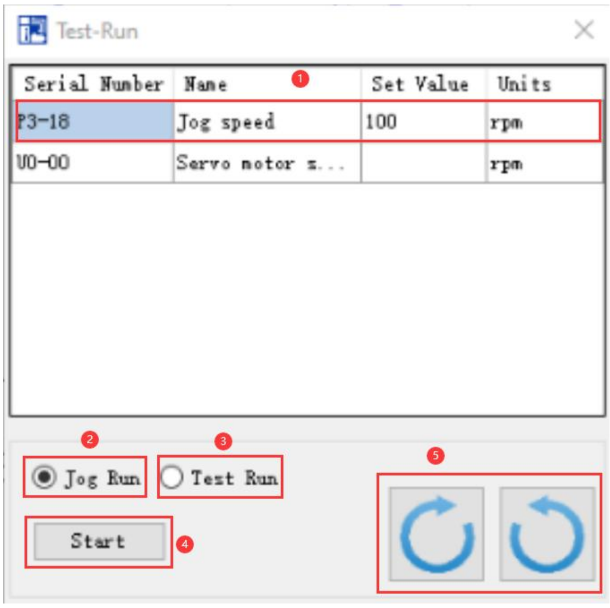
Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
P3-18	JOG Point Movement Speed	100	1rpm	0 ~ 1000	servo bb	immediately

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

2. The host computer software Xinje Servo Tuner enables speed jogging control.

Open the Xinje Servo Tuner host software, 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.

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;

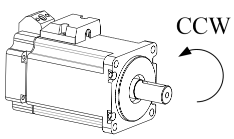
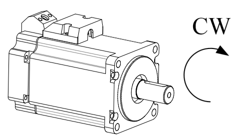
④ Enable: Activation in push-button mode;

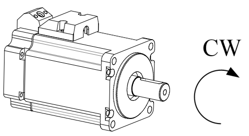
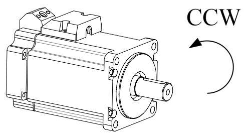
⑤ Forward/reverse: Causes the motor to rotate forward or backward.

4.1.4 Confirmation of Motor Rotation Direction

Check the servo motor's operating direction. If it is opposite to the required direction, turn off the servo, set parameter P0-05 to 0 or 1, then power on again to apply the change.

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

pattern	corotation	reversal	P0-05 Settings
Standard Setting CCW is forward rotation	 CCW	 CW	P0-05=0

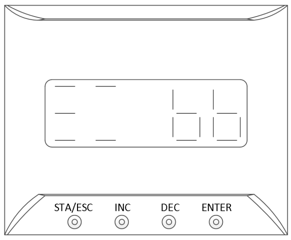
Reverse Mode CW means forward rotation	 	 	P0-05=1

- relevant parameter

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P0-05	Rotation Direction Definition 0: Normal Mode 1: Anti-pattern	0	-	0~1	servo bb	Power On Again

4.2 New Device Panel and Status Description

4.2.1 Instructions for the Operation Panel



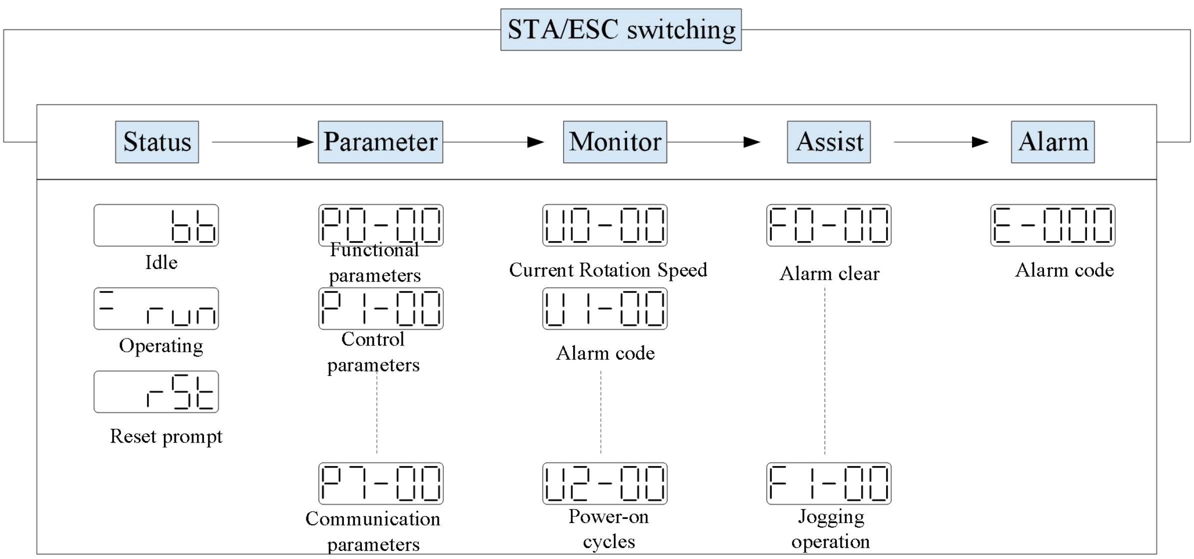
Button Name	operation declaration
STA/ESC	Short press: Switch states or return to the previous state.
INC	Short press: Display data in ascending order; Long press: Show data in ascending order.
DEC	Short press: Show data in descending order; Long press: Show data decreasing sequentially.
ENTER	Short 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.

4.2.2 Operation Panel Display

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 Xs indicate the parameter sequence number within that group.

- Monitoring Status UX-XX: The first X represents the group number, while the subsequent two Xs indicate the parameter sequence number within that group.
- Auxiliary Function FX-XX: The first X represents the group number, while the subsequent two Xs indicate the parameter sequence number within that group.
- Alarm Status E-XX: □ indicates the major alarm category, while □ denotes a subcategory within that category.

4.2.3 Status Display Explanation

Panel Short Code Display Content

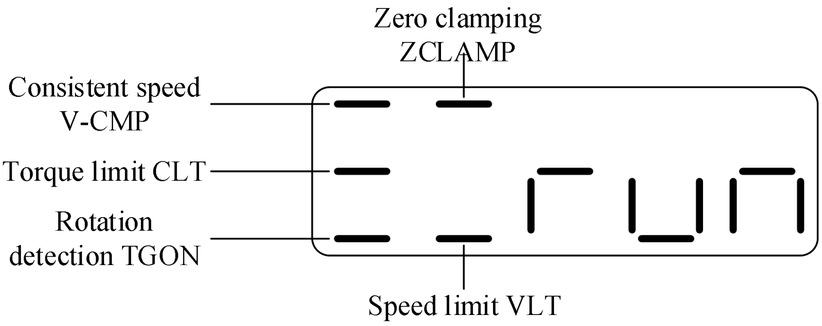
Short Code Display Content	Display Content
bb	In standby mode Servo off state (motor is not powered)
run	in service Server-enabled state. (The motor is powered on)
rSt	needs to be reset The server needs to be powered on again
Pot	Prohibited forward drive state P-OTON state 。
not	Prohibit Inverse Drive State N-OTON state 。
IdLE	Control Mode 2 is empty
E-161	The panel is currently in alarm mode; clear the alarm first. For detailed alarm information, refer to Section 7.1.

4.2.4 Status Display Under Various Operating Modes

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

Parameter	Signal Name	Factory Settings	Applicable Mode	Meaning	Revise	Activate
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

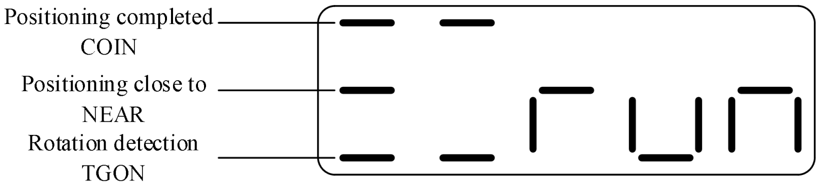
■ When operating in speed or torque control mode



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 Speed Limit (/VLT)	When torque control is enabled, the light turns on if the speed exceeds the set value. Forward speed limit during torque control: P3-16; Reverse speed limit: P3-17.

■ When in position control mode



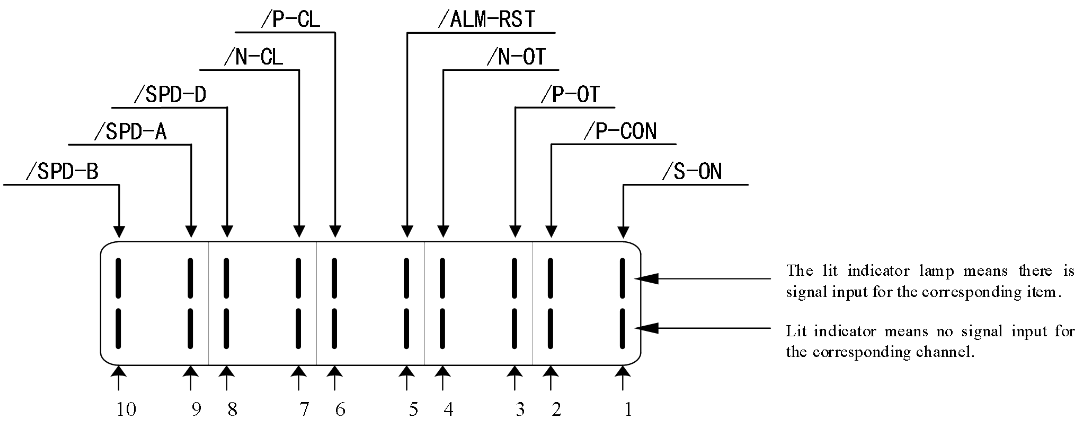
Number of digits displayed

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: instruction pulse)

P5-46 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)

4.2.5 Monitoring Parameters for Group U

■ State of the U0-21 input signal

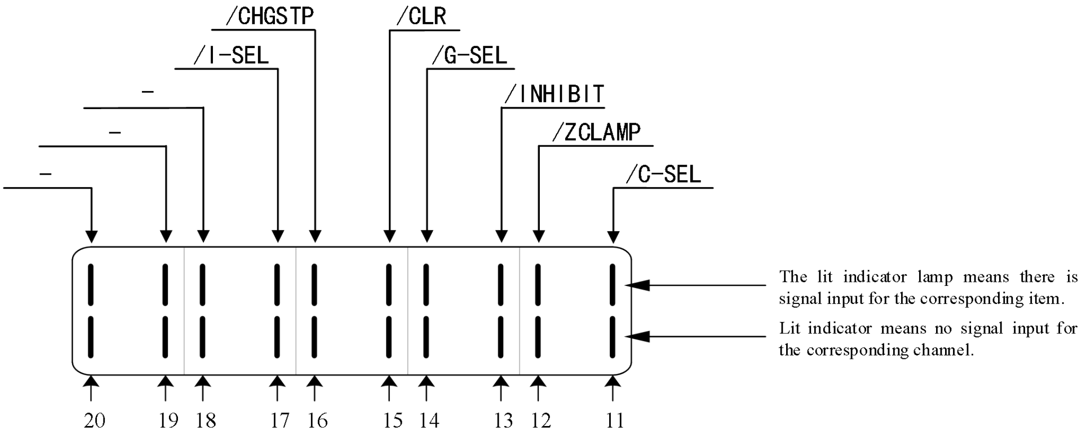


■ U0-21 Input Signal 1 Allocation

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 Setting for Speed Direction Selection
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

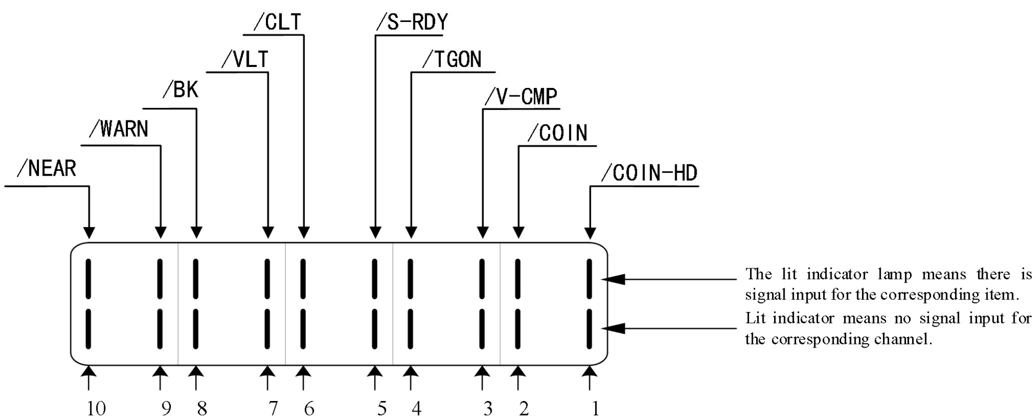


■ U0-22 Input Signal 2 Allocation

block code	explain	block code	explain
11	/C-SEL Control Method Selection	12	/ZCLAMP Zero Clamping
13	/INHIBIT: Pulse inhibition prohibition	14	/G-SEL Gain Switching
15	/CLR Pulse Clear	16	/CHGSTP Step Change
17	-I-SEL Inertia Switching	18	—
19	—	20	—

- 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.
- "—" is retained for display purposes and does not represent any signal; this status bit remains set to 0.

■ State of the U0-23 output signal

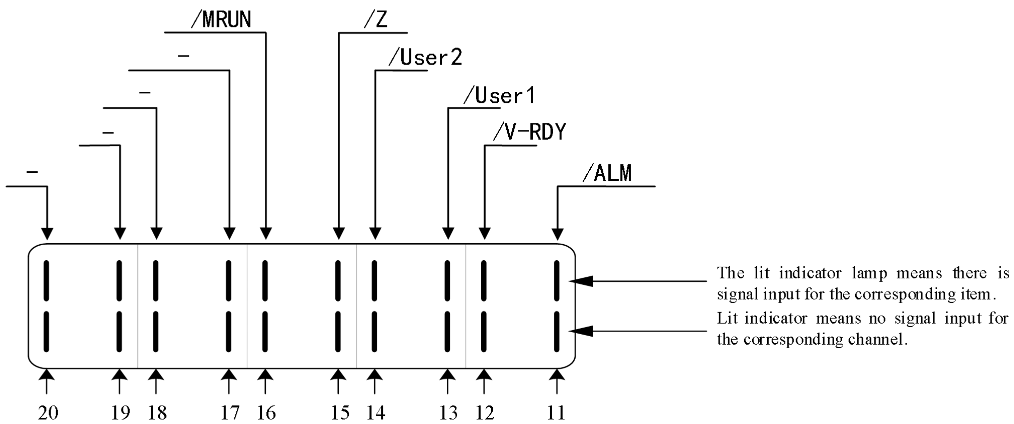


■ U0-23 Output Signal 1 Allocation

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 from right to left correspond 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, and 0x0201 indicates outputs from both /COIN_HD and /NEAR.

- U0-24 Output Signal Status



- U0-24 Output Signal Distribution

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 value read from right to left corresponds to the positions of /ALM and "—": 0 indicates no output at that position, while 1 indicates output. For example, 0x0001 indicates output at /ALM, and 0x0011 indicates outputs at both /ALM and /Z.
- Used for display only; does not represent any signal, and this status bit remains set to 0.

■ U4-18 Input Signal Status

SI1	SI2	SI3	U4-18 Display
1	0	0	0x0001
0	1	0	0x0002
1	1	0	0x0003
0	0	1	0x0004
...	...	...	...

U4-18 displays the software-enabled status of SI terminals: the terminal's high-level input is shown only after its corresponding function has been configured. For example, SI1 has no assigned function; even if hardware sets SI1 to a high level, the 0th bit of U4-18 will not display a 1 (supported by firmware version 3790 and above). Versions 3800 and above display the same format as U0-21/22.

■ U4-19 Output Signal Status

SO1	SO2	SO3	U4-19 shows
1	0	0	0x0001
0	1	0	0x0002
1	1	0	0x0003
0	0	1	0x0004
...	...	...	...

U4-19 displays the software-enabled status of SO terminals: the terminal's high-level input is shown only after its corresponding function has been configured. For example, SO1 has no assigned function; even if hardware sets SO1 to a high level, the 0th bit of U4-19 will not display a 1 (supported in firmware version 3790 and above). Versions 3800 and above display the same format as U0-23/24.

4.2.6 Auxiliary Parameters for Group F

1、F0-XX

Function Code	explain
F0-00	Clear Alert
F0-01	Restore Factory Settings
F0-02	Clear Position Deviation

- Clear Alarm (Parameter F0-00)

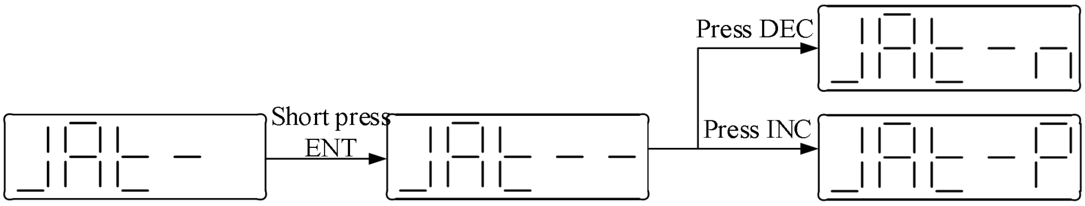
When a fault occurs, the E-XXX automatically displays an alarm status with the corresponding alarm number; this status is not visible when no fault exists.
When the alarm is active, writing 1 to F0-00 via the panel operation resets the fault.
When an alarm occurs, first identify the cause before clearing it. If the alarm is triggered by a powered-down servo unit, no clearance is required.

- Set parameters to factory defaults (Parameter F0-01)

First, turn off the servo, then perform the factory reset procedure as follows:
Set F0-01 to 1 and press ENTER to confirm. The parameters will be restored to factory settings automatically; no power shutdown is required.

- Panel Inertia Identification (Parameter F0-07)

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.
If servo jitter occurs under adaptive default parameters, first switch to the Adaptive High Inertia Mode (P2-03.3=1) and ensure stable basic servo operation before performing inertia identification!
The servo enters the BB state and displays parameter F0-07:



For detailed steps, refer to Section 6.2.4.

- Panel External Instructions from Setpoint (Parameter F0-08)

For detailed steps, refer to Section 6.4.5.

- Internal panel instructions for self-setting (Parameters F0-09)

For detailed steps, refer to Section 6.4.4.

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

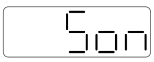
Vibration Suppression Mode	Show	Changed parameters
pattern 1	vib-1	Only changes vibration suppression-related parameters
pattern 2	Vib-2	Changes vibration suppression parameters and speed loop gain

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.

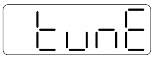
perhaps 

2. Press and hold the ENTER key; the panel will display "Son" and flash. At this point, manually enable it.

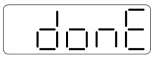


3. After enabling the servo, the panel displays "Tune" and flashes, indicating that the system has entered the

calibration state.



4. The upper-level device initiates pulse command transmission until the "done" indicator flashes, indicating successful vibration suppression.

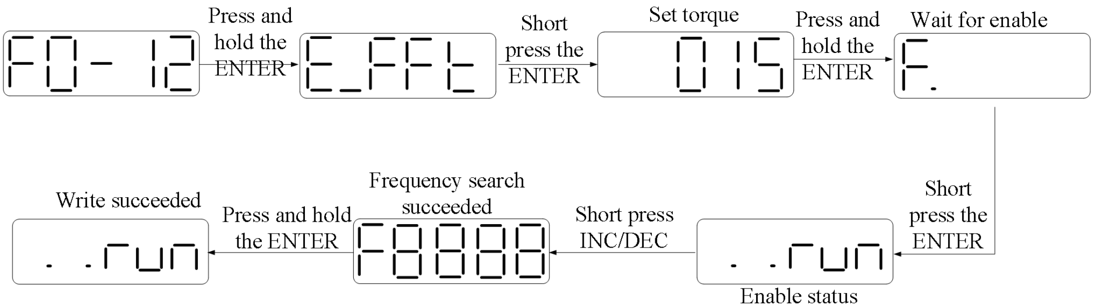


5. Press and hold the STA/ESC key to exit;

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 6.7.7 Notch Filters.

- Panel vibration suppression (Fast FFT) (Parameters F0–12)

This function enables mechanical characteristic analysis via parameters F0–12 on the servo control panel, identifying mechanical resonance frequencies to achieve vibration suppression.

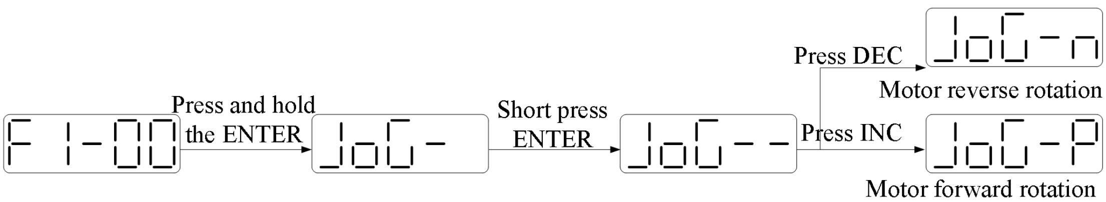


2、F1-XX

Function Code	Explain
F1-00	Click
F1-01	pilot run
F1-02	Current Sampling Zeroing
F1-05	Panel Enable
F1-06	Absolute encoder reset count

- Click operation (Parameter F1-00)

Before entering manual operation mode, confirm that the motor shaft is not connected to any machinery and that the driver is in BB idle state!

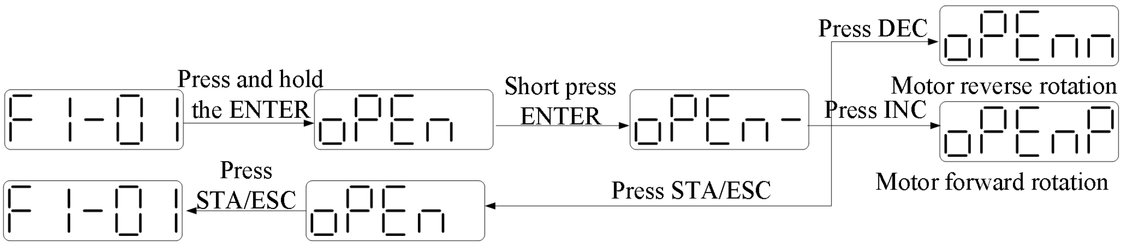


When performing a tap operation, parameters such as gain are involved in control. The appropriateness of parameter settings can be assessed based on operational conditions.

P3-18	JOG Point Movement Speed					
	Set Unit	Factory Settings	Set Range	Applicable Mode	revise	Activate
	1rpm	100	0~1000	JOG final motion	servo OFF	immediately

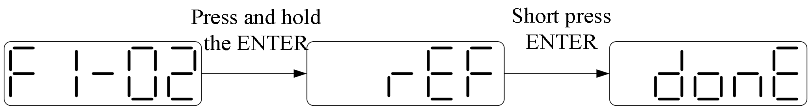
- Test Run (Parameter F1-01)

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 verify proper connections. Follow these steps to ensure the motor operates correctly 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.



- Current Sampling Zeroing (Parameter F1-02)

When the servo driver has completed self-update, or when the motor exhibits unstable operation after an extended period, users are advised to perform automatic current offset adjustment by following these steps while the driver is in BB idle mode.



Press Status/ESC to exit this function and power on again.

- Panel Enable (Parameter F1-05)

Parameter	Signal Name	Setting	Meaning	Revise	Activate
P0-03	Enable Mode	0	Do not disable	servo bb	immediately
		1 (Default)	I/O Enable/S-ON		
		2	Software Enablement (F1-05 or Communication)		
		3	Bus Enable (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.					

Forcing enablement will fail after power restoration.
To enable the feature upon power-on and maintain its effectiveness after power loss, set P5-20 to n.0010 (with P0-03 set to 1 for activation).

- Absolute encoder reset cycles (Parameter F1-06)

(Only applicable to multi-turn motors) When the servo is in BB mode, perform an absolute encoder turn-clear operation as follows:
By pressing 1 on the panel, write 1 to F1-06 to clear the absolute encoder revolution count.
To clear the number of cycles, write 1 to the hexadecimal address 0x2106 via Modbus RTU (the servo BB status will take effect; after clearing, write 0 to 0x2106).

4.3 Parameter Settings for Group P

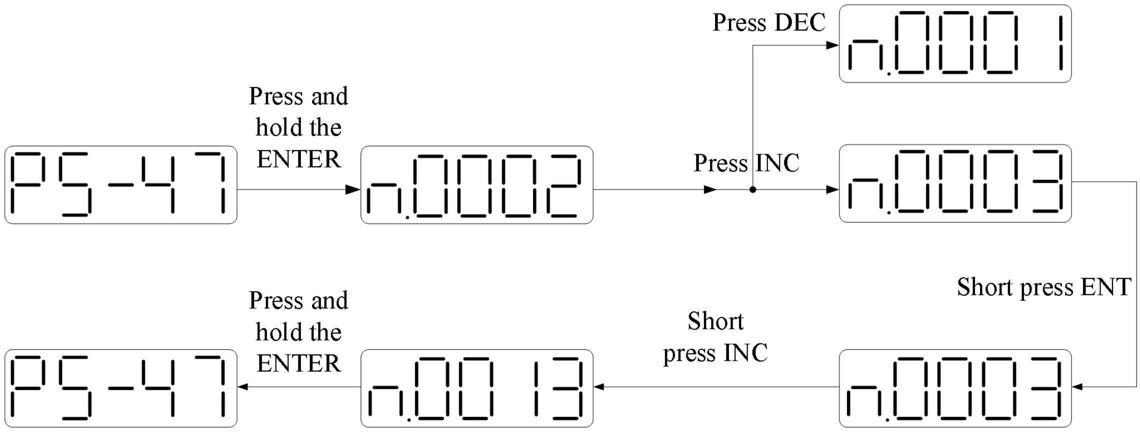
For example, describe the operational steps when changing the value of parameter P3-09 from 2000 to 3000.

step	panel display	The buttons you are using	concrete operations
1	bb	STA/ESC INC DEC ENTER ◎ ◎ ◎ ◎	No action required
2	P0-00	STA/ESC INC DEC ENTER ◎ ◎ ◎ ◎	Press the STA/ESC key to access parameter settings
3	P3-00	STA/ESC INC DEC ENTER ◎ ◎ ◎ ◎	Press the INC key once to increment by 1; set the parameter to 3 and display P3-00
4	P3-00	**STA/ESC INC DEC ENTER** ◎ ◎ ◎ ◎	Shortly press the ENT key to make the last zero on the panel flash
5	P3-09	STA/ESC INC DEC ENTER ◎ ◎ ◎ ◎	Press INC to add to 9
6	P3-09	**STA/ESC INC DEC ENTER** ◎ ◎ ◎ ◎	Long-press the ENT key to access the P3-09 interface and modify values.
7	3000	**STA/ESC INC DEC ENTER** ◎ ◎ ◎ ◎	Use the INC, DEC, and ENT keys to add, subtract, or shift. Press and hold ENT to confirm changes.
8	Operation completed		

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

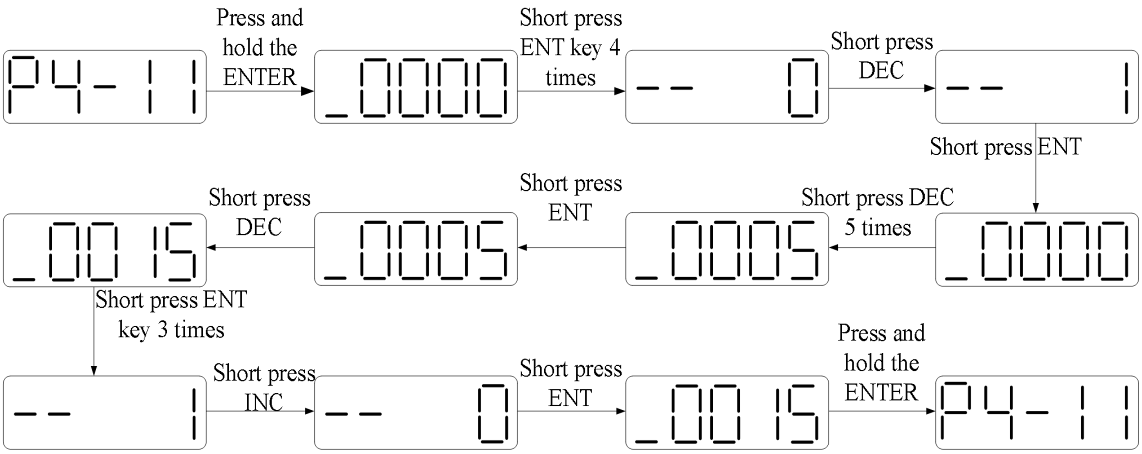
4.3.1 Example of setting parameters for SI and SO-related P groups in input/output configurations

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.



4.3.2 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.



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.

<table>
<tr><th colspan="2">User Parameters</th><th>control model</th><th>Refer to the chapter</th></tr>
<tr><td rowspan="5">P0-01
Sub-pattern 1</td><td>1</td><td>Torque Control (Internal Setting)</td><td>5.5.1</td></tr>
<tr><td>3</td><td>Speed Control (Internal Set Speed)</td><td>5.4.2</td></tr>
<tr><td>5</td><td>Position Control (Internal Position Command)</td><td>5.3.3</td></tr>
<tr><td>6 (Default)</td><td>Position Control (External Pulse Sequence Command)</td><td>5.3.2</td></tr>
<tr><td>7</td><td>Speed Control (Pulse Sequence Frequency Command)</td><td>5.4.3</td></tr>
<tr><td rowspan="5">P0-02
subschema</td><td>1</td><td>Torque Control (Internal Setting)</td><td>5.5.1</td></tr>
<tr><td>3</td><td>Speed Control (Internal Set Speed)</td><td>5.4.2</td></tr>
<tr><td>5</td><td>Position Control (Internal Position Command)</td><td>5.3.3</td></tr>
<tr><td>6 (Default)</td><td>Position Control (External Pulse Sequence Command)</td><td>5.3.2</td></tr>
<tr><td>7</td><td>Speed Control (Pulse Sequence Frequency Command)</td><td>5.4.3</td></tr>
</table>

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 input, 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 in digital, analog voltage, or communication formats, 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 maintain consistent material tension regardless of changes 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-SEL), when the servo is enabled (marked as ON) and the servo panel displays "run".

- Relevant parameter

Parameter	Signal name	Factory settings	Applicable mode	Meaning	Revise	Activate
P5-30	/C-SEL	n.0000	All	Control Mode Switching Signal	At any time	Immediately
Parameter range: n.0000–0014, assigned to other input terminals via parameter P5-30. To switch the control mode for SI2 input signals, set P5-30 to n.0002/0012. For detailed hardware wiring, refer to Chapter 3.2.3 SI Input Signals.						

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	of no avail	The control mode set for P0-01 The control modes supported by 5L2 are detailed in Chapter 5.1.1.
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 The control modes supported by 5L2 are detailed in Chapter 5.1.1.
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, ensuring 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 sequence is to first perform trial operation before proceeding to point operation. Both modes require the servo to be disabled (i.e., the panel set to bb) for proper functioning.

- Relevant parameter

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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 two point-start modes; it is invalid in other normal control modes.

1. Panel Click

- relevant parameter

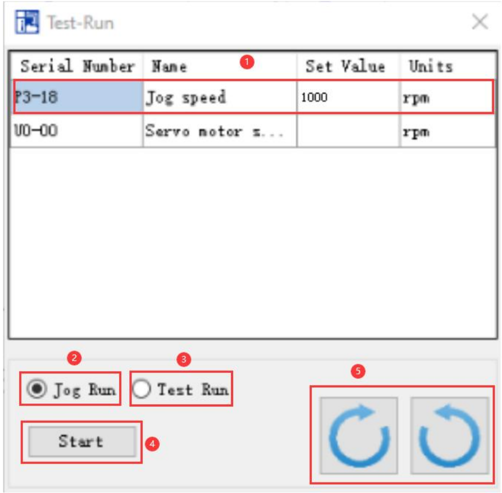
Function Code	meaning	explain
F1-00	Click	Closed-loop pulse operation
F1-01	pilot run	Open-loop point movement operation

Panel Point 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.

Step-by-step procedure for manual operation on the host computer:

Open the Xinje Servo Tuner host software, 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 without power. Enablement can be controlled via external terminal signals or computer communication.

- relevant parameter

Parameter	Meaning	Setting	Meaning	Revise	Activate
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	Activate
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 to hex address 0x2105 using Modbus RTU protocol communication.

2. Enable upon power-on

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.

<table>
<tr><th>premise condition</th><th>Parameter Setting Status</th><th>Signal/S-ON Terminal input mode</th><th>Signal/S-ON Terminal Logic</th><th>Server Status</th></tr>
<tr><td rowspan="4">P0-03=1</td><td>P5-20=n.000□</td><td>The SI□ terminal has no signal input.</td><td rowspan="2">of no avail</td><td rowspan="2">The panel displays "bb"; the servo is disabled.</td></tr>
<tr><td>P5-20=n.001□</td><td>The SI□ terminal has a signal input.</td></tr>
<tr><td>P5-20=n.000□</td><td>The SI□ terminal has a signal input.</td><td rowspan="2">valid</td><td rowspan="2">Panel shows "Run", servo enabled</td></tr>
<tr><td>P5-20=n.001□</td><td>The SI□ terminal has no signal input.</td></tr>
</table>

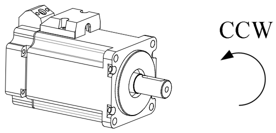
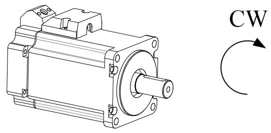
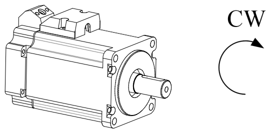
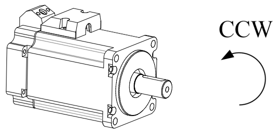
5.2.3 Switching Rotation Direction

- relevant parameter

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P0-05	Rotation Direction Definition 0: Normal Mode 1: Anti-pattern	0	-	0~1	servo bb	Power On Again

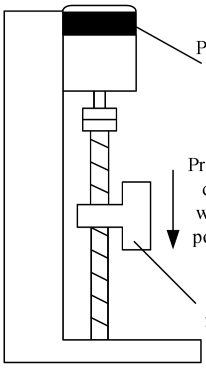
Users can change the rotation direction of the servo motor using parameter P0-05. The motor's "forward rotation" is defined as rotating counterclockwise, and "reverse rotation" as rotating clockwise (both measurements are taken from the perspective of the motor shaft).

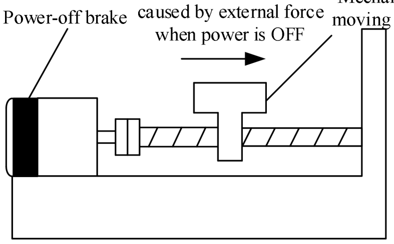
pattern	corotation	reversal	P0-05 Settings

pattern	corotation	reversal	P0-05 Settings
Standard Setting CCW is forward rotation	 CCW	 CW	P0-05=0
Reverse Mode CW means forward rotation	 CW	 CCW	P0-05=1

5.2.4 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.





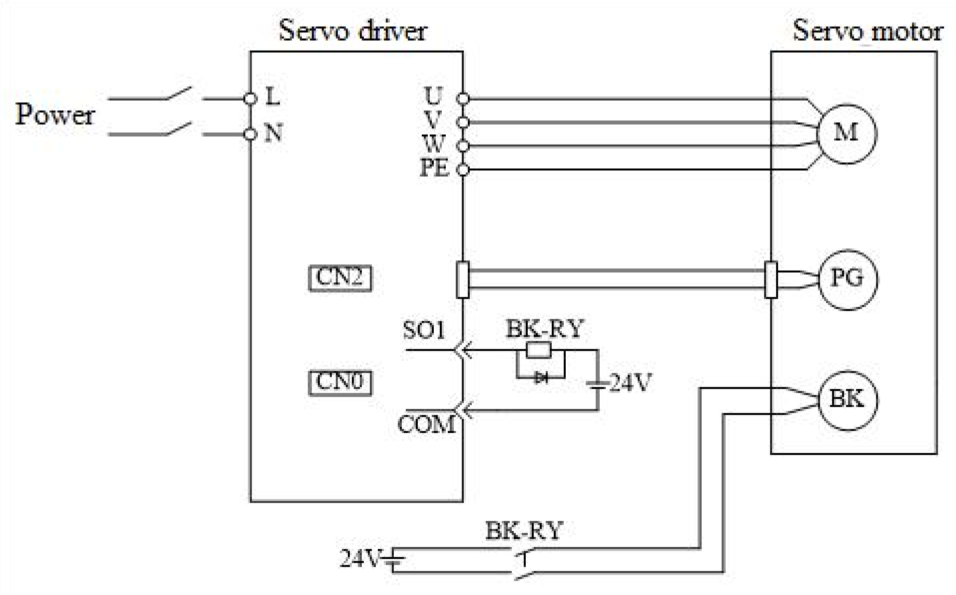
The brake integrated into the servo motor is a fixed, dedicated type without excitation operation. It cannot be used for dynamic braking and should only be employed when keeping the servo motor stationary.

- Relevant parameter

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
P5-44	Brake Interlock /BK	n.0000	-	n.0000~n.ffff	servo bb	immediately
P5-07	Servo-off delay time	500	1ms	0 ~ 65535 -500~9999 (After version 3760)	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 braking current exceeds 400 mA, use a relay adapter to prevent terminal burnout due to excessive current.

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	of no avail	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	of no avail	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.

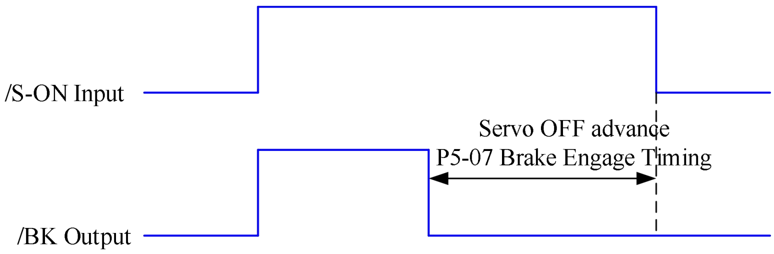
- When the SO terminal is used to control the brake, and the servo enable function is activated, the brake power supply is turned on, allowing the motor to rotate.
- If the motor fails to rotate during new device debugging, verify whether the brake is released.

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 activates 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

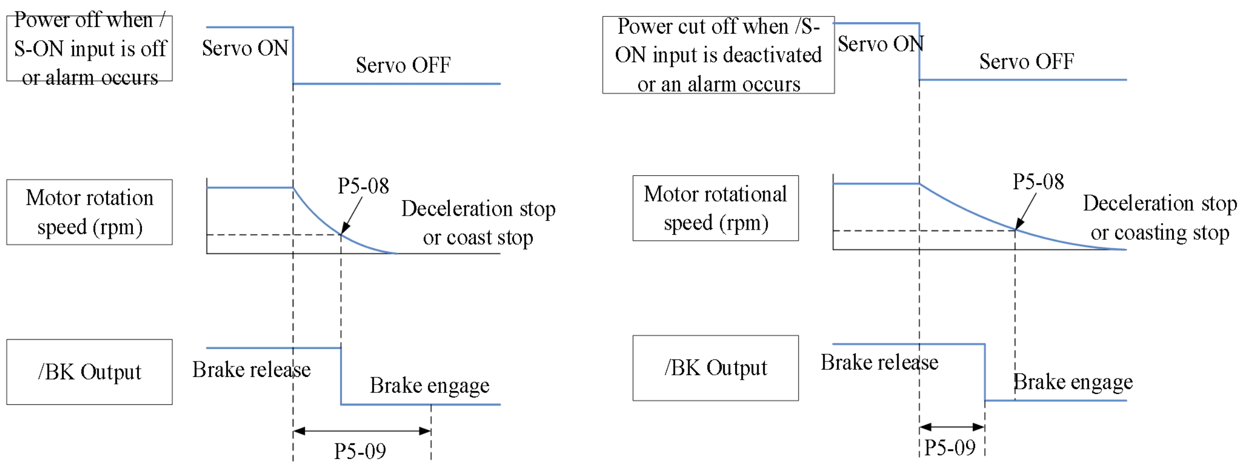
Upon occurrence of an alarm or power outage, the motor rapidly transitions to an unpowered state. During the period when the brake activates due to gravity or inertia, the mechanism may shift position. To prevent this,

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.

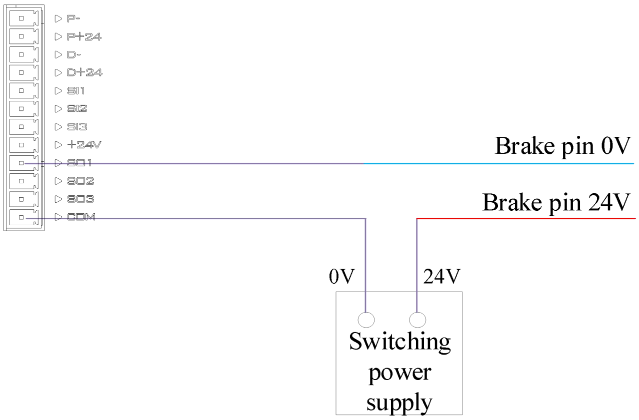
The timeline diagram is as follows:



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

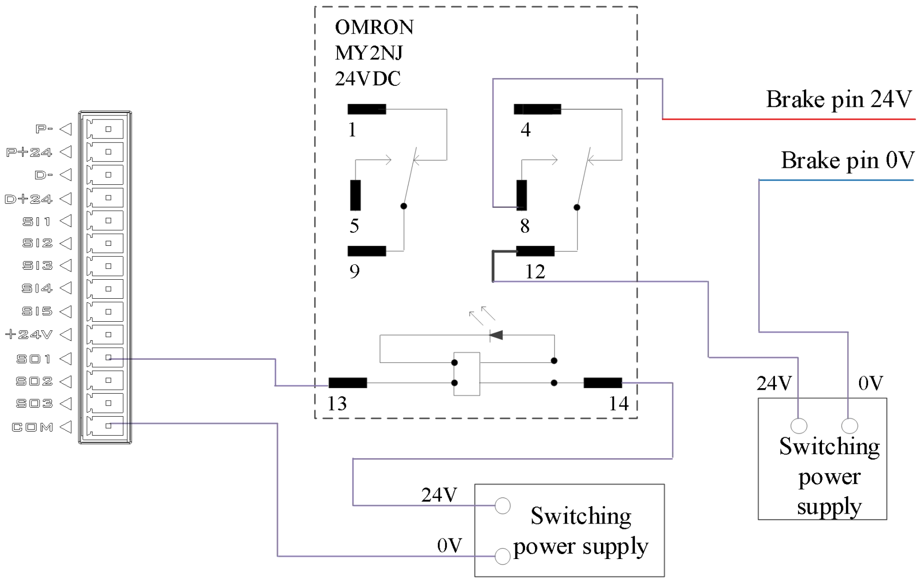
1) When the drive power is below 750 W, it can be directly connected via the SO terminal as shown in the figure below:



And set the parameter P5-44 to n.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, connection must be made via an intermediate relay as follows:



And set the parameter P5-44 to n.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.

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 steps to resolve the issue:

① Appropriately reduce P5-07 (it can be set to a negative value);

② Set P0-69.2 directly to 1.

6. Brake protection detection function (supported in version 4030 and above)

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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 detection, 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)

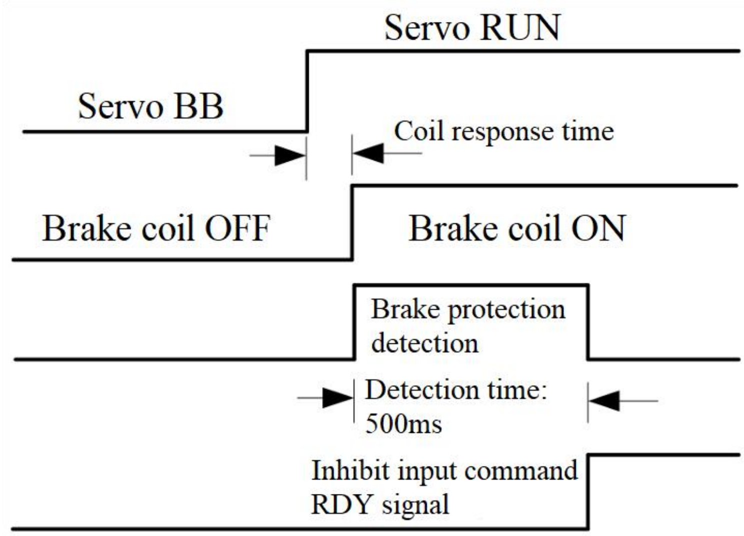
For applications employing brake motors under gravity loads, the input command must be zero within 700 ms after servo activation and the brake opening signal is triggered, with the rotational speed below 10 rpm. Between 100 ms and 500 ms after activation and signal output, verify whether the motor torque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

Abnormal brake release detection is performed only once after enabling the function and outputting the brake release signal; it will not be repeated during operation while enabled.

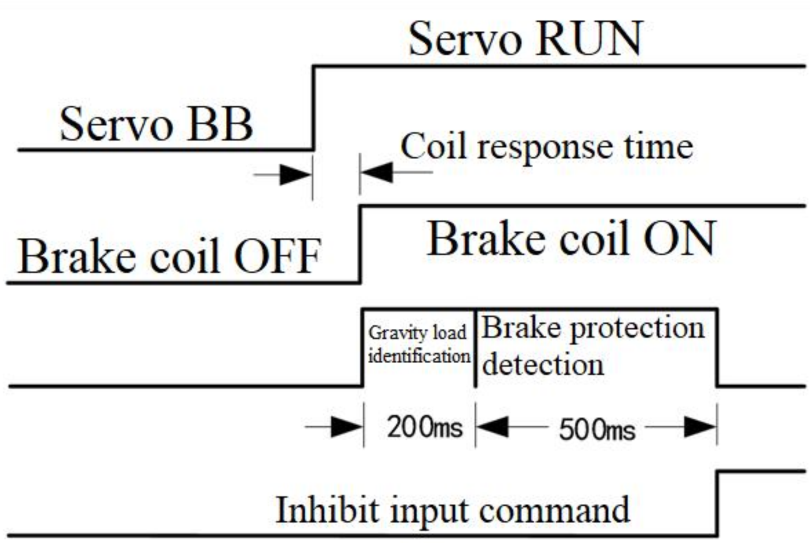
If the Automatic Gravity Identification function P9-41 is enabled, this brake abnormal disengagement detection procedure will be executed within 500 ms after the completion of the automatic gravity identification process.

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 identification not enabled



Auto gravity identification enabled

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 Parking Methods

5.3.1 Setting of Stop Method

Servo shutdown is categorized into three types based on operation mode: free 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 disabled, and the servo motor is not powered. It freely decelerates to zero, with the deceleration time influenced by mechanical inertia and equipment friction.	The servo driver outputs reverse braking torque, causing the motor to decelerate rapidly to zero.	The servo motor operates in short-circuit 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.

1. Servo OFF and alarm-induced shutdown

- relevant parameter

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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	Numeric 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 has stopped; it remains running freely after stopping.
	5	The DB stops; its state is maintained after stopping.

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

Explain ：

1) Servo shutdown enable mode (P0-27)

① When P0-27 = 0, if the servo mode is turned off, the motor will initiate free-stop operation without any alarm.
② When P0-27=1, if the servo mode is turned off, the motor will initiate free-stop operation and maintain the DB state after stopping.
③ 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, alarm E-262 will be triggered.
④ When P0-27 = 3, if the servo is turned off, the motor will initiate deceleration-based stopping until its speed falls below 50 rpm, after which it transitions to free stopping; 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, alarm E-262 will be triggered; the system will remain in DB state after stopping.
⑤ When P0-27 = 4, if the servo mode is activated, the motor DB stops and remains in free-running mode after stopping.
⑥ When P0-27 = 5, if the servo mode is activated, the motor DB will stop and maintain its stopped state.

2) Servo Alarm Parking Mode (P0-29)

(1) Enable Alarm for Relevant Properties

① When P0-29 = 0, if a servo alarm occurs, the motor will initiate free-stop operation.
② When P0-29=1, if a servo alarm occurs, the motor will initiate free-stop operation and maintain the DB state after stopping.
③ When P0-29 = 2, if a servo alarm occurs, the motor DB will stop and remain in free-running mode after stopping.
④ When P0-29 = 3, if a servo alarm occurs, the motor DB will stop and maintain its stopped state thereafter.

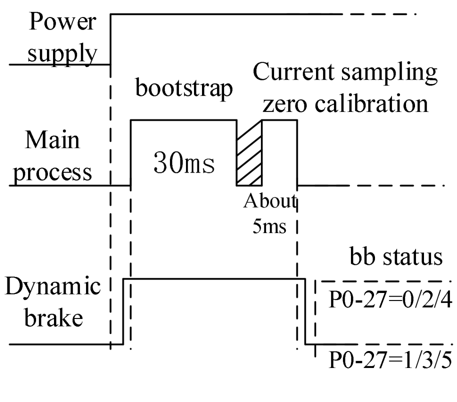
⑤ When P0-29 = 4, if a servo alarm occurs, the motor DB will stop and remain in free-running mode after stopping.
⑥ When P0-29 = 5, if a servo alarm occurs, the motor DB will stop and maintain its DB state after shutdown.

（2）Do not enable attribute alerts

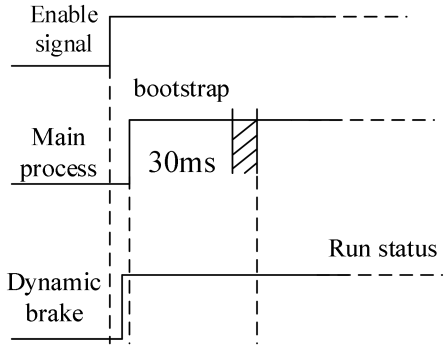
① When P0-29 = 0, if a servo alarm occurs, the motor will initiate free-stop operation.
② When P0-29=1, if a servo alarm occurs, the motor will initiate free-stop operation and maintain the DB state after stopping.
③ When P0-29 = 2, if a servo alarm occurs, the motor will initiate deceleration-based stopping until its speed falls below 50 rpm, after which it transitions to free stopping; 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 stopping. 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.
④ When P0-29 = 3, if a servo alarm occurs, the motor will initiate deceleration-based stopping until its speed drops below 50 rpm, after which it transitions to free stopping; 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 stopping. 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 DB status.
⑤ When P0-29 = 4, if a servo alarm occurs, the motor DB will stop and remain in free-running mode after stopping.
⑥ When P0-29 = 5, if a servo alarm occurs, the motor DB will stop and maintain its DB state after shutdown.

3) The SO terminal of the servo drive is assigned a brake engagement function; the values set for P0-27 and P0-29 are invalid, and both will stop via deceleration.

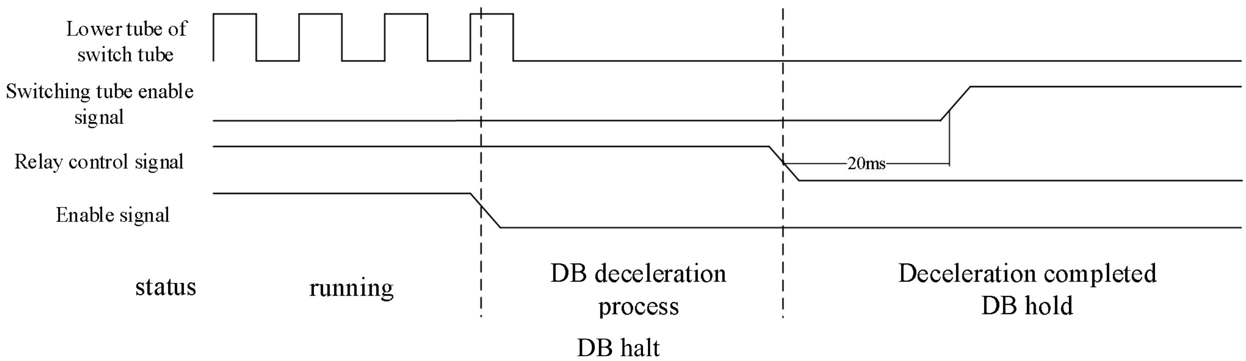
Dynamic Braking (DB) sequence diagram (low level indicates active):



Power On



Enable



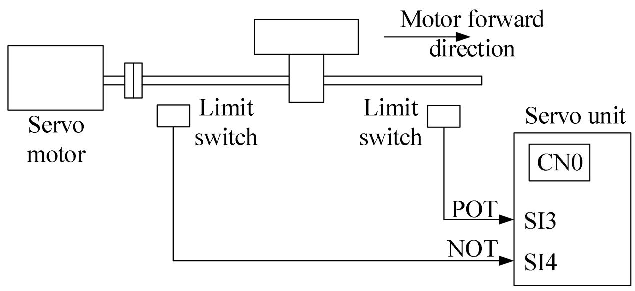
2. Parking method when exceeding the allowed distance

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	Activate
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	-		at any time	immediately
P5-23	Reverse/N-OT is prohibited	n.0004	-		at any time	immediately

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



For rotational applications such as conical tables and conveyors, the 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	of no avail
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	Limit switch triggered	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	Numeric value	Meaning
P0-28	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)

- 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 triggering an alarm.
- During torque control, the SO terminal of the servo drive is assigned for brake engagement functionality 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.

5.4 Position Control

5.4.1 General Position Modes

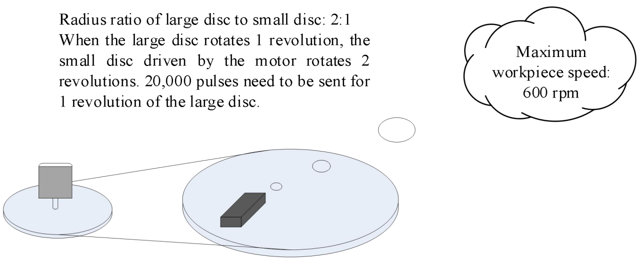
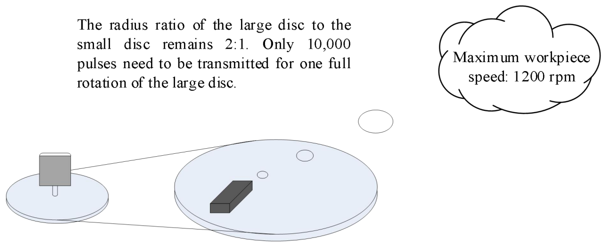
5.4.1.1 Electronic Gear Ratio

1. Overview

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

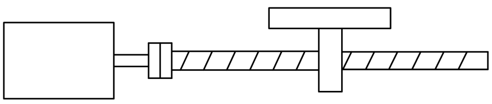
(1) Determine the number of command pulses required for the motor to complete one full rotation, ensuring it reaches the desired speed.

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 command 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. At a reduction ratio of 1:1, you can directly set the pulse count per revolution as P0–11 = 6000 and P0–12 = 0; the upper computer will then issue 6000 pulses to move the workpiece by 6 mm (for detailed calculation methods, refer to steps 1–6).



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

Do not 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 by one full revolution

Change the gear ratio settings
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

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. Round-off errors may occur during pulse delivery due to rounding of decimal values.	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	Activate
P0-11	Number of pulses per revolution * 1	0	pul	0 ~ 9999	servo OFF	immediately
P0-12	Number of pulses per revolution × 10,000	1	pul	0 ~ 9999	servo OFF	immediately
P0-13	Electronic Gear Ratio (Molecular)	1	-	0 ~ 65535	√	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	○ (pattern 5) √ (pattern 6)	immediately
P0-93	Second group of electronic gear ratios (molecules): high position * 10,000	0	-	0 ~ 65535	servo OFF	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 (denominator): high value × 10,000	0	-	0 ~ 65535	servo OFF	immediately

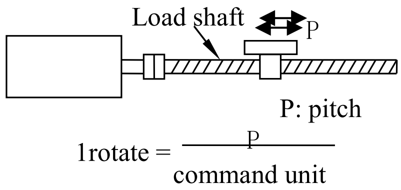
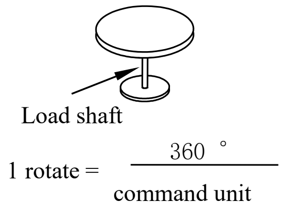
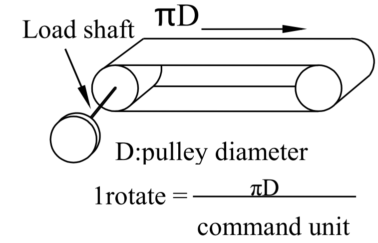
- Parameters P0-11 through P0-14 all relate to the electronic gear ratio. P0-11 and P0-12 form one group, while P0-13 and P0-14 form another group; however, the priority of the per-turn pulse count values for P0-11 and P0-12 takes precedence over those for the electronic gear ratios P0-13 and P0-14. The electronic gear ratios P0-13 and P0-14 will only be activated 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.

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

Step	Content	Explain
1	Confirm Mechanical Specifications	Verify the reduction ratio n:m (where the servo motor rotates m revolutions while the load shaft rotates n revolutions), 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 shaft to complete one full rotation.
5	Calculate the number of pulses M required 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 $\frac{P0-13}{P0-14}=\frac{\text{Encoder resolution}}{M}=\frac{\text{Encoder resolution}\times m}{N\times n}$ Priority: High → Low

- 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 DS5L2 series servo motor encoders offer resolution options 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 enhances 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 required 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)/(P0-92~95)	P0-13=524288 P0-14=6000 After the appointment P0-13=32768 P0-14=375	P0-13=524288 P0-14=1200 After the appointment P0-13=32768 P0-14=75	P0-13=524288 P0-14=7850 After the appointment P0-13=262144 P0-14=3925 Convert to the second gear ratio P0-92=2144 P0-93=26 P0-94=3925 P0-95=0

5.4.1.2 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	Unit	Set range	Revise	Activate

		settings				
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	Activate
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 3.2.4. To generate an SO2 output signal, set P5-37 and P5-38 to n.0002/0012. Note that each SO terminal can only serve one signal function.						

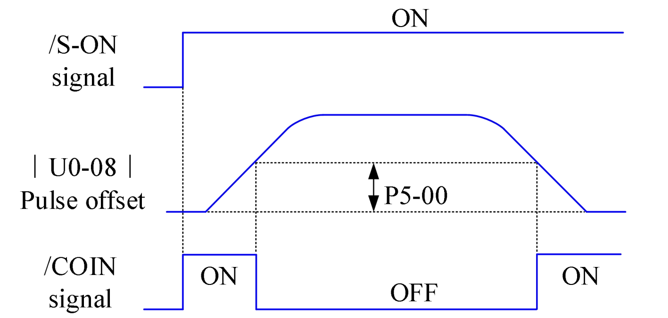
1. Conditions for completing signal output positioning

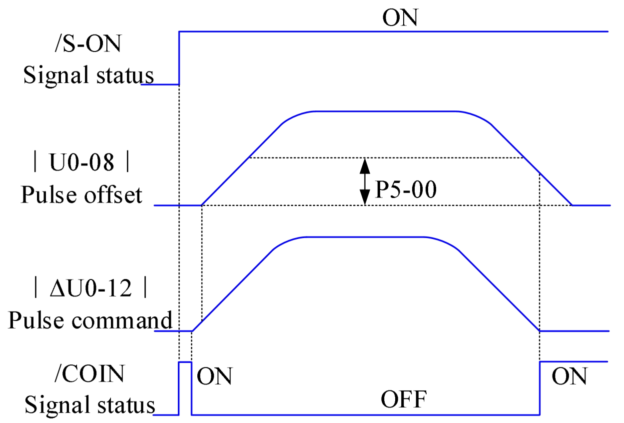
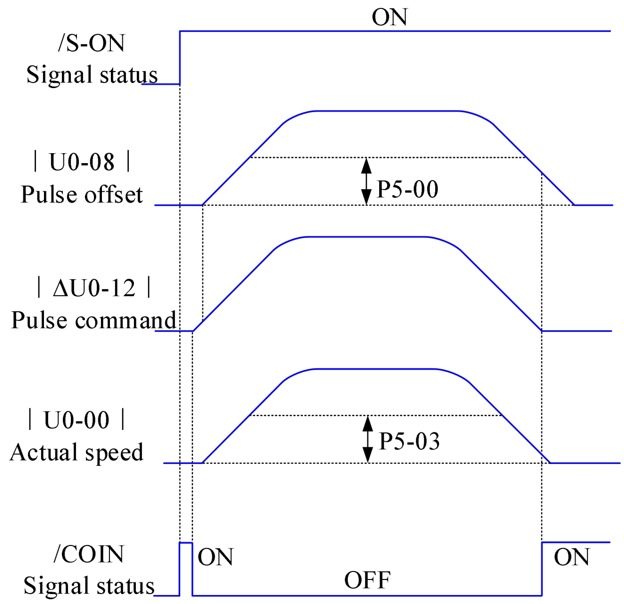
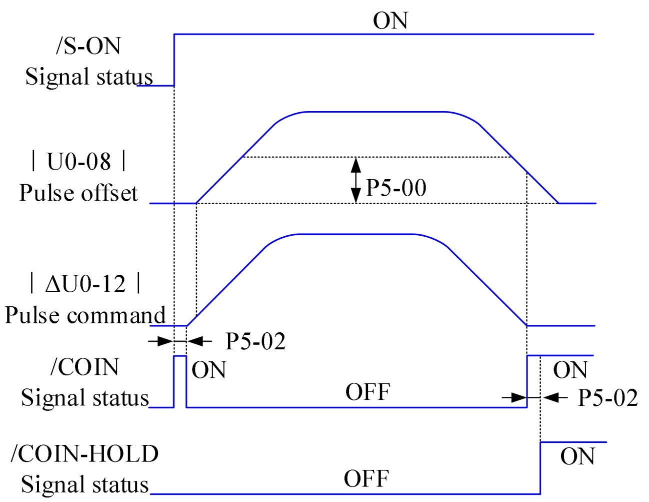
(1) COIN-HD Signal Output Conditions

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 by 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 will be output.	

Settings for P5-01	Content	Diagrammatic sketch
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.	
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 completion width P5-00 varies proportionally with changes in the electronic gear ratio, with a factory default value of 11 instruction 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: a smaller width results in delayed 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.

5.4.1.3 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.

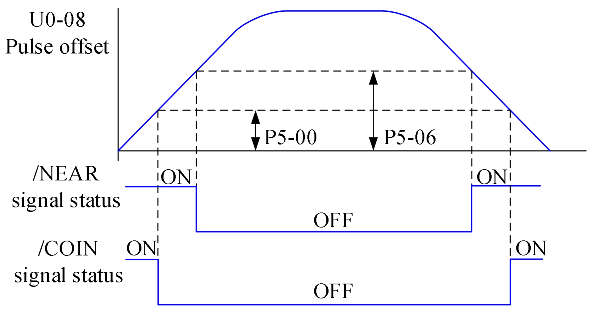
- relevant parameter

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P5-06	Approach Signal Output Width	50	Command Unit	0 ~ 65535	at any time	immediately

parameter	Signal Name	Factory Settings	Applicable Mode	meaning	revise	Activate
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 proximity 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 for one complete rotation of the motor.

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

5000	25
3000	15
2000	10

(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.

5.4.1.4 Instruction Pulse Inhibition (/INHIBIT)

Position instruction prohibition, including both internal and external position instructions. This function prevents pulse input for stop commands during position control. When the /INHIBIT signal is ON, pulse commands are no longer counted.

- relevant parameter

<table>
<tr><th>Parameter</th><th>Signal name</th><th>Factory settings</th><th>Applicable mode</th><th>Meaning</th><th>Revise</th><th>Activate</th></tr>
<tr><td>P5-32</td><td>/INHIBIT</td><td>n.0000</td><td>5|6</td><td>Instruction Pulse Prevention</td><td>at any time</td><td>immediately</td></tr>
<tr><td colspan="7">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.</td></tr>
</table>

1. Explanation of the validity of the /INHIBIT terminal

<table>
<tr><th>Parameter Setting Status</th><th>Signal/INHIBIT Terminal Input Status</th><th>Signal/INHIBIT Terminal Logic</th></tr>
<tr><td>P5-32=n.0000</td><td>No external terminal input required</td><td rowspan="3">Of No Avail</td></tr>
<tr><td>P5-32=n.000□</td><td>The SI□ terminal has no signal input.</td></tr>
<tr><td>P5-32=n.001□</td><td>The SI□ terminal has a signal input.</td></tr>
<tr><td>P5-32=n.0010</td><td>No external input terminals required</td><td rowspan="3">Valid</td></tr>
<tr><td>P5-32=n.000□</td><td>The SI□ terminal has a signal input.</td></tr>
<tr><td>P5-32=n.001□</td><td>The SI□ terminal has no signal input.</td></tr>
</table>

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

<table>
<tr><th rowspan="2">Control model</th><th colspan="2">Motor Operating Status</th></tr>
<tr><th>/INHIBIT terminal logic is valid</th><th>/INHIBIT terminal logic is invalid</th></tr>
<tr><td>5-Internal Position Control</td><td>Pause the current section</td><td>Set the INHIBIT signal from ON to OFF and resume execution from the pause point.</td></tr>
<tr><td>6. External Position Pulse Control</td><td>Pause pulse instruction reception</td><td>The INHIBIT signal switches from ON to OFF; operations continue after receiving a pulse command upon returning from OFF.</td></tr>
</table>

5.4.1.5 Deviation Removal (/CLR)

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

The position deviation cancellation function enables the drive to reset its position deviation to zero when the servo is OFF or a /CLR signal is received.

- relevant parameter

<table>
<tr><th>parameter</th><th>Signal Name</th><th>Factory Settings</th><th>Applicable Mode</th><th>meaning</th><th>revise</th><th>Activate</th></tr>
<tr><td>P5-34</td><td>/CLR</td><td>n.0000</td><td>All</td><td>Pulse Deviation Elimination</td><td>at any time</td><td>immediately</td></tr>
<tr><td colspan="7">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.</td></tr>
</table>

1. Validity of the CLR signal

<table>
<tr><th>Parameter Setting Status</th><th>Signal/CLR Terminal Input Status</th><th>Signal/CLR Terminal Logic</th></tr>
<tr><td>P5-34=n.0000</td><td>No external terminal input required</td><td rowspan="3">of no avail</td></tr>
<tr><td>P5-34=n.000□</td><td>The SI□ terminal has no signal input.</td></tr>
<tr><td>P5-34=n.001□</td><td>The SI□ terminal has a signal input.</td></tr>
<tr><td>P5-34=n.0010</td><td>No external input terminals required</td><td rowspan="3">valid</td></tr>
<tr><td>P5-34=n.000□</td><td>The SI□ terminal has a signal input.</td></tr>
<tr><td>P5-34=n.001□</td><td>The SI□ terminal has no signal input.</td></tr>
</table>

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.

5.4.1.6 Position Pulse Deviation Setting

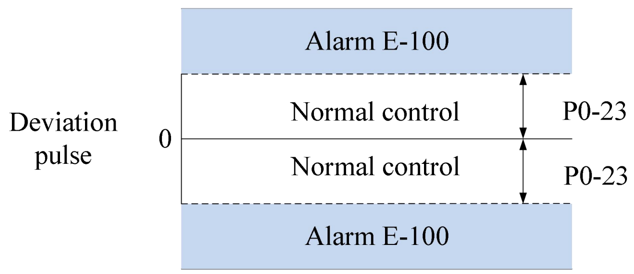
The pulse deviation value refers to the difference between the command pulse of an instruction controller (e.g., PLC) and the servo unit's feedback pulse in position mode, measured in 1 command units that correspond to those determined by the electronic gear ratio.

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	aCTIVATE
P0-23	Pulse Deviation Limit	2000	0.01 turn	0 ~ 65535	at any time	immediately

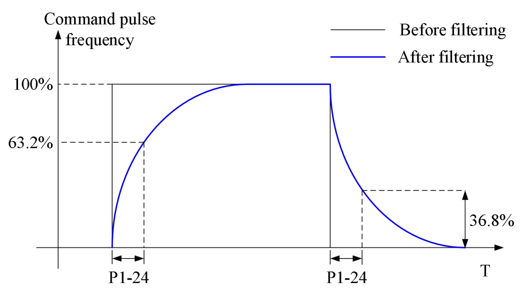
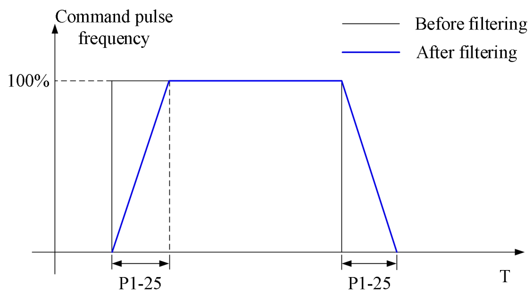
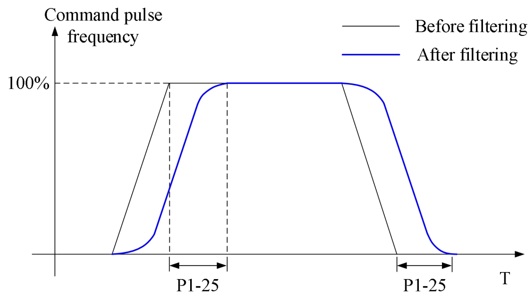
When the deviation pulse threshold is set to 0, the magnitude of deviation pulses will not be detected.



5.4.1.7 Position Command Filter

- relevant parameter

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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.

<table>
<tr><th>Position instruction acceleration/deceleration filtering</th><th>Position Command Smoothing Filter</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td></td><td>
</td></tr>
</table>

5.4.1.8 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 choose to locate the reference origin either on the forward rotation side or the reverse rotation side.

- Function Settings

Parameter	Meaning	Factory	Unit	Set range	Revise	Activate

		settings				
P4-00 n.xx(x	Origin Function	0	-	0 ~ 1	servo OFF	immediatel y
Note: This feature is available for 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. (For Version 3770 and later, set P9-21 to 0.)						

- Signal Settings

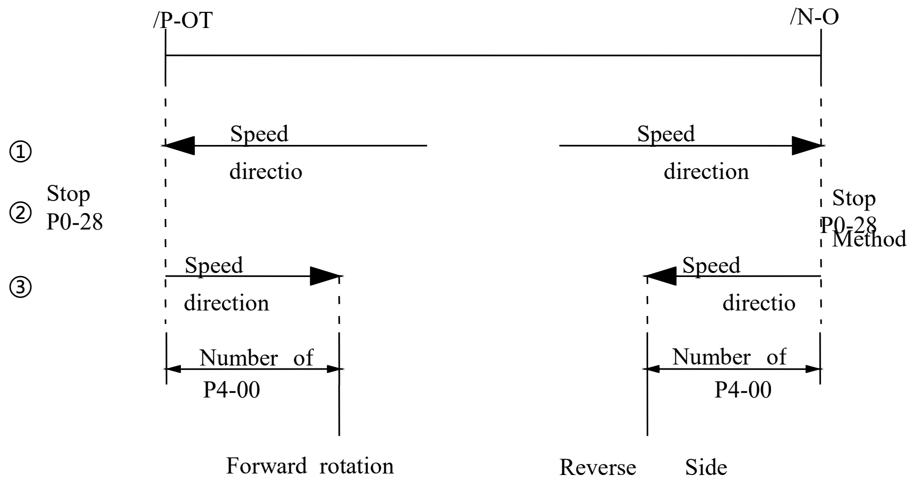
Parameter	Signal name	Factory settings	Meaning	Revise
P5-28	/SPD-A	n.0000	Mode 3: Internal Speed Selection Signal Mode 5: Find origin in forward direction	The parameter range is 0000–0014, assigned to the input interface via parameters P5–28. Setting it to 0001 indicates signal input from terminal SI1.
P5-29	/SPD-B	n.0000	Mode 3: Internal Speed Selection Signal Mode 5: Reverse Direction to Find Origin	The parameter range is 0000–0014, assigned to the input interface via parameters P5–29. Setting it to 0001 indicates signal input from terminal SI1.

- Related Parameter Settings

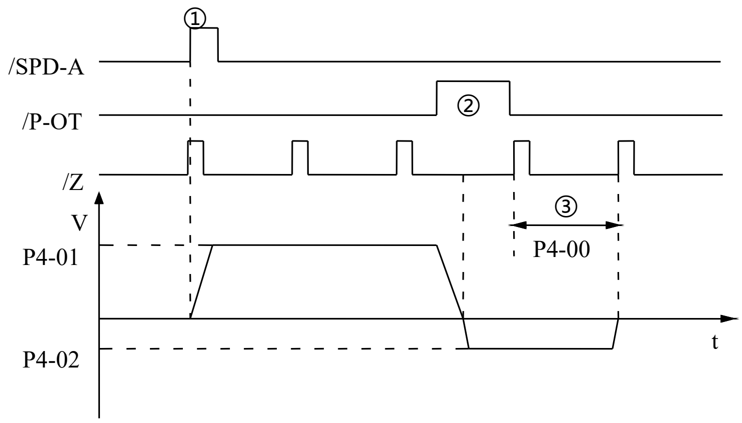
Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
P4-00 n.xxx☐	Z believes the number of signs	2	individual	0 ~ f	servo OFF	immediately
P4-00 n.(xxx	Return to the original state and complete automatic calibration of the encoder zero position	0	-	0 ~ 1	servo OFF	immediately
P4-01	Speed of collision with the proximity sensor	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 the encoder zero position to its original value using P4-00.3 (supported in version 4030 and later).

- 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 specified 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.

5.4.1.9 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 and returns to the origin point, completing 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 successful 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 value 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	Activate Time	Leave the factory Give tacit consent to
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 offsets	servo OFF	servo ON	200
P9-13	Return to the starting point at low speed	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 times here refer 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-based return-to-origin 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	Activate Time	Leave the factory Give tacit consent to
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 quantized pulse count	-9999~9999	-	Low-bit value of quantized 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/Old Return to Origin Function Selection	0、1	-	P9-21=0: Return to origin function P9-21=1: Return to Origin Function	servo OFF	Power On Again	0

Parameter	Name	Set range	Unit	Meaning	Setting Time	Activate Time	Leave the factory Give tacit consent to
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

The actual mechanical offset = P9-19 + P9-20 × 10,000, where P9-19 and P9-20 must share the same sign (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	Activate time	leave the factory give tacit consent to
P5-22	Positive Overtravel Signal POT	0~ffff	Forward limit signal in origin return mode	Operation Settings	immediately Activate	3
P5-23	Reverse Overlimit Signal NOT	0~ffff	Reverse limit signal in origin return mode	Operation Settings	immediately Activate	4
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 Activate	0

parameter n.xxxx	name	setting scope	meaning	Set Time	Activate time	leave the factory give tacit consent to
P5-64	Origin Switch Signal	0~ffff	The process of returning to the origin requires a switch signal at the origin.	Operation Settings	immediately Activate	0
P5-28	The SI terminal returns to its original 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 Activate	0

3. Select New Origin Mode

Using the reset-to-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 both be applied simultaneously. 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 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 zero return; 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).

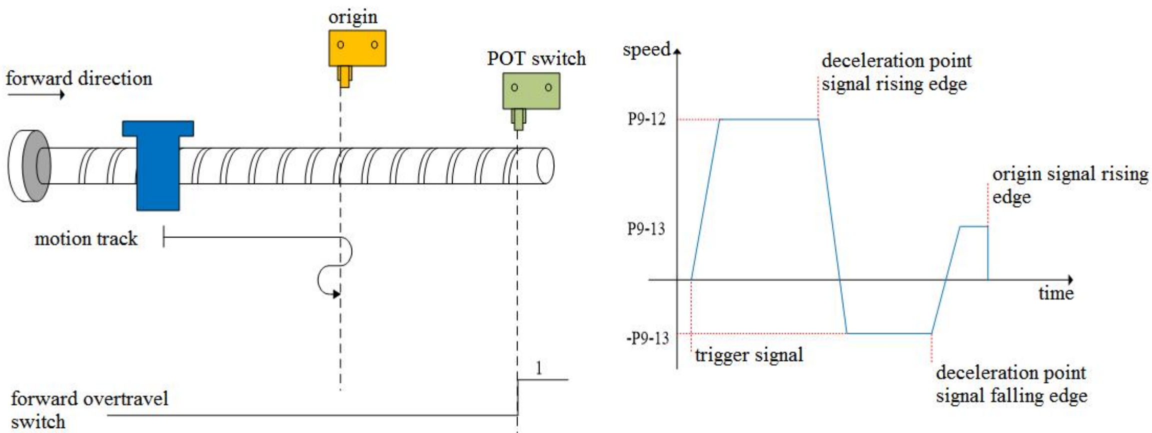
To use this mode, connect the POT, NOT, and origin switches.

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

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 returning 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 (origin low-speed mode) during the signal rising edge detection process; stop immediately upon detecting the deceleration point (origin) signal's rising edge.

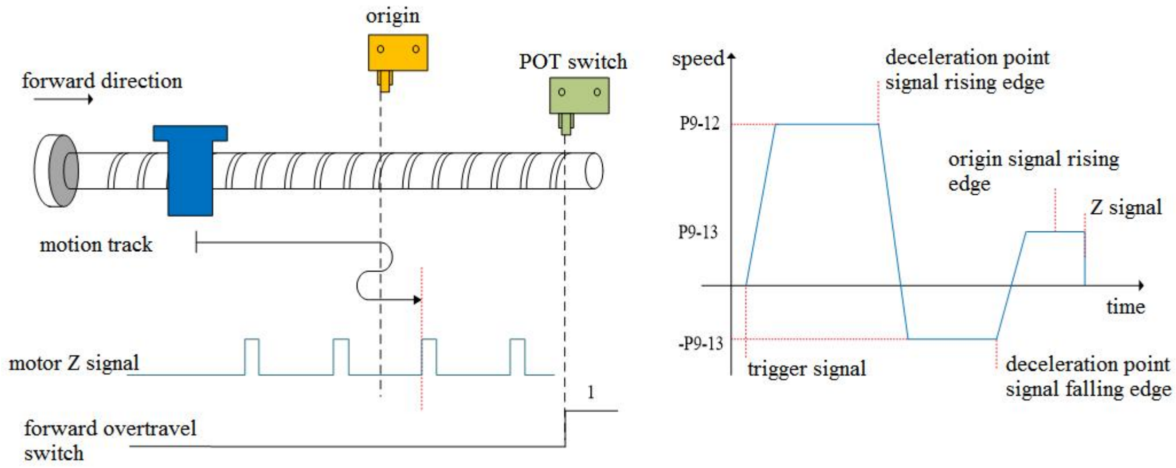


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

During the low-speed search for the deceleration point (origin) using command P9-13 (return to origin at low speed), 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 at low speed), based 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 (origin) signal's rising edge, proceed accordingly, then stop immediately upon identifying 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:

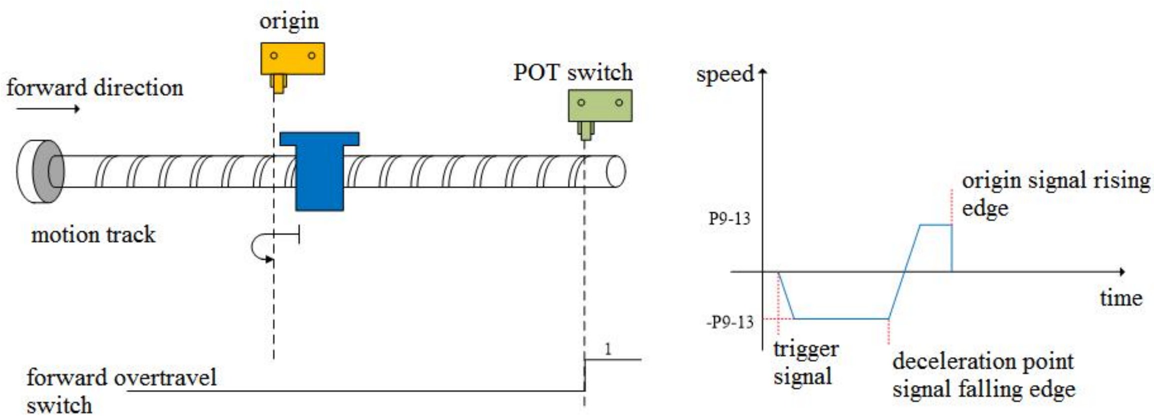
While continuing the low-speed search for the deceleration point (origin) signal's rising edge using P9-13 (return-to-origin low-speed speed), proceed until encountering the deceleration point; upon detecting the first Z-axis signal, stop immediately. After the motor has completely stopped, drive it forward at the speed set by P9-13 (return-to-origin low-speed speed) for a predetermined number of pulses (P9-19, P9-20) in either positive or negative direction, 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 of P9-13 (return-to-origin low-speed speed) to search for the deceleration point (origin) at low speed in reverse direction upon detecting the falling edge of the deceleration point signal; upon encountering this edge, it reverses direction (i.e., moves forward) and continues searching for the deceleration point (origin) at low speed using P9-13 (return-to-origin low-speed speed) by following the rising edge of the deceleration point 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.

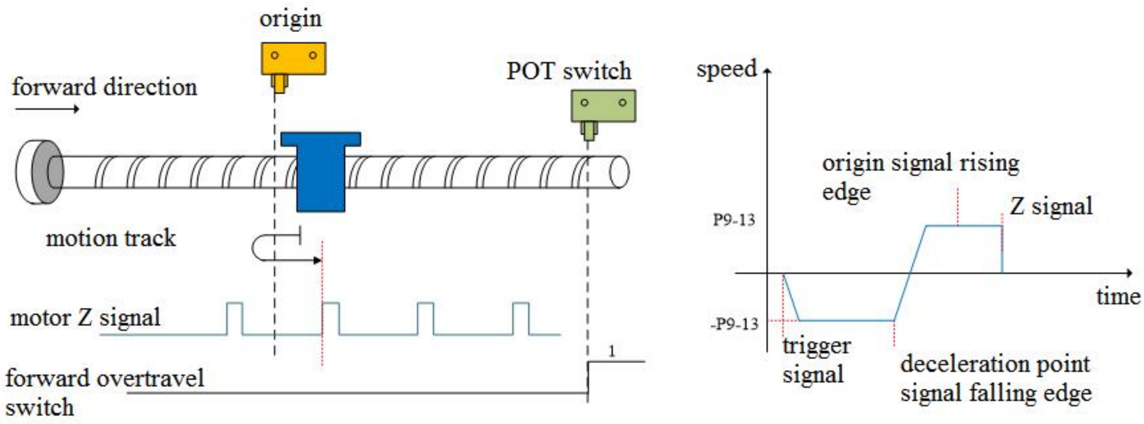


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

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), as indicated by P9-19 and P9-20, before final shutdown.

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:

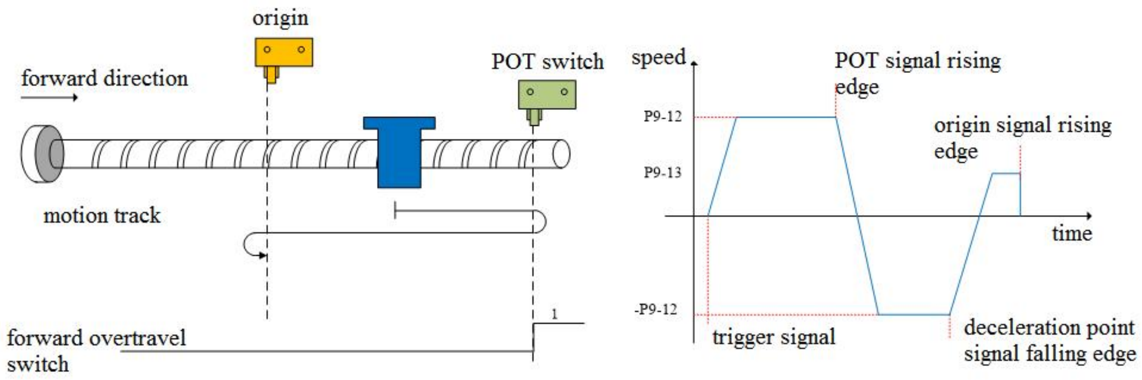
During forward acceleration or constant-speed operation, continue running upon encountering the rising edge of the origin signal; immediately stop when the first Z-axis signal is detected. After the motor has completely ceased rotation, proceed at the speed set by P9-13 (low-speed return to origin) for 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 operating, the origin switch (reduction point) signal is invalid (signal terminal assigned by P5-64:0 = invalid, 1 = valid); during operation, the forward overtravel 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 detecting 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 operation. 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 procedure 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 forward operation, immediately stop the machine upon encountering the rising edge of the origin signal.

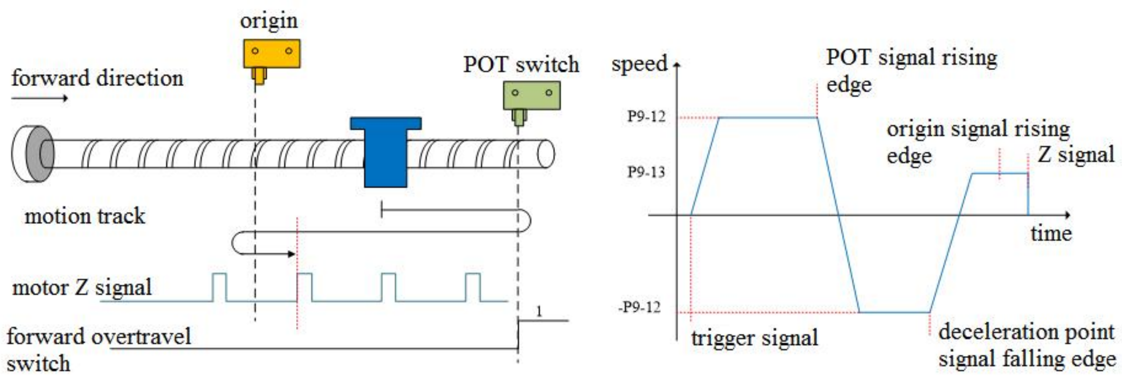


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

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 (low-speed return to origin), covering a fixed distance as indicated by pulses P9-19 and P9-20, before final 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 (P9-19, P9-20), after which the motor stops.

(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).

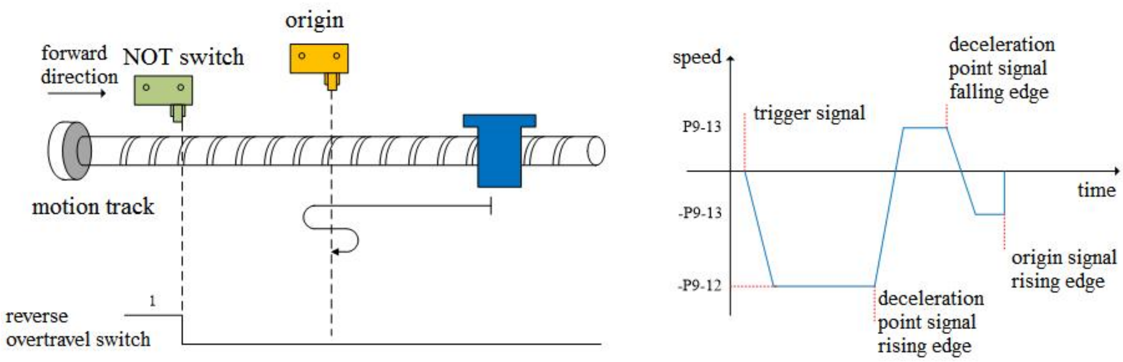
To use this mode, connect the POT, NOT, and origin switches.

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

The servo motor first performs a 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 this signal. It then accelerates gradually 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 conducts a low-speed forward search 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 the low-speed search 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.

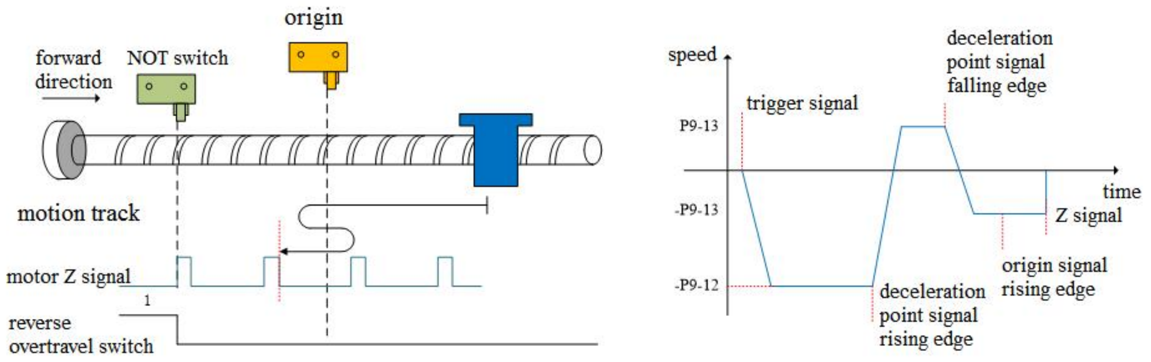


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

Continue the low-speed search for the deceleration point (origin) using command P9-13 (return to origin at low speed). During signal rise-time execution, stop immediately upon detecting the deceleration point signal's rising edge; once the motor has fully ceased rotation, proceed with a fixed number of pulses (P9-19 and P9-20) at the speed set by P9-13 (return to origin at low speed), following the specified direction (positive or negative), 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 the low-speed search for the deceleration point (origin) using-P9-13 (low-speed return to origin). 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:

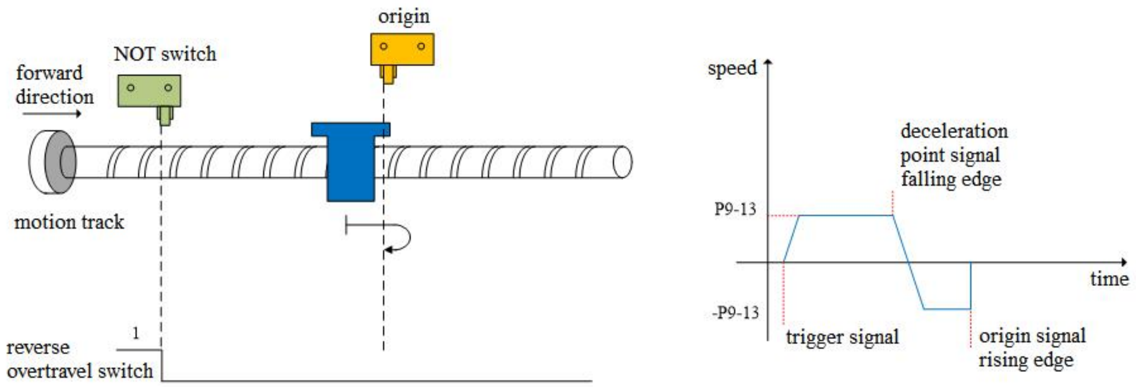
Continue the low-speed search for the deceleration point (origin) using command P9-13 (return to origin at low speed). During signal ascent, proceed until encountering the deceleration point; upon detection, stop immediately. After complete motor cessation, execute a fixed number of pulses (P9-19 and P9-20) according to the preset mechanical offset quantity and direction (positive or negative), then halt the motor.

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

The servo motor directly detects the falling edge of the signal indicating the deceleration point (origin) using the set value P9-13 (low-speed speed for returning to origin). Upon detecting this falling edge, it reverses direction (i.e., moves in the opposite direction) and continues searching for the deceleration point (origin) by following the rising edge of the signal with-P9-13 (low-speed speed for returning to origin). 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.

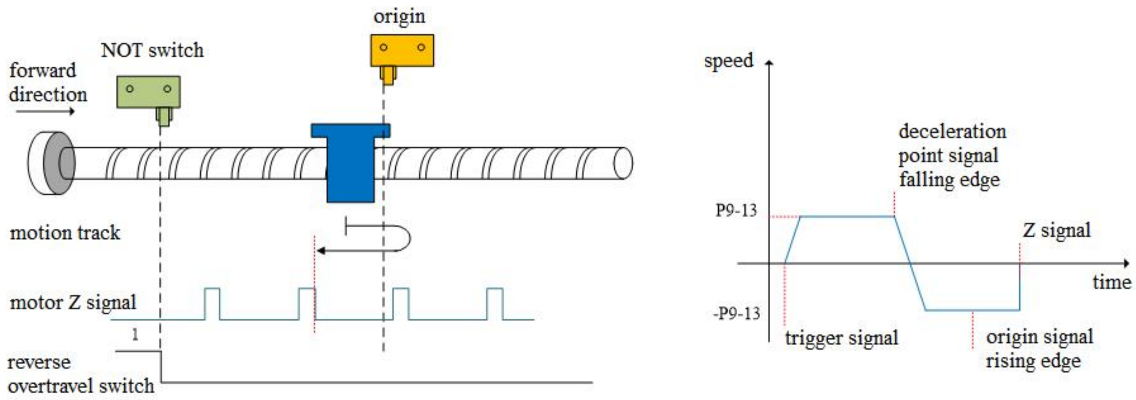


② The number of Z phases is P9–11.0 = 0, and the mechanical offsets (P9–19, P9–20) are not zero:

During negative acceleration or negative constant-speed operation, the system shall immediately stop upon encountering the rising edge of the origin signal; 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), 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:

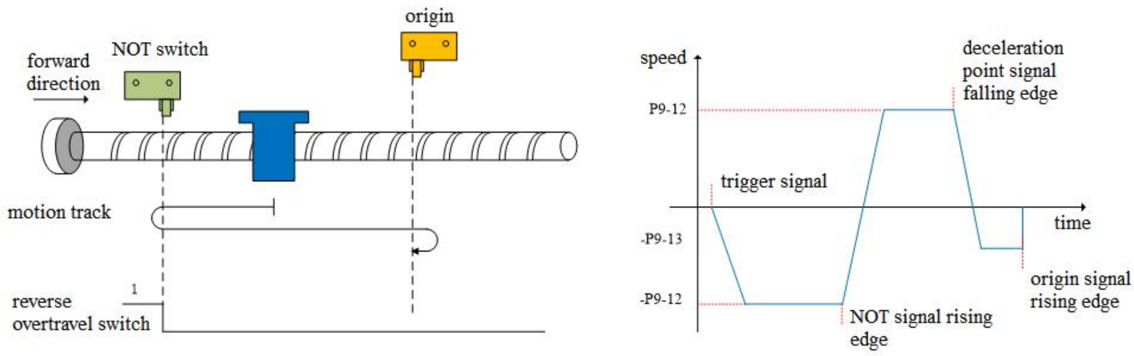
During negative acceleration or negative constant-speed operation, continue running after encountering the rising edge of the deceleration point (origin) signal; immediately stop upon detecting the first Z-axis signal. Once the motor has completely ceased rotation, drive it at the speed set via P9-13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

3) 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 speed). 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 return to origin), immediately searching for the deceleration point (origin) signal's falling edge while maintaining high speed in forward direction. After detecting the deceleration point (origin) signal's falling edge, the motor decelerates and reverses direction (i.e., moves backward) according to the setting value P9-14 (acceleration/deceleration time for return to origin). It then searches for the deceleration point (origin) signal's rising edge at low speed in reverse direction using-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 reverse acceleration or constant-speed reversal operation, immediately stop the machine upon encountering the rising edge of the origin signal.

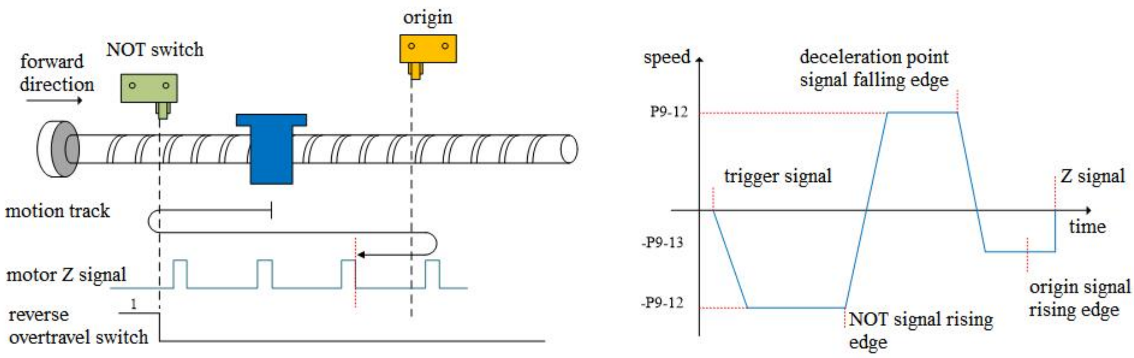


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

During 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 execute a predetermined number of pulses with specified mechanical offset values and direction (positive or negative) at the speed set in P9-13 (low-speed return to origin), covering a fixed distance as defined by pulses P9-19 and P9-20 before final 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, proceed 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)

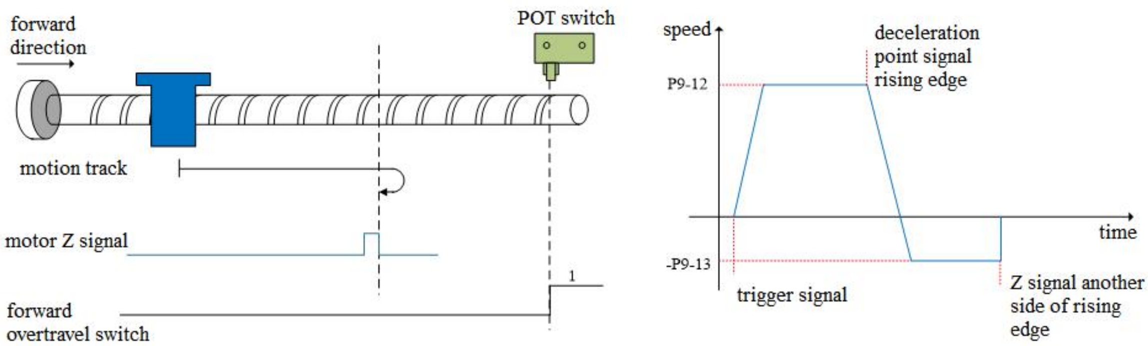
This mode does not determine the number of Z phases for the motor. To use this mode, connect POT and NOT.

1) When the motor starts moving, the Z signal is either invalid or valid (signal terminal assigned by P5-64:0 = invalid, 1 = valid), and no forward overshoot 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 (P9-19, P9-20) is not equal to 0:

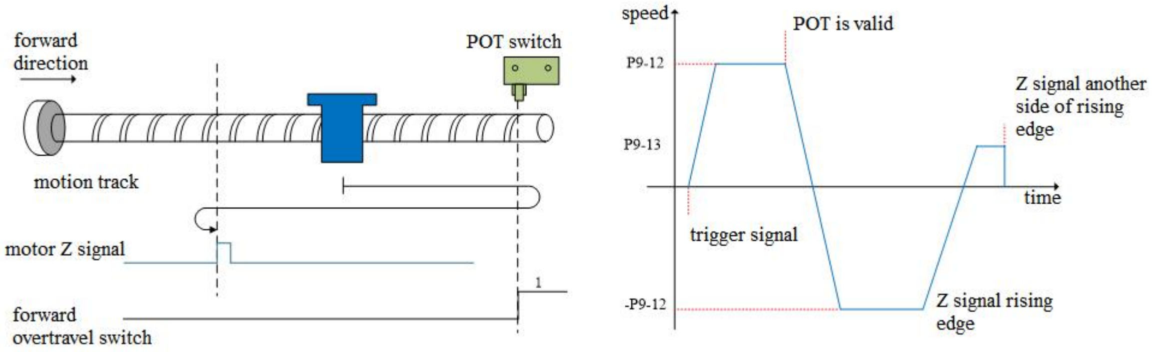
During reverse acceleration or constant-speed reverse operation, the motor stops immediately upon encountering the rising edge on the opposite side of the Z signal. After complete motor cessation, the motor advances a predetermined number of pulses (P9-19 and P9-20) at the speed set in P9-13 (low-speed 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 to P5-64:0 = invalid, 1 = valid); during operation, this triggers the forward overshoot switch (POT, P5-22).

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 overshoot 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 the forward direction 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 in 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 (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 on the opposite side of the Z signal. After complete cessation, the motor 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.

(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).

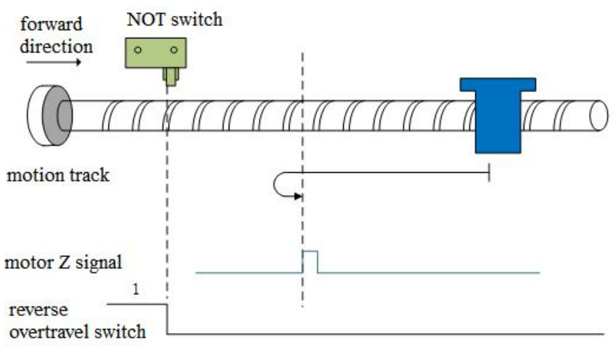
This mode does not determine the number of Z phases for the motor. To use this mode, connect POT and NOT.

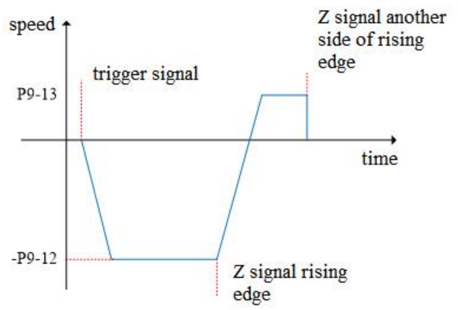
1) When the motor starts operating, the Z signal must be either invalid or valid (signal terminal assigned by P5-64:0 = invalid, 1 = valid), and the reverse overtravel switch (NOT) must not be triggered throughout the entire process.

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 the setting value P9-14 (acceleration/deceleration time for origin return), then accelerates to the setting value 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 (P9-19, P9-20) is not equal to 0:

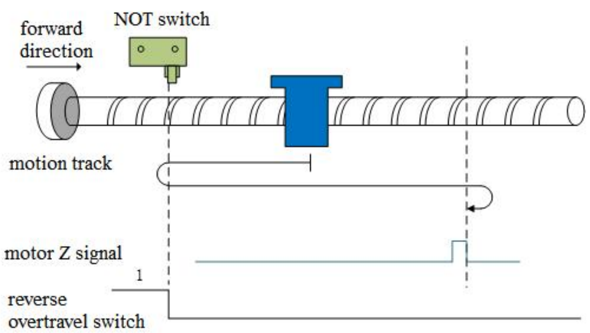
During forward acceleration or constant-speed operation, the motor stops immediately upon encountering the rising edge on the opposite side of the Z signal. After complete cessation, the motor advances a predetermined number of pulses (P9-19 and P9-20) at the speed set by P9-13 (low-speed return to origin),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

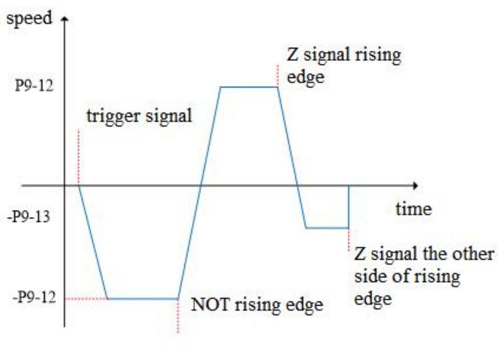
2) When the motor starts moving, the Z signal is either invalid or valid (signal terminal assigned by P5-64:0 = invalid, 1 = valid); during operation, this triggers the reverse overtravel switch (NOT).

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 (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).

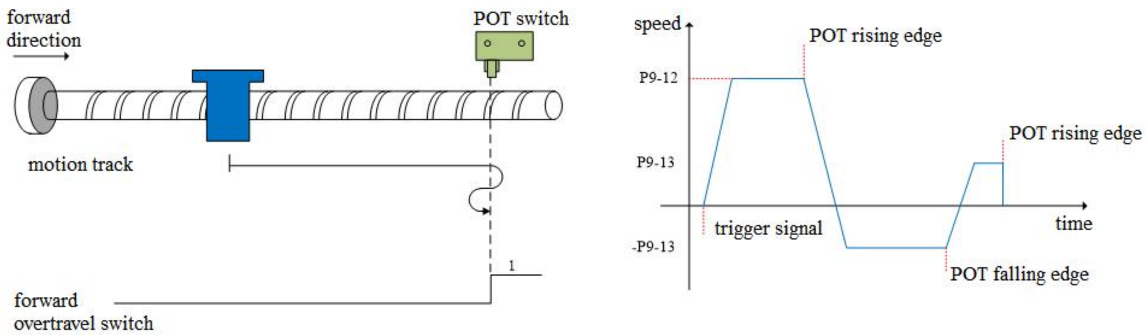
To use this mode, connect NOT and POT.

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.

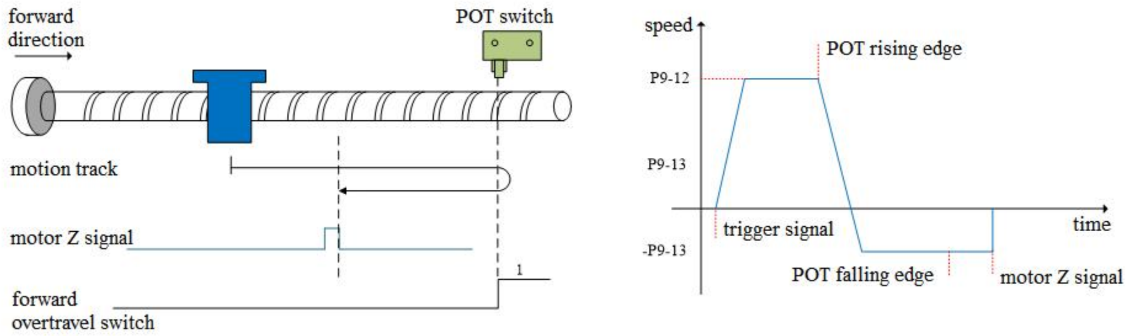


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

Reverse the deceleration (i.e., return to forward motion), and using P9-13 (returning to low-speed speed at origin), perform a low-speed search for the rising edge of the forward overshoot switch signal. During forward acceleration or constant-speed operation, immediately stop the motor upon encountering the rising edge of the forward overshoot switch signal; after complete motor cessation, proceed with a fixed number of pulses according to the preset mechanical offset value and direction (only negative direction is allowed, i.e., movement must occur between the origin switch and NOT position), 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:

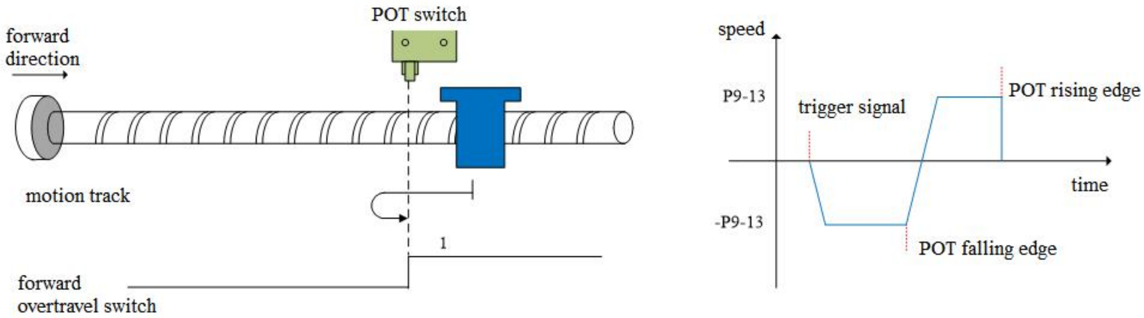
Continue reverse operation at the low speed setting specified by P9-13 (returning to the origin at low speed). Upon encountering the rising edge of the first Z signal, stop immediately. Once the motor has completely ceased rotation, proceed with a fixed number of pulses according to the preset mechanical 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 (returning to the 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 searches in reverse low speed using the set value-P9-13 (low-speed return to origin) for the falling edge of the forward overtravel 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 motion): Use P9-13 (return to origin at low speed) to detect the rising edge of the POT signal during low-speed forward search. During forward acceleration or constant-speed operation, immediately stop when encountering the POT rising edge.

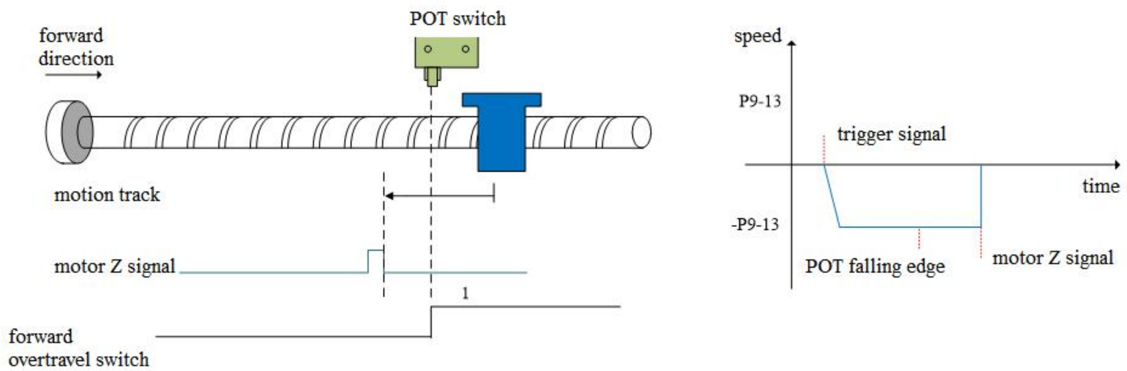


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

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 the motor upon detecting the POT rising edge; once the motor has completely stopped, 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 set 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: the deceleration point and origin are defined by the reverse overtravel switch NOT (P5-23) (P9-11.2=5).

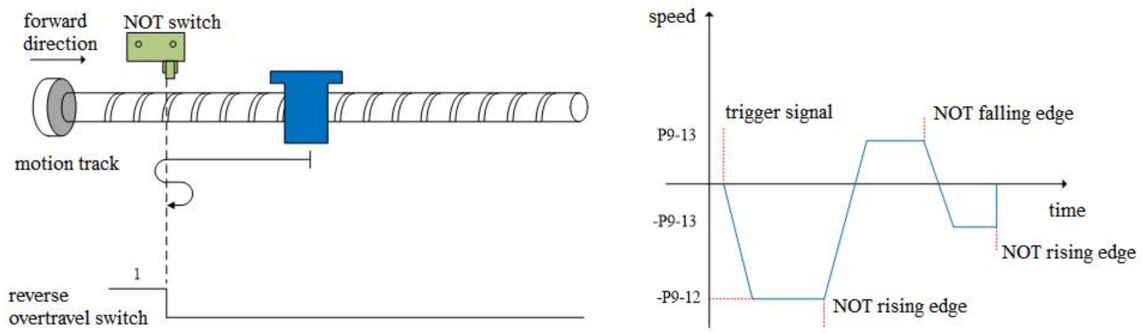
To use this mode, connect POT and NOT.

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 P9-12 setting (return-to-origin high-speed speed). Upon detecting the rising edge of NOT, it gradually decelerates and reverses direction according to the P9-14 setting (return-to-origin acceleration/deceleration time). Then, it conducts a forward low-speed search for the NOT's falling edge using the P9-13 setting (return-to-origin low-speed speed). 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 search for the NOT rising edge at reverse low speed. During reverse acceleration or constant-speed reversal, stop immediately upon encountering the NOT rising edge.

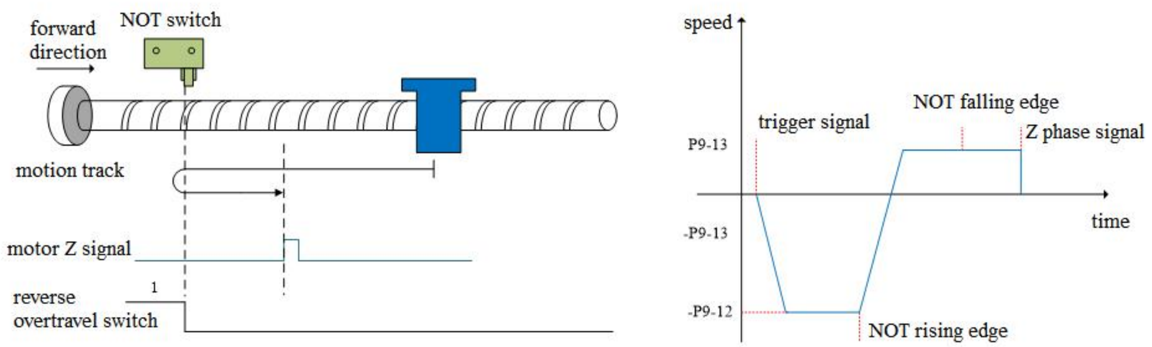


② The number of Z phases (P9−11.0) is 0, and the mechanical offsets (P9−19, P9−20) are non-zero:

Reverse deceleration (i.e., 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 overshoot switch signal (NOT). During reverse acceleration or constant-speed reversal, immediately stop the motor upon encountering the NOT rising edge; after complete motor cessation, proceed with a predetermined number of pulses and in the specified direction (only forward, i.e., movement between the origin switch and POT) according to the set mechanical offset value. The motor then travels a fixed distance at the speed set by P9-13 (returning to the origin at low speed), 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 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:

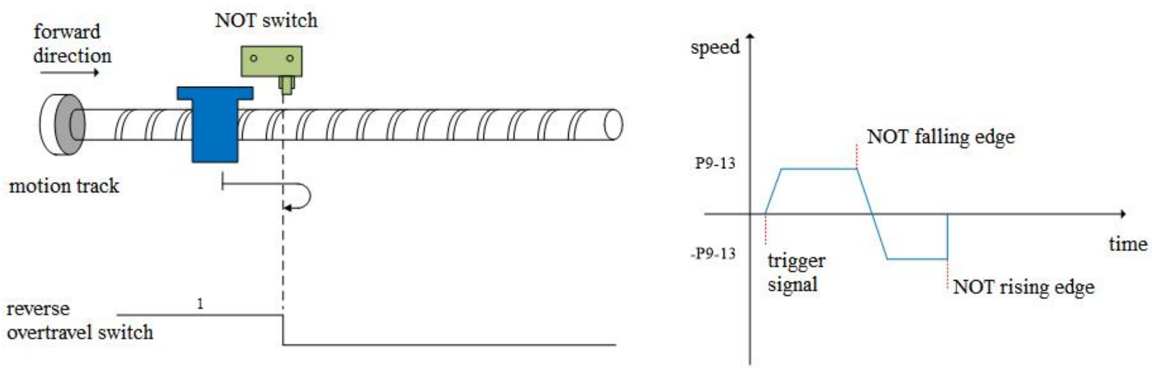
Continue forward operation at low speed set by P9-13 (returning to origin at low speed), then stop immediately upon encountering the rising edge of the first Z signal. Once the motor has completely stopped, proceed according to the preset number of pulses and direction for mechanical offset (which can be either positive or negative, but must move between the origin switch and the POT) to execute a fixed sequence of pulses (P9-19, P9-20) 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 monitors the falling edge of the NOT signal (reverse overtravel switch signal) at the forward low-speed setting value P9-13 (return-to-origin low-speed speed). 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 reverse speed travel, stop immediately upon encountering the NOT rising edge.

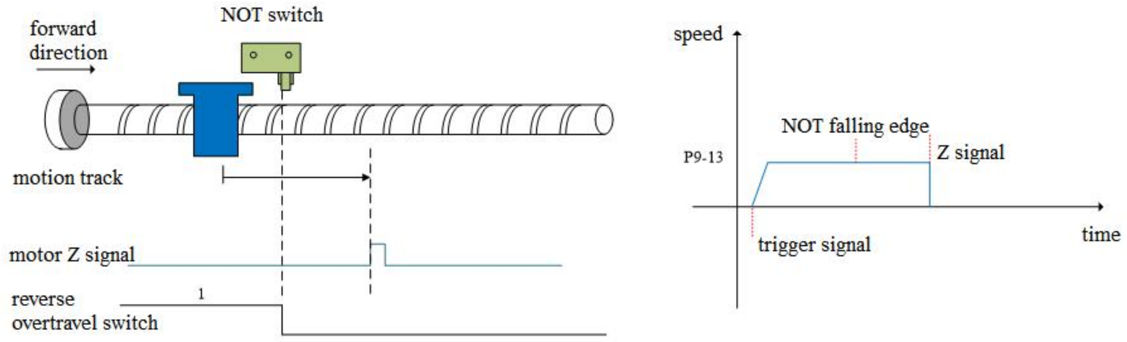


② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

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 via 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:

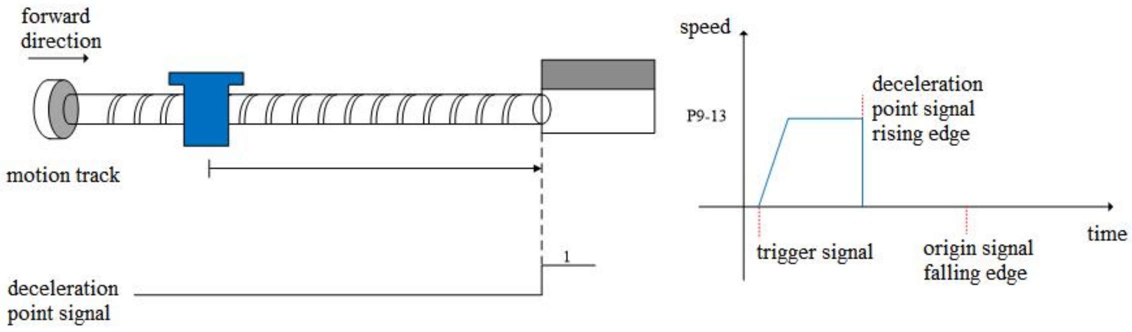
Continue forward operation at low speed set by P9-13 (returning to origin at low speed), then stop immediately upon encountering the rising edge of the first Z signal. Once the motor has completely stopped, proceed according to the preset number of pulses and direction for mechanical offset (which can be either positive or negative, but must move between the origin switch and the POT) to execute a fixed sequence of pulses (P9-19, P9-20) 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.

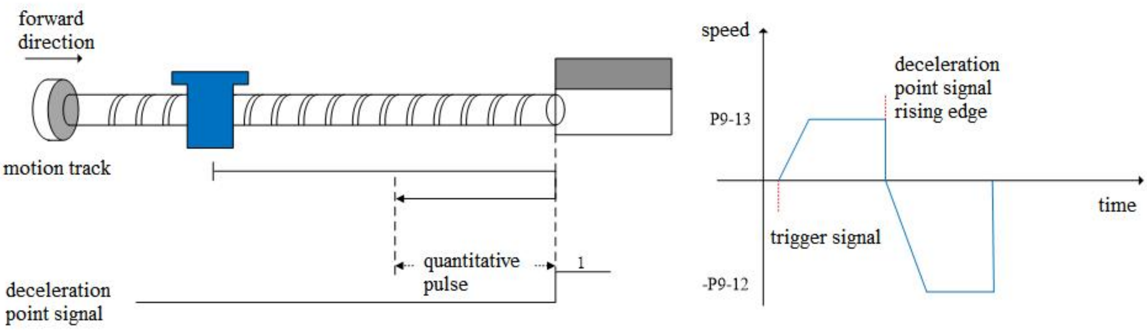
The servo motor first operates forward at low speed using the P9-13 setting (low-speed return to origin). Upon reaching the mechanical limit position, if the absolute torque value reaches the upper limit of P9-17 (stop-triggered return-to-origin torque threshold) while the absolute speed remains below 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-phase positions (P9-11.0) is 0 and the mechanical offset values (P9-19, P9-20) are both 0, stop immediately.



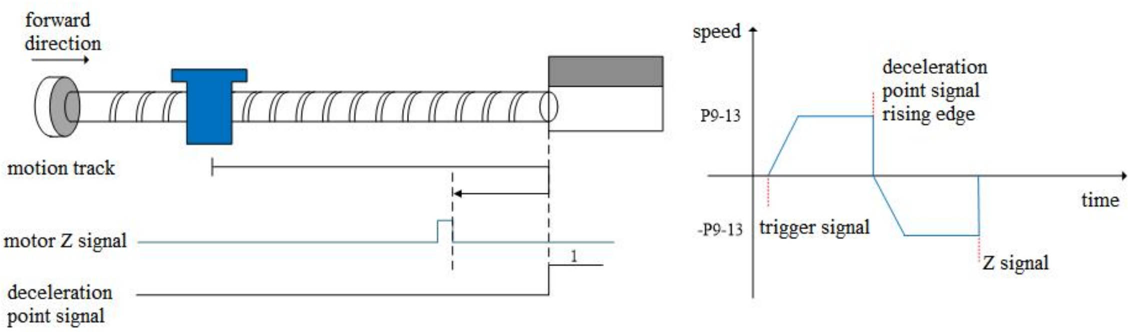
② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

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.



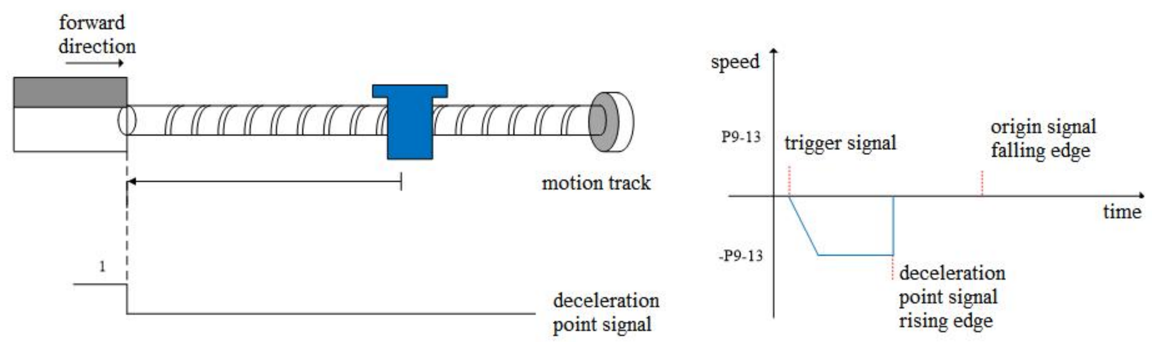
④ The number of Z phases (P9-11.0) is 1, and the mechanical offset values (P9-19, P9-20) are not zero:

Perform low-speed reverse operation using the-P9-13 setting (returning to origin at low speed), then stop immediately upon encountering the rising edge of the first Z-axis signal. After complete cessation, the motor will execute a fixed number of pulses at the speed set by-P9-13 (returning to origin at low speed); this operation may occur in either forward or reverse direction, but must remain within the mechanical limit range, before the motor stops 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)

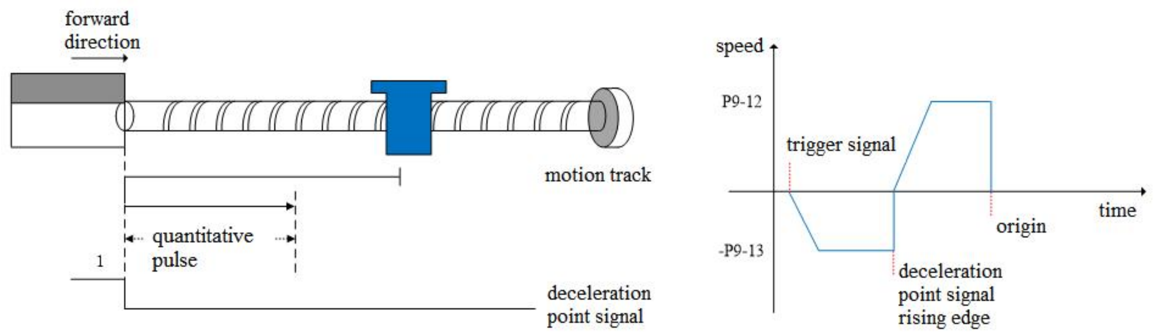
With this mode, you don't need to connect the POT, NOT, or origin switches.
The servo motor first operates in reverse at low speed using the set value P9-13 (low-speed return to origin). Upon reaching the mechanical limit position, if the absolute torque value reaches P9-17 (stop-triggered origin-return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

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



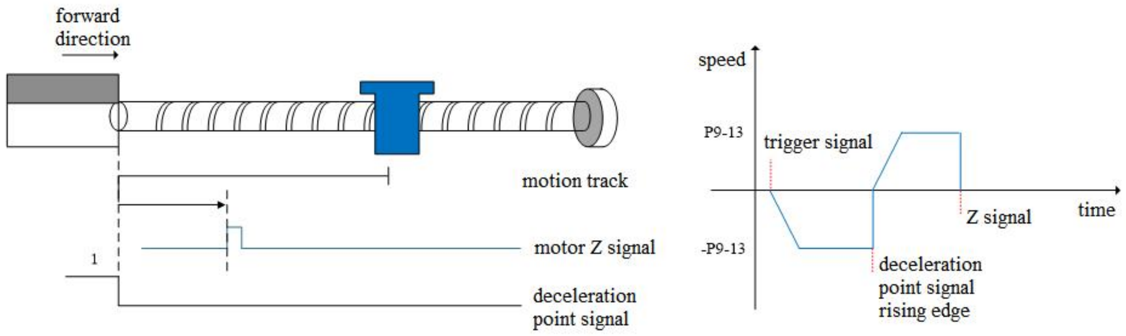
② The number of Z phases (P9–11.0) is 0, and the mechanical offsets (P9–19, P9–20) are non-zero:

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 it 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 mode). Upon encountering the rising edge of the first Z-axis signal, stop immediately. After complete cessation, 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 mode); this operation may occur in either forward or reverse direction, but must remain within the mechanical limit range. Subsequently, the motor stops.

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 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.

5.4.2 Position Control (External Pulse Sequence Command)

parameter	essentials	Reference Chapter
P0-01 Control Method Selection	Set to 6: External Pulse Mode	5.4.2.1 External Pulse Position Mode
P0-10 Pulse Instruction Format	Set Pulse Shape 0：CW/CCW 1：AB 2：P+D	5.4.2.2 Positive Direction of Pulse Instructions and Pulse Shape
P0-11 Set the number of pulses per motor revolution *1	Number of command pulses required for the motor to complete one full rotation	5.4.1.1 Electronic Gear Ratio

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	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.	5.4.2.2 Positive Direction of Pulse Instructions and Pulse Shape

5.4.2.1 External Pulse Position Mode

parameter	set value	meaning	revise	Activate
P0-01	6	Use external pulse sequence commands for position control	servo OFF	immediately

5.4.2.2 Positive Direction of Pulse Instructions and Pulse Shape

1. Selection of the positive direction for pulse commands

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P0-09.0 n.xxx□	Pulse instruction positive direction	0	-	0/1	servo bb	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	Activate
P0-09.2 n.x□xx	Pulse instruction filtering time	F	4.167ns	0~F	servo bb	Power On Again
P0-09.2 represents the pulse filtering time, which enhances interference resistance for low-speed pulses (below 200 kHz). When the input frequency is below 700 kHz, the maximum filtering time F should be used; when the input pulse frequency exceeds 1 MHz, the filtering time must not exceed 7.						

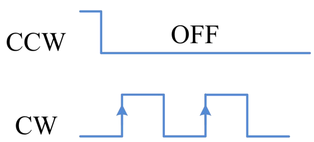
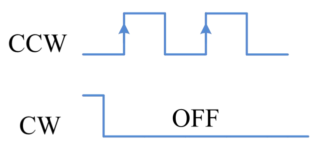
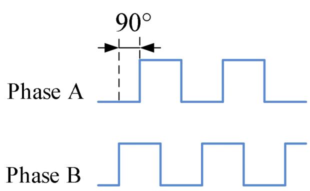
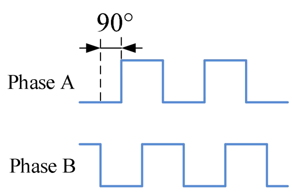
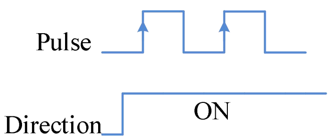
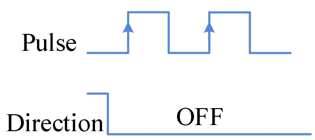
parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P0-09.3	Input Pulse Instruction Filtering Pre-allocation	0	-	0~7	servo bb	Power On Again

n.□xxx						
Set P0-09.3 to n (range 0–7); the number of received pulses will be equal to 2^n－n, and the received frequency will also be 2^n－n. For example, if each cycle contains 10,000 pulses, transmit 10,000 pulses at a frequency of 10,000. When P0–09 = 1000, then U0–12 = 5000, and the speed of U0–00 is reduced to 2^n times its original value.						

2. Selection of Pulse Instruction Patterns

Parameter	Meaning	Setting	Meaning	Revise	Activate
P0-10 n.xxx□	Pulse Instruction Format	0	CW、CCW pattern	servo bb	immediately
		1	AB Xiang		
		2	Pulse + Direction (factory default)		

3. Detailed Description of the Instruction Pulse

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

4. Pulse Specifications

Pulse Specifications		Maximum Input Frequency	Voltage specification	Forward current
Low-speed pulse	Open-circuit collector signal	200Kpps	24V	<25mA
	differential wave	500Kpps	3.3~5V	<25mA

5.4.3 Position Control (Internal Position Instructions)

Parameter	Essentials	Reference Chapter
P0-01 Control Method Selection	Set to 5: Internal Position Mode	5.4.3.1 Internal Position Patterns
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	5.4.3.2 Internal Position Mode Settings
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	5.4.3.4 Step-change Signal (/CHGSTP) 5.4.1.4 Instruction Pulse Inhibition (/INHIBIT) 5.4.3.5 Skip the current segment signal (/ZCLAMP)
The number of Z-phase 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: Find the reference origin on the reversal side in position mode / SPD-B	Internal Position Return to Origin Settings Parameters	5.4.1.8 Reference Origin
Any setting for position F2-09 35	Number of Communication Settings Sections	5.4.3.6 Communication Setting Segment Number

5.4.3.1 Internal Position Patterns

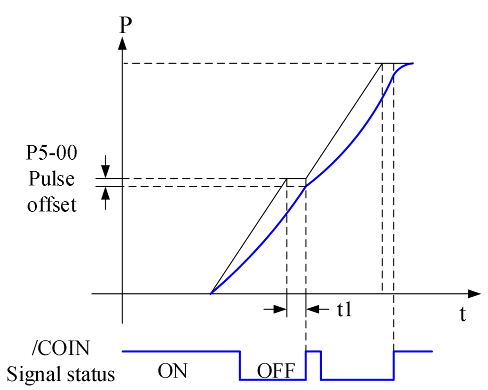
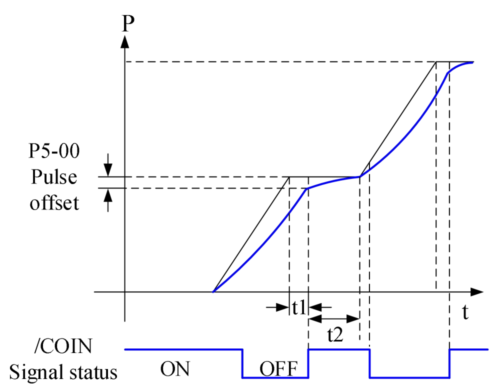
Parameter	Set value	Meaning	Revise	Activate
P0-01	5	Use preset values in the servo unit's internal registers for position control.	servo bb	immediately

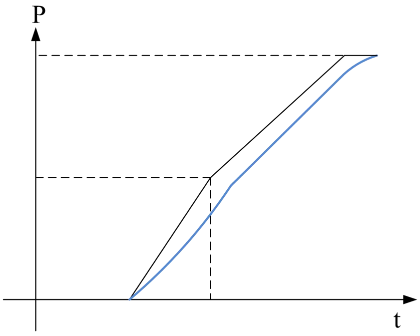
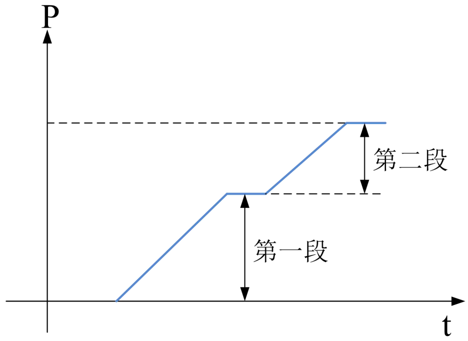
5.4.3.2 Internal Position Mode Settings

Parameter	Parameter functions	Set unit	Factory settings	Applicable mode	Revise	Activate
P4-03	Internal Location Mode Settings	-	n.0000	5	servo bb	immediately
	parameter setting	Functionality Overview	Factory Settings	Set Range		
	n.□xxx	insignificance				
	parameter setting	Functionality Overview	Factory Settings	Set Range		
	n.x□xx	Waiting Mode	0	0 ~ 1		
	n.xx□x	Step Change Mode	0	0 ~ 6		
	n.xxx□	positioning mode	0	0 ~ 1		

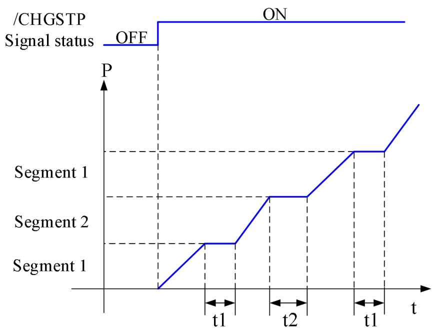
1. Wait Mode

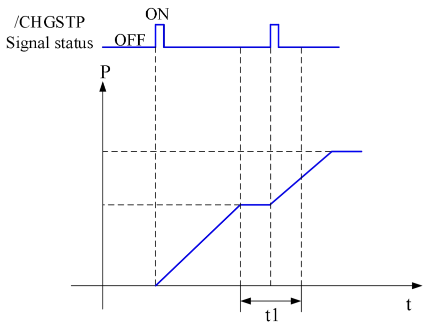
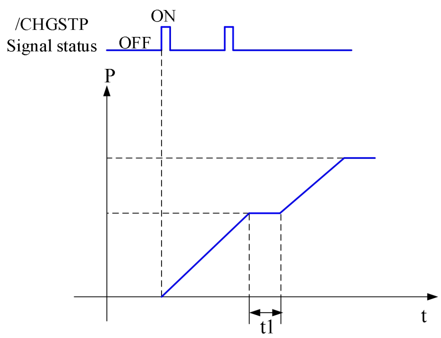
n.x□xx	Meaning
0	Waiting for the process to complete
1	Do not wait for positioning to complete
Note: Wait mode determines whether to wait for motor positioning completion after sending a position command to the drive when the internal position is set. This mode applies in all step-change modes.	

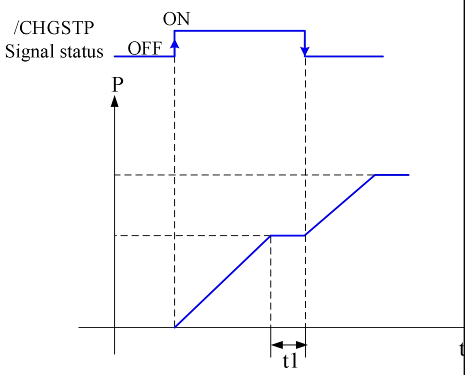
<table>
<tr><th>Waiting Mode = 0, Adjustment Time = 0 ms</th><th>Waiting Mode = 0, Adjustment Time> 0 ms</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>After sending a position command, the driver waits until the motor completes positioning before immediately initiating the next position command. In</td><td>After issuing a position command, the driver waits for the motor to complete positioning before initiating the next command after the adjustment period. In the diagram, t1 denotes</td></tr>
</table>

the diagram, t1 represents the positioning time—the interval between pulse transmission and the output of the positioning completion signal.	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 position 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 sending 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 Step when Signal ON; 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.

n.xx□x	Define	
1 The signal transitions on the rising edge, executed in single steps;	 	Taking the two-stage setup as an example, t1 = P4-16 in the diagram. 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. 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.
2 The signal rising edge initiates execution of all steps sequentially without looping.	 	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.
3 Communication Setting Number	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.	

<table>
<tr><th>n.xx□x</th><th colspan="2">Define</th></tr>
<tr><td>4
/CHGSTP
Bilateral
Trigger
Edge</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 full operation of the first segment, the /CHGSTP signal remains ON until its end.
2. Only in this mode, the valid segment count for P4-04 is disabled (but cannot be set to 0).
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,
with
options
ranging
from 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 position)</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 proximity 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 at the edge 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 position section even after the overtravel signal is cleared.</td></tr>
</table>

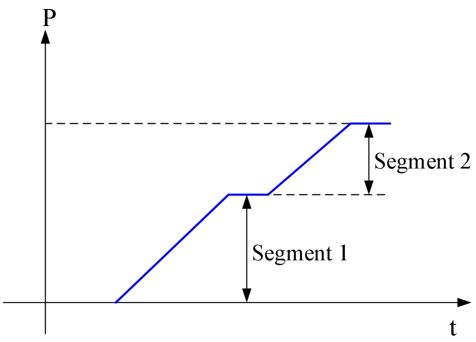
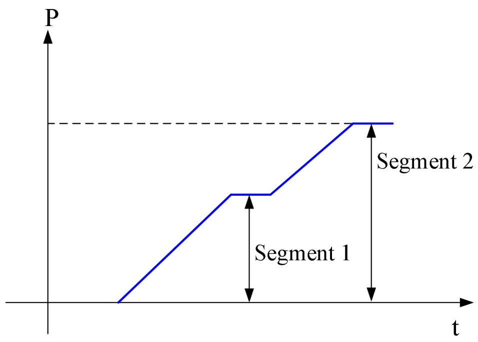
<table>
<tr><th>n.xx□x</th><th>Define</th></tr>
<tr><td>6
/PREFA
（P5-57）、
/PREFB
（P5-58）、
/PREFC
（P5-59）、
/P PREFD
(P5-60):
Select a terminal section number from 1 to 16</td><td>
<table>
<tr><th>/PREFD</th><th>/PREFC</th><th>/PREFB</th><th>/PREFA</th><th>segment number</th></tr>
<tr><td>0</td><td>0</td><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 position)</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 of the eighth paragraph)</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>
Note: The rising edge of the P5-35 step-change signal triggers each position segment (the rising edge is invalid during operation).
1. 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.
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.
</td></tr>
</table>

Use the following input signals to switch between internal positions 1–3 and 1–8.

parameter	Signal Name	leave	suit	Set Range	revise	Activate

		the factory setting	pattern			
P5-57	Internal Position – First Segment Selection/PREFA	n.0000	5	Parameter range 0000–0014, 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 0000–0014, assigned to other input interfaces via parameters P5–58.		
P5-59	Internal Position – Third Section Selection/PREFC	n.0000	5	Parameter range 0000–0014, allocated to other input interfaces via parameters P5–59.		
P5-60	Internal Position: Fourth Section Selection/PREFD	n.0000	5	Parameter range: 0000–0014, configured via parameters P5–60 on other input interfaces.		

3. Positioning Mode

n.xxx□	meaning
0	relative localization
1	Absolute Positioning
2	izable absolute positioning with enable/disenable function
0: Relative Positioning	1: Absolute positioning (using the reference origin as the zero point)
	

5.4.3.3 Setting of Position Parameters for Paragraphs 1 to 35

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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-bit pulse count) × 10000 + (low-bit pulse count);

2) In the formula P4-10+(n－1)*7, n represents the segment number of the internal position (range: 1–35); parameters for segments 1–12 can be configured via the panel, while those for segments 13–35 require parameter writing via communication (RS232 or RS485).

3) In relative positioning mode, if the pulse high bit is set to 9999 and the pulse low bit is set to 9999, or if the pulse high bit is set to-9999 and the pulse low bit is set to-9999, and P4-03.2 = 1 (indicating no waiting for positioning completion), the system enters infinite pulse mode; otherwise, the number of pulses generated is limited.

4) If the speed of any section is set to zero, it will be skipped during execution and the next section will be processed.

5) 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.

6) 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.

7) 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

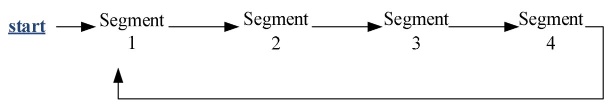
designated waiting mode for that segment remains active.
8) In absolute positioning mode, the number of rotations the motor can make is limited and cannot be unlimited.
9) Currently, the position segments in the internal position model only support two velocity types: step velocity and ramp velocity, with no other velocity forms available. When the trapezoidal acceleration time and deceleration time are set to 0, it corresponds to the step velocity form; when these values are greater than 0, it corresponds to the ramp velocity form.
10) Trapezoidal acceleration time and trapezoidal deceleration time refer to the duration required to increase or decrease from 0 to the rated speed.
11) If the rotational speed in a specified parameter section is set to 0, the position instruction for that section will be ignored under step-change modes 0/1/2. Under step-change modes 4/5/6, the motor will not rotate when the position in that section triggers a step change.
12) The position settings for pulse high and pulse low in the internal position segment parameters remain influenced by the electronic gear ratio; the actual number of motor rotations must be determined by combining the configured pulse commands with the electronic gear ratio.
13) In absolute positioning mode, the starting position for each step change is determined relative to the initial trigger point. In relative positioning mode, the starting position for each step change is determined relative to the end position of the previous step change.
14) In relative positioning mode, an unlimited number of pulse position segments can be set at positions 35 and beyond; however, when reaching this segment, the motor will continue running unless the "skip current segment" function is activated.

There are 35 internal positions in total. If you need to switch between operating 10 and 5 positions based on process requirements, you can configure the valid position count. For example, if all positions 1–10 have parameters set, set P4–04's valid position count to 5 (i.e., positions 1–5 are valid); set it to 10 to make positions 1–10 valid.

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P4-04	Number of valid segments	0	-	0 ~ 35	servo bb	immediately

P4-08 sets the starting run segment number after the first round; only the 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.

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P4-08	Internal Location Pattern Starting Segment Number	1	-	0 ~ 35	servo bb	immediately

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	

	1 ≤ P4-08 ≤ P4-04	P4-08=2 P4-04=4	start → Segment 1 → Segment 2 → Segment 3 → Segment 4
P4-03.1=1	P4-08=0 or P4-08>P4-04	P4-08=8 P4-04=4	Start → Segment 1 → Segment 2 → Segment 3 → Segment 4 → End
	1 ≤ P4-08 ≤ P4-04	P4-08=2 P4-04=4	start → Segment 1 → Segment 2 → Segment 3 → Segment 4

5.4.3.4 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 5.3.3.2 for the application of step-change signals in the step-change mode table.	The parameter range is 0000–0014, allocated to the input interface via parameters P5－35. Setting it to 0001 indicates signal input from terminal SI1.

5.4.3.5 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 0000–0014, assigned to the input interface via parameters P5–31. Setting it to 0001 indicates that signals are 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
2		Cancel the current section and proceed to the next one immediately
3		Current section canceled; F2-09 redefined
4		Current segment canceled; the falling edge of the /CHGSTP transition signal triggers the next segment.
5		Cancel the current section. Select another section and apply the corresponding section settings.
6		Current segment canceled; the rising edge of the /CHGSTP step signal selects the target segment.

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

5.4.3.6 Communication Setting Segment Number

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
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.

5.4.3.7 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 0000－0014, allocated to the output interface via parameters P5－50. Setting it to 0001 indicates signal output from terminal SO1.

5.4.3.8 IO Point Control Function (Supported in versions 4030 and above)

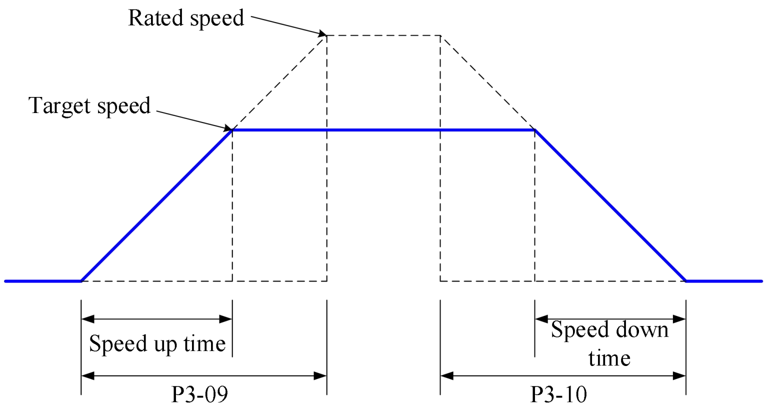
Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
P3-18	Click Speed	100	RPM	0 ~ 1000	servo bb	immediately
P5-72	/JOG-P	0	-	0~ff	at any time	immediately
P5-73	/JOG-N	0	-	0~ff	at any time	immediately

In internal position mode, when speed is set to 0, you can use IO ports/JOG-P (P5-72) and/JOG-N (P5-73) for jogging operation, where JOG-P serves as the positive terminal and JOG-N as the negative terminal; the jogging speed is set to P3-18.

5.5 Speed Control

5.5.1 General Control for Speed Modes

5.5.1.1 Soft Start

<table>
<tr><th>parameter</th><th>meaning</th><th>Factory Settings</th><th>unit</th><th>Set Range</th><th>revise</th><th>Activate</th></tr>
<tr><td>P3-09</td><td>Soft start acceleration time</td><td>200</td><td>ms</td><td>0 ~ 65535</td><td>servo bb</td><td>immediately</td></tr>
<tr><td>P3-10</td><td>Soft-start deceleration time</td><td>200</td><td>ms</td><td>0 ~ 65535</td><td>servo bb</td><td>immediately</td></tr>
<tr><td colspan="7">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 reach the rated speed from the idle state;
P3-10: Time from operating at rated speed to stopping.

</td></tr>
</table>

5.5.1.2 Zero Clamping Function (/ZCLAMP)

1. Functional Overview

This advanced function uses a "speed command" input and is intended for systems without a "position loop" configuration. It must also stop the motor when the speed command is non-zero, and is designed 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: 0001–0014. These values can be assigned to other input terminals via parameters P5–31.
		n.0002	Enter the signal using the SI2 terminal	

3. Setting of Relevant Parameters

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P3-13	Zero clamping speed	10	rpm	0 ~ 300	servo bb	immediately
P3-12	Zero Clamping Mode	0	-	0 ~ 3	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 motor reverts to normal operation only 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 enters position servo lock. If the set speed exceeds P3-13, the motor resumes operation.

5.5.1.3 Speed arrival signal (/V-RDY)

- relevant parameter

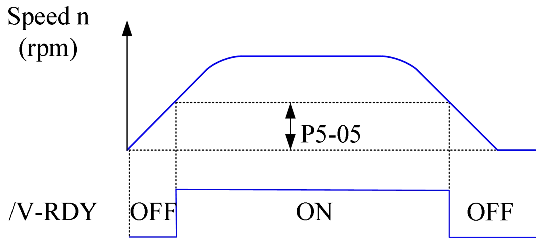
parameter	Signal Name	Factory Settings	Applicable Mode	meaning	revise	Activate

P5-51	Speed Ratio / V-RDY	n.0000	3、4、7	Speed Arrival Signal	at any time	immediately

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
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).

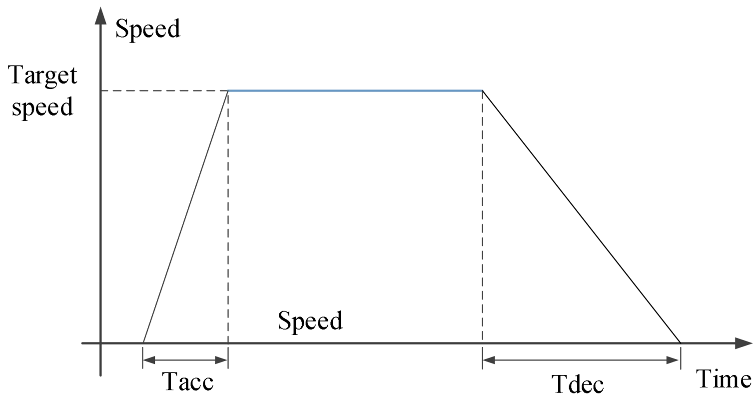


5.5.1.4 Speed Command Filter

- relevant parameter

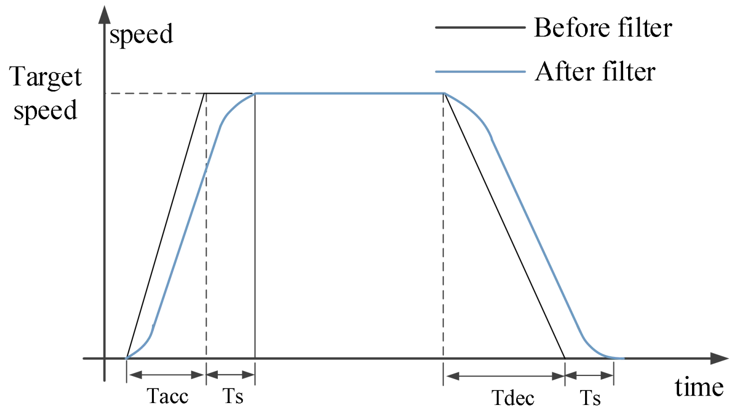
parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P1-23	Speed Command Filter Time Constant	0	0.1ms	0 ~ 65535	servo bb	immediately
P3-09	acceleration time	200	1ms	0 ~ 65535	servo bb	immediately
P3-10	deceleration time	200	1ms	0 ~ 65535	servo bb	immediately
P3-11	Sliding Average Filter 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.



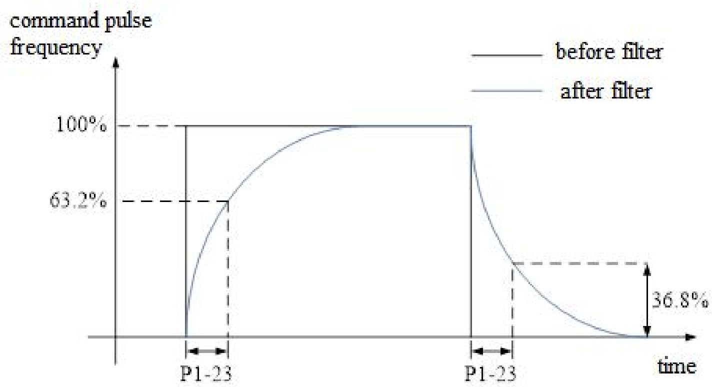
Where Tacc is the acceleration time calculated as (target speed / rated speed) × P3-09 [ms], and Tdec is the deceleration time calculated as (target speed / rated speed) × P3-10 [ms].

Set the appropriate moving average filter time constant P3-11 (S-type acceleration/deacceleration 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.

5.5.2 Speed Control (Internal Set Speed)

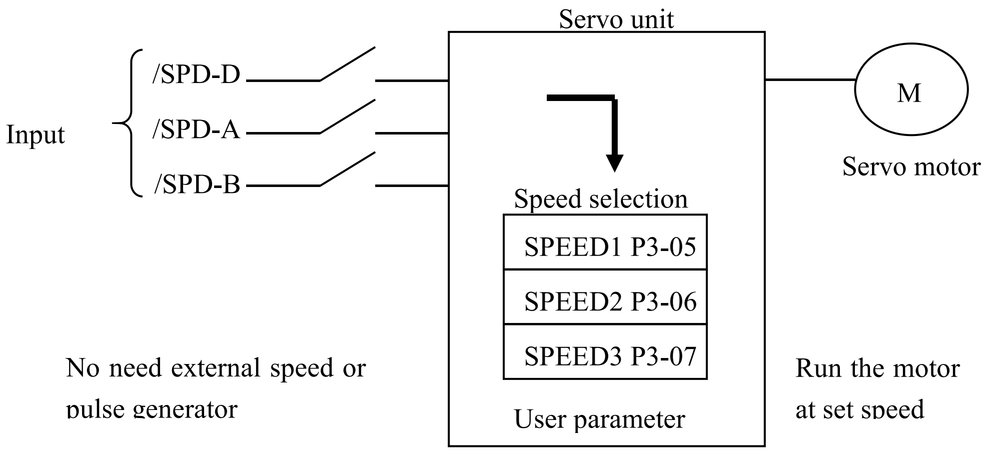
parameter	essentials	Reference Chapter
P0-01 Control Method Selection	Set to 3: Internal Speed Control Mode	5.5.2.1 Internal Speed Mode
P3-05 Internal Set Speed 1 P3-06 Internal Set Speed 2 P3-07 Internal Set Speed 3	Speed value setting for the internal 3-speed stage, in rpm	5.5.2.1 Internal Speed Mode

P5-28 Internal Speed Selection/SPD-A P5-29 Internal Speed Selection/SPD-B	The combination of terminals determines the corresponding section speed.	5.5.2.1 Internal Speed Mode
P5-27 Internal Speed Direction Selection/SPD-D	The default direction is n.0000. If direction is specified via the SI2 terminal, set P5-27 to n.0002.	5.5.2.1 Internal Speed Mode
P3-09 Soft-start acceleration time P3-10 Soft-start deceleration time	Set acceleration and deceleration times in ms	5.5.1.1 Soft Start

5.5.2.1 Internal Speed Mode

parameter	set value	meaning	revise	Activate
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	Activate
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	Activate
P5-27	Internal Direction Selection/SPD-D	n.0000	Parameter range 0000 – 0014, allocated to other input interfaces	at any time	immediately

			via parameters P5–27.		
P5-28	Internal Speed Selection/SPD-A	n.0000	Parameter range 0000 – 0014, allocated to other input interfaces via parameters P5–28.		
P5-29	Internal Speed Selection/SPD-B	n.0000	Parameter range 0000 – 0014, allocated 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 multi-stage speed setting.
- In the table above, 0/1 indicates whether the signal is valid: 0 means the terminal input is invalid, and 1 means it is valid.

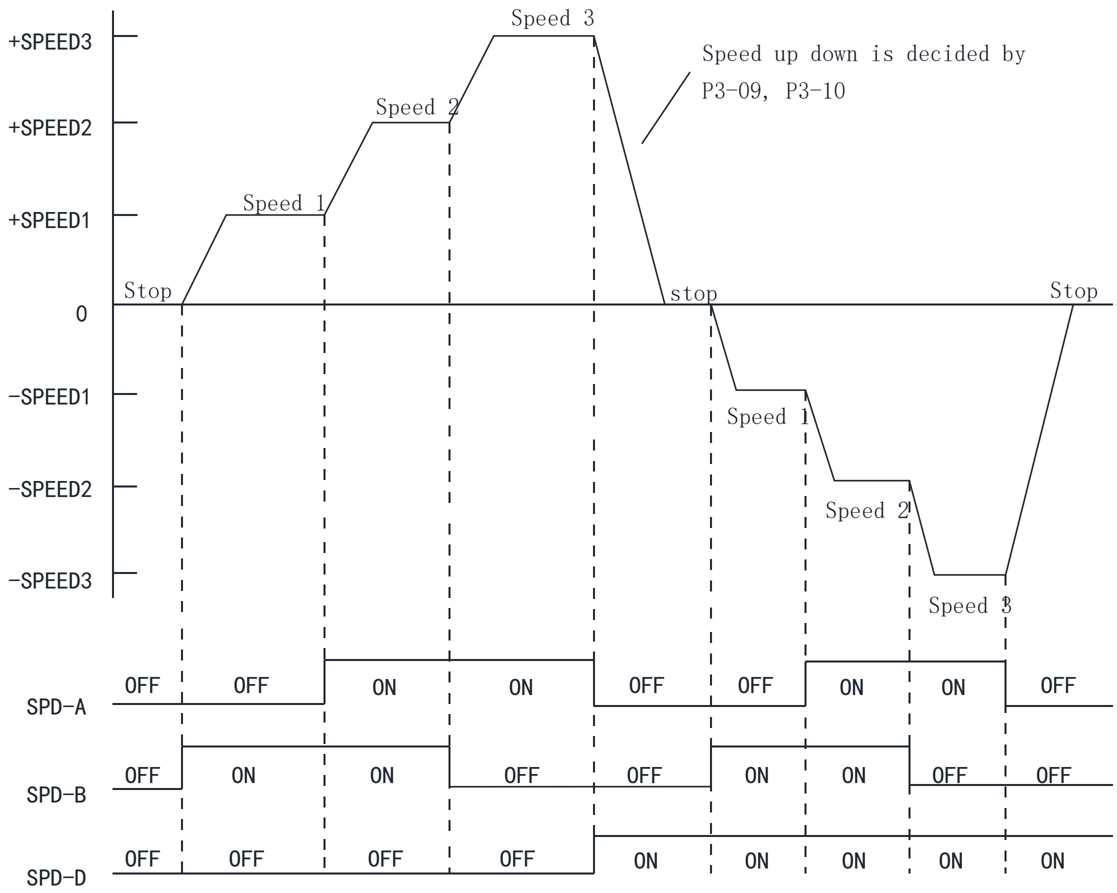
2. Description of Terminal Validity

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	of no avail

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



5.5.3 Speed Control (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 Format	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 Command pulse frequency at rated speed
P0-16 Speed Command Pulse Filtering Time	When the instruction pulse frequency is relatively low, appropriately setting this parameter	5.4.3.4 Speed Command Pulse Filtering Time

	can reduce speed fluctuations.	
P5-71 Pulse Speed Mode Direction Terminal Function Selection	Change Pulse Direction	5.4.3.5 Direction Selection for Speed Command Pulses

5.5.3.1 External Pulse Speed Mode

parameter	set value	meaning	revise	Activate
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 positioning instructions remain identical, allowing selection of CW/CCW modes, AB phases, or a "direction + pulse" pulse configuration.				

5.5.3.2 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.

5.5.3.3 Instruction pulse frequency at rated speed

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P0-15	The rated speed corresponds to the pulse frequency.	1000	100Hz	0 ~ 10000	servo bb	immediately
Note: The unit 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.						

5.5.3.4 Speed Command Pulse Filtering Time

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
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.						

5.5.3.5 Direction Selection for Speed Command Pulses

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P5-71	Pulse Velocity Mode Direction Terminal Function Selection	0	-	0 ~ 1	servo bb	immediately

5.6 Torque Control

parameter	essentials	Reference Chapter
P0-01 Control Method Selection	Set to 1: Internal Torque Mode	5.6.1 Torque Control (Internal Setting)
P3-33 Internal Torque Instruction Given	Given a percentage value of the rated torque	5.6.1.1 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	5.5.2.1 Internal Speed 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.	

5.6.1 Torque Control (Internal Setting)

parameter	set value	meaning	revise	Activate
P0-01	1	Torque Control: Internal Setting	servo bb	immediately
Function Overview: Uses the internally set torque as a torque command for torque control.				

5.6.1.1 Internal Torque Command Setting

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
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
The preset torque is defined as 1% of the rated torque, with positive or negative values indicating forward or 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 mode with 20% of its rated torque. In addition to controlling the servo direction using torque values, you can also use the /SPD-D command to set the direction.

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), or /SPD-B (P5-29) to select preset torque values 1–3 (supported in versions 4030 and above).

parameter	Signal Name	Factory Settings	Set Range	revise	Activate
P5-27	Internal Direction Selection/SPD-D	n.0000	Parameter range 0000 – 0014, 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 – 0014, assigned to other input interfaces via parameters P5–28		
P5-29	Internal Speed Selection/SPD-B	n.0000	Parameter range 0000 – 0014, allocated to other input interfaces via parameters P5–29		

1. The relationship between operating speed and terminal signals

incoming signal			Operating Torque
/SPD-D（P5-27）	/SPD-A（P5-28）	/SPD-B（P5-29）	
0 <Forward>	0	0	Internal Instruction 0 Torque
	0	1	P3-33: Preset Torque 1
	1	1	P3-34: Preset Torque 2
	1	0	P3-35: Preset Torque 3
1 <Reversal>	0	0	Internal Instruction 0 Torque
	0	1	P3-33: Preset Torque 1
	1	1	P3-34: Preset Torque 2
	1	0	P3-35: Preset Torque 3

- 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 of the SPD-A and SPD-B input terminals determines the multi-stage torque.
- In the table above, 0/1 indicates whether the signal is valid: 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	of no avail
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.	

5.6.1.2 Internal Speed Limitation During Torque Control

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
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
Note: 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)						

5.6.1.3 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	Activate
P5-43	/VLT	n.0000	1、2	Speed Limit Detection	at any time	immediately
By default, no terminals are assigned (parameter range: 0000−0014), and they are allocated to the						

output interface via parameter P5-43. Setting it to 0002 enables signal output from the SO2 terminal. The VLT signal is only active in torque mode.

5.7 Absolute Value System

5.7.1 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 cell 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, severe positional deviation may occur, posing a hazard.

5.7.2 Replace the Battery

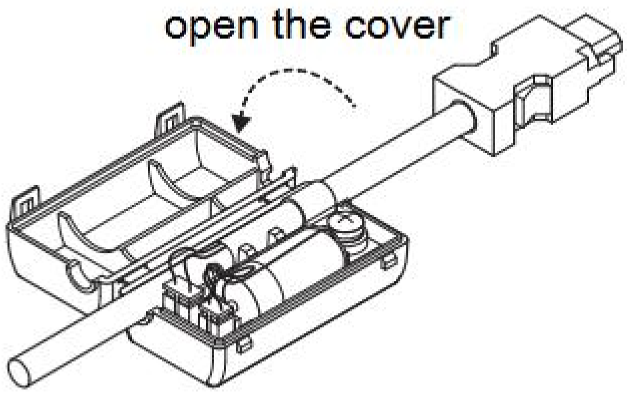
When replacing the battery, ensure the driver is properly connected to the motor and the control power supply is turned on. Replacing the battery with the control power supply off will result in loss of data stored in the encoder.

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

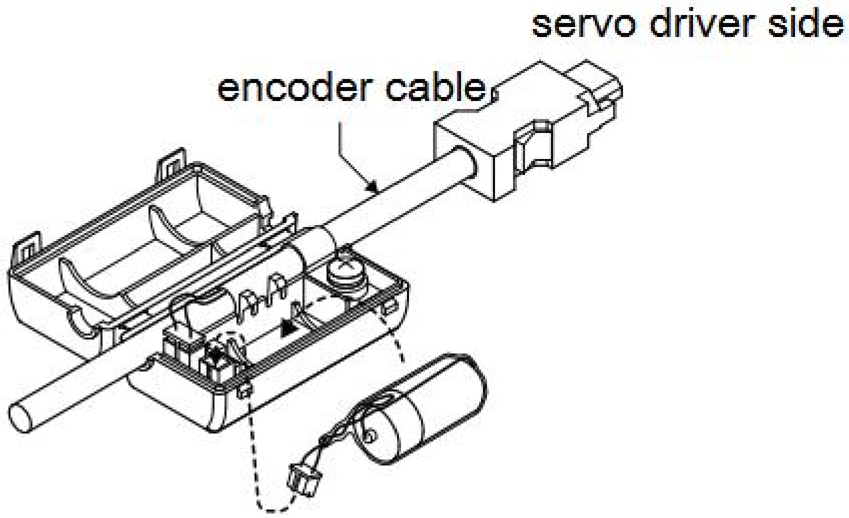
Steps for replacing the battery

When using an encoder cable with a battery unit

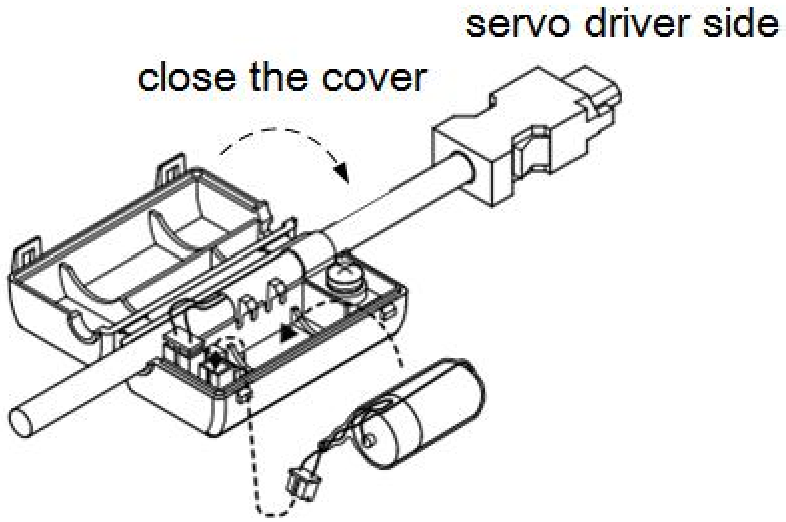
1. Connect only the control power supply to the servo unit;
2. Open the box cover of the battery unit;



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



4. Close the box cover of the battery unit;

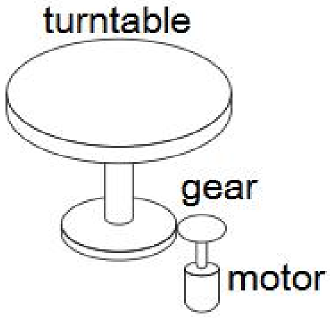


5. After replacing the battery, clear the alarm (F0-00=1) twice to eliminate the "Encoder Battery Alert (E-222)" display (only once required for version 3770 and later).
6. Re-power the servo unit;
7. Confirm that error messages have disappeared and the servo unit is functioning properly.

5.7.3 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 exceed the maximum count limit of the absolute encoder.

Servo Motor Series	resolution ratio (Single-loop data)	Serial Data with Rotation Count Output Range	Operation beyond the 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

5.7.4 Communication Reading Absolute Value Position

Essential parameter		
User parameters	Name	Make use of
U0-10	Encoder Feedback Value	The absolute position per revolution is determined by reading the hexadecimal addresses 0x100A and 0x100B using the Modbus RTU single-word command; 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 determine 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 Sign)		

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.

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 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: [U0–57×1 + 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.

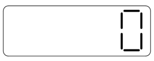
For details of communication parameters, refer to Appendix 1 (P7–XX).

5.7.5 Absolute encoder reset to multiple turns

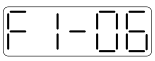
The encoder's reset count must be completed in servo BB mode; it can be cleared via the servo panel or Modbus RTU communication. Writing 1 to F1-06 will set the multi-turn absolute current count (U0-91) to zero, and the multi-turn counts in the absolute encoder position feedback signals U0-57–U0-60 and U0-94–U0-97 will also be cleared, retaining positions up to 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 the [ENT] key 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 0x2106 in hexadecimal format using the Modbus RTU.
The servo BB status takes effect; after clearing, set 0x2106 to 0.

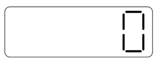
5.7.6 Absolute Encoder Position Calibration

User parameters	Name	Description
F1-06	Set to 1: Clear absolute encoder position Set to 3: Absolute encoder zero calibration	
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

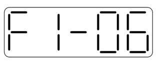
Absolute encoder zero calibration must be performed in servo BB mode and can be conducted via either servo panel calibration or Modbus RTU communication calibration. Set F1-06 to 3; the encoder position indicated on U0-94–97 will be calibrated to zero.

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 the [ENT] key to confirm exit:



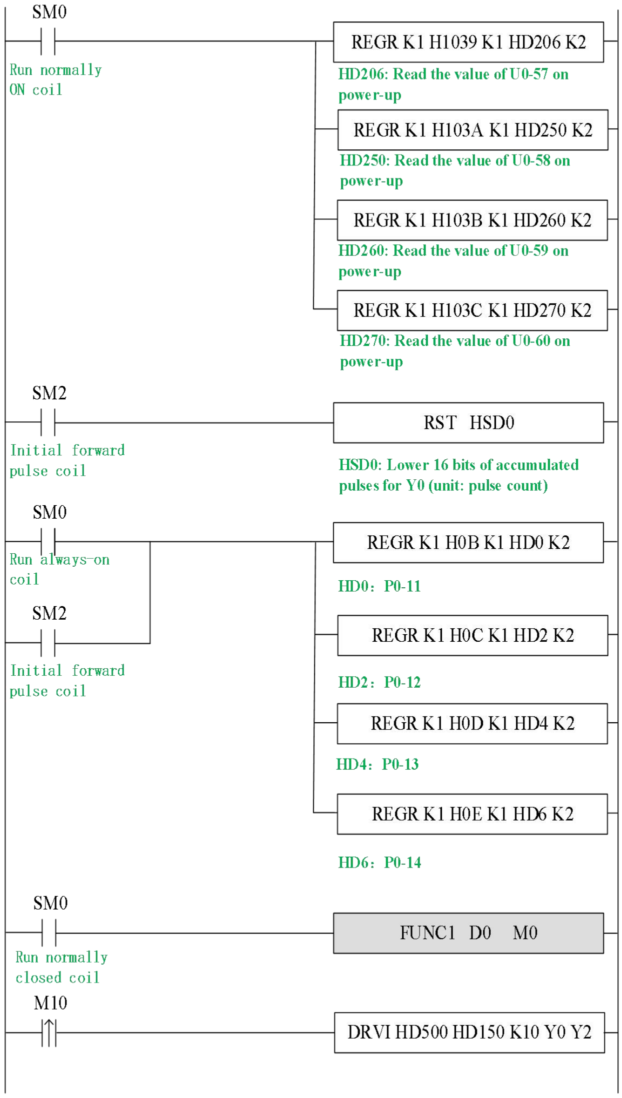
Using F1-06, set the encoder's current position to zero via panel calibration; U0-94 to 97 displays the calibrated encoder position.

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.

5.7.7 Returning to the original case based on absolute values

Use the Xinje PLC to read multi-turn absolute position values using four-digit encoding. The following example demonstrates returning to the origin via 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 values of U0-57~U0-60 after power-on and store them in designated registers. The first K1 represents the servo station number, the second K1 is the quantity of registers, and K2 stands for the 485 communication serial port number.

// Clear the value stored in HSD0 upon power-on

// Read the pulse count per revolution for calculation in C functions

// Call C function

// Send the pulse count stored in UHD[500] to perform homing

```
***********************************************************************/
void FUNC1( WORD W , BIT B )
{
#define SysRegAddr_SFD_HD_HM_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
     //HD[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 bytes of register data

// Calculate the total pulses needed for one motor rotation based on the pu revolution and electronic gear ratio read via communication, then store the FHD[100]

① Calculate the real-time feedback value of the encoder and store it in UHI
② When running in the forward direction, U0-60 ＞ 0. Since the encoder resolution differs from pulses per revolution, first calculate the number o revolutions, then multiply by pulses per revolution to obtain the puls corresponding to the real-time travel distance.
③ As the axis travels forward, negative pulses shall be output for homing; negative value and store it in UHD[500].

① For reverse operation where U0-60 ＜ 0, first take the absolute value of t time travel encoder feedback value.

5.7.8 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) (Supported in version 4030 and above)	Encoder Pulse	0	0~65535	○	5|6
P9-34	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 2^16 (Supported in version 4030 and above)	Encoder Pulse	0	0~65535	○	5|6
P9-35	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 2^32 (Supported in version 4030 and above)	Encoder Pulse	0	0~65535	○	5|6
P9-36	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 248 (Supported in version 4030 and above)	Encoder Pulse	0	0~65535	○	5|6
P9-37	Absolute Position Rotation Mode Gear Ratio Fraction (Supported in version 4030 and above)	-	65535	0~65535	○	5|6

parameter	functional description	unit	Factory Default Value	span	Effectiveness Time	suit scope
P9-38	Absolute Position Rotation Mode Gear Ratio (numerator/denominator) (Supported in version 4030 and above)	-	1	0~65535	○	5|6
The equations 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 absolute position rotation 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.

5.8 Auxiliary Functions

5.8.1 Anti-Backflow 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	Activate
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
P3-38	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 values for P3-38 and P3-39 are properly set;

b) Inspect the external mechanical structure and its installation;

3) The default alarm time for P0-74 stall condition is set 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

5.8.2 Torque Limit

1. Internal Torque Limit

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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, if the motor operates under a 3x overload condition, the factory default is set at 300% of the rated torque, with the actual maximum output torque also limited by the motor's overload factor.						

2. External torque limitation (activated via input signal)

Parameter	Meaning	Factory settings	Unit	Set range	Revis e	Activate
P3-30	Forward rotation and external torque limitation	By Device Model	%	0 – Motor overload factor	at any time	immedi ately
P3-31	Reverse Side External Torque Limit	By Device Model	%	0 – Motor overload factor	at any time	immedi ately
The setting unit is expressed as% of the motor's rated torque; for example, if the motor operates under 3 times overload, the factory default is set at 300% of the rated torque.						

Parameter	Signal name	Factory settings	Meaning	Set range	Revise	Activate
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 relationship among internal torque limit, external torque limit, /P-CL, and /N-CL.

P-CL/N-CL state	Final value of forward rotation torque	Final reversal torque value
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

4. Output torque reaches the limit value

Parameter	Signal name	Factory settings	Applicable mode	Meaning	Revise	Activate
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, assigned to the output interface via parameter P5-42. Setting to 0002 enables signal output from SO2 terminals.						

5.8.3 Speed Limitations

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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

The parameters set for P3-14 and P3-15 are valid in all modes. (In version 3770, this parameter does not apply in Position Mode.)

5.8.4 Input/Output Terminal Allocation

5.8.4.1 Input Terminal Allocation

1. Allocation of Input Signals

parameter	Parameter Meaning	set value	meaning

<table>
<tr><td rowspan="4">P5-20 ~ P5-36</td><td rowspan="4">n. 0 □ □ □
□ → Distribute input terminal no.
□ → 0: NO signal, 1: NC signal
□ → Basic filter time
0 → No meaning</td><td>n.0000</td><td>Not assigned to terminal input</td></tr>
<tr><td>n.000x</td><td>Enter a normally open signal from the SIx terminal</td></tr>
<tr><td>n.0010</td><td>Set the signal to always active</td></tr>
<tr><td>n.001x</td><td>Enter a normally closed signal from the SIx terminal.</td></tr>
</table>

The basic filtering time refers to the filtering time of the input terminal.

2. Factory settings for input terminals

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

3. Filter Time for the Terminal

- relevant parameter

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
P5-18	IO Filtering Time Factor	1	Times	0 ~ 10000	at any time	immediately

The filtering time is determined jointly by the IO parameter value and P5-18, as illustrated below:

Set the pulse deviation clearance configuration at terminal SI1 with a filtering time of 30 ms.

The parameters are set as follows:

P5-34=n. 0 3 0 1
- 1 → P5-34.0
- 3 → 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.

5.8.4.2 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

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

5.8.5 Description of Output Terminal Functions

5.8.5.1 Servo Ready Output (/S-RDY)

- relevant parameter

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P5-70	/S-RDY: Output Condition Selection	0	-	0~1	at any time	immediately

parameter	Signal Name	Factory Settings	Applicable Mode	meaning	revise	Activate
P5-41	/S-RDY	n.0000	All	Server Ready Output	at any time	immedia tely

For details on hardware wiring, refer to Chapter 3.2.4.

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 the 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.

5.8.5.2 Rotation Detection Output (/TGON)

1. Signal Settings

Parameter	Signal name	Factory settings	Applicable mode	Meaning	Revise	Activate
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: no output signal assigned to terminals. Parameter range: 0000–0014, which can be assigned to other output terminals via parameter P5–40. 2. Indicates that when the servo motor's rotational speed exceeds the set value of P5-03, it signifies the servo is rotating.						

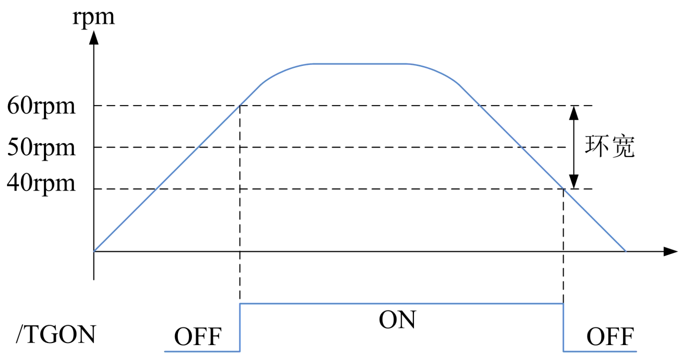
2. Relevant Parameters

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
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 is designed to prevent the system from exhibiting repeated responses or oscillations when parameters fluctuate around a specific value. Once the hysteresis value is set, a fixed hysteresis width is established: the system only activates when the parameter exceeds a certain threshold and deactivates only when it falls below another threshold; this width determines the interval between activation events. A narrow hysteresis results in rapid and frequent responses, while a wide hysteresis causes delayed responses. It should be noted that rotation detection speed (P5-03), synchronous detection speed (P5-04), and arrival detection speed (P5-05) all incorporate a 10 rpm hysteresis. For example, setting rotation detection speed P5-03 to 50 with the rotation detection/TGON output port at SO3. The hysteresis is designed to prevent the system from exhibiting repeated responses or oscillations when parameters fluctuate around a specific value. Once the hysteresis value is set, a fixed hysteresis width is established: the system only activates when the parameter exceeds a certain threshold and deactivates only when it falls below another threshold; this width determines the interval between activation events. A narrow hysteresis results in rapid and frequent responses, while a wide hysteresis causes delayed responses. It should be noted that rotation detection speed (P5-03), synchronous detection speed (P5-04), and arrival detection speed (P5-05) all incorporate a 10 rpm hysteresis. For example, setting rotation detection speed P5-03 to 50 with the rotation detection/TGON output port at SO3.


rpm
60rpm
50rpm
40rpm
环宽
/TGON
OFF
ON
OFF

5.8.5.3 Speed Matching Test (/V-CMP)

Parameter	Signal name	Factory settings	Applicable mode	Meaning	Revise	Activate
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	Activate
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; the concept of hysteresis refers to Section 5.8.5.2.

5.8.5.4 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	Activate
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	Activate
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.						

5.8.5.5 Servo Alarm Output (/ALM)

1. Servo Alarm Output/ALM

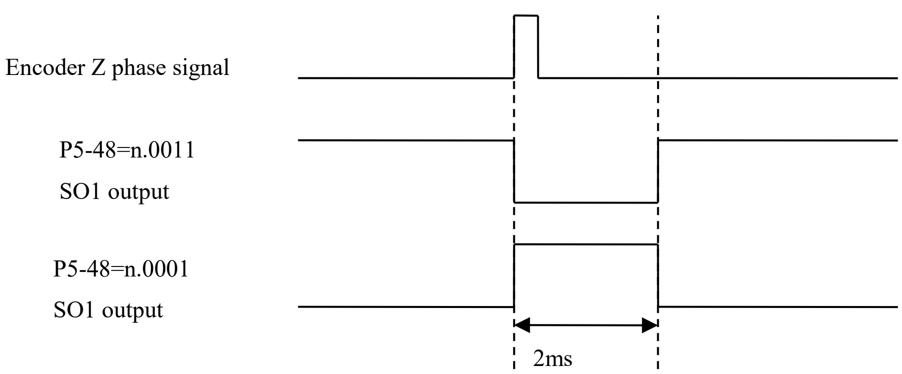
parameter	Signal Name	setting	meaning	Modification Scope
P5-47	Alarm Output /ALM	n.0002 （give tacit consent to）	When a servo alarm occurs, conduction is established between SO2 and COM, generating an alarm signal.	The parameter range is 0000－0014, assigned to the output interface via parameters P5－47. Setting it to 0001 indicates signal output from terminal SO1.
		n.0012	When the servo alarm occurs, the connection between SO2 and COM is disconnected.	

1) 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 5.2.4.
2) The output terminals assigned to functional parameters must not be duplicated.

5.8.5.6 Encoder Z-phase Output (/Z)

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P5-48	Z-phase Output/Z	n.0000	-	0000～0014	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 pulse width of approximately 2 ms, which can be adjusted via parameter P5-19 and remains independent of the motor's rotational speed.
Note: Multi-turn motors do not have a Z-phase output (version 3770 and later support Z-phase output for multi-turn motors).



5.8.5.7 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	Activate
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	Activate
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; or output for SOx when P5-10 <P5-11.				
set value	function	Factory Value	Applicable Mode	revise	Activate
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	Activate
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 terminal output signal	Parameter range 0000 – 0014, assigned to other output terminals via parameters P5–52

Custom Output 2

<table>
<tr><td rowspan="3">P5-14</td><td colspan="7">Custom Output 2 Trigger Condition</td></tr>
<tr><td colspan="2">Default Trigger Condition</td><td>Trigger Condition Settings</td><td>unit</td><td>Applicable Mode</td><td>revise</td><td>Activate</td></tr>
<tr><td colspan="2">0</td><td>See table: Optional trigger conditions</td><td>Related to the selected trigger condition</td><td>All Modes</td><td>at any time</td><td>immediately</td></tr>
<tr><td rowspan="3">P5-15</td><td colspan="7">Value to compare with the trigger condition for Custom Output 2</td></tr>
<tr><td colspan="2">Set Unit</td><td>Factory Settings</td><td>Set Range</td><td>Applicable Mode</td><td>revise</td><td>Activate</td></tr>
<tr><td colspan="2">Related to the selected trigger condition</td><td>0</td><td>-9999~9999</td><td>All Modes</td><td>at any time</td><td>immediately</td></tr>
<tr><td rowspan="6">P5-16</td><td colspan="7">Select output when P5-14 ≥ P5-15, or select SOx output when P5-14 <P5-15.</td></tr>
<tr><td>set value</td><td colspan="2">function</td><td>Factory Value</td><td>Applicable Mode</td><td>revise</td><td>Activate</td></tr>
<tr><td>0</td><td colspan="2">When P5-14 ≥ P5-15, SOx output is generated.</td><td rowspan="4">0</td><td rowspan="4">All Modes</td><td rowspan="4">at any time</td><td rowspan="4">immediately</td></tr>
<tr><td>1</td><td colspan="2">When P5-14 <P5-15, SOx output is generated.</td></tr>
<tr><td>2</td><td colspan="2">When the absolute value of P5-14 is ≥ P5-15, SOx output occurs.</td></tr>
<tr><td>3</td><td colspan="2">When the absolute value of P5-14 is ≤ P5-15, SOx output is generated.</td></tr>
<tr><td rowspan="3">P5-17</td><td colspan="7">Set Custom Output 2 Hysteresis Loop</td></tr>
<tr><td colspan="2">Set Unit</td><td>Factory Settings</td><td>Set Range</td><td>Applicable Mode</td><td>revise</td><td>Activate</td></tr>
<tr><td colspan="2">Related to the selected trigger condition</td><td>0</td><td>-32768~32767</td><td>All Modes</td><td>at any time</td><td>immediately</td></tr>
<tr><td rowspan="2">P5-53</td><td colspan="7">Custom Output 2: Output Port Configuration</td></tr>
<tr><td colspan="2">Signal Name</td><td>Factory</td><td>meaning</td><td colspan="3">revise</td></tr>
</table>

		Settings		
	Custom Output 2	n.0000	Default unallocated terminal output signal	Parameter range: 0000 – 0014, assigned to other output terminals via parameter P5–53

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

5.8.5.8 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	5.8.2
/VLT	Speed Limit Detection	5.5.1.3
/MRUN	Internal Location Mode Movement Has Begun	5.3.2.7
/V-RDY	Speed Arrival Signal	5.4.1.3

5.8.6 Input Terminal Functions

5.8.6.1 Proportional Motion Command (/P-CON)

parameter	Signal Name	type	Factory Settings	state	meaning	revise	Activate
P5-21	Proportional Action/P-CON	import	n.0000	valid	Run in P-control mode	at any time	immediately
				of no	Operate in PI control		

				avail	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.

5.8.6.2 Alarm Reset (/ALM-RST)

- Alarm Reset/ALM-RST

parameter	Signal Name	Factory Settings	Applicable Mode	meaning	revise	Activate
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, identify and resolve the cause, 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).

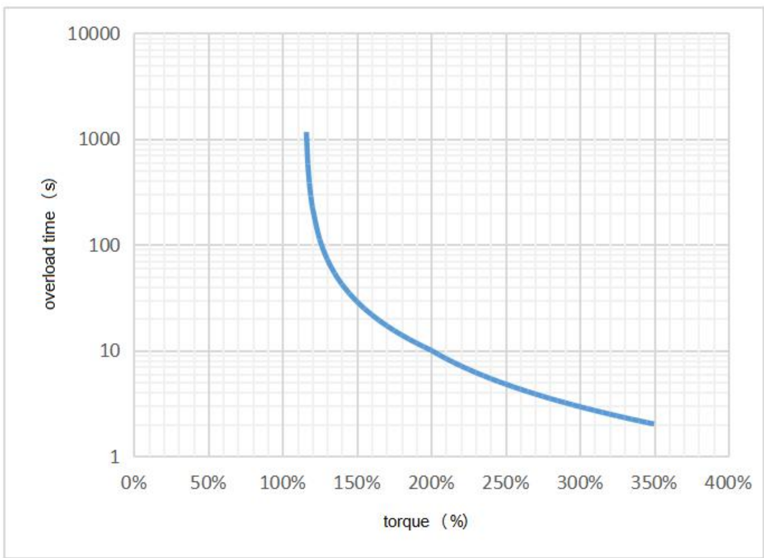
5.8.6.3 Other SI Terminal Function Links

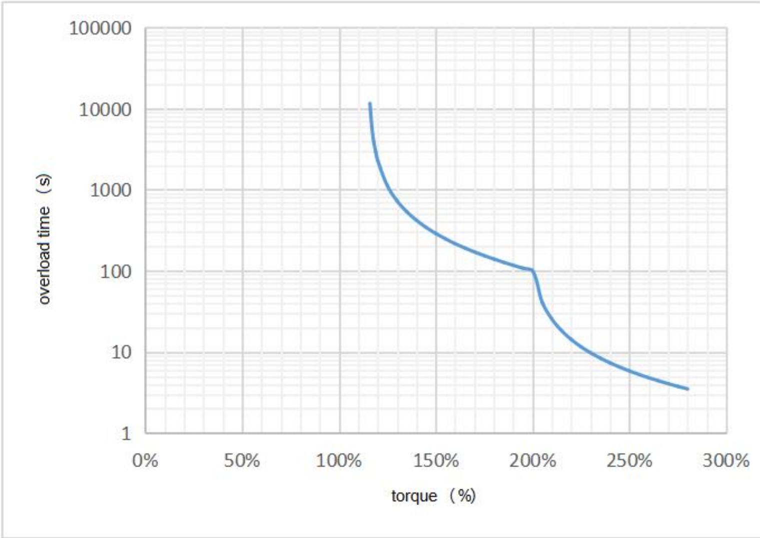
Terminal Name	explain	Quick Link
/S-ON	Server Enablement	5.2.2
/P-OT	Forward drive is prohibited	5.2.4
/N-OT	Reverse Drive Prohibited	5.2.4
/P-CL	Forward rotation and external torque limitation	5.8.2
/N-CL	Reverse Side External Torque Limit	5.8.2
/SPD-D	Internal Speed Direction	5.4.2
/SPD-A	Internal Set Speed	5.4.2
	Position Mode Reference Origin Trigger	5.4.1.8
/SPD-B	Internal Set Speed	5.4.2
	Position Mode Reference Origin Trigger	5.4.1.8
/C-SEL	Control Method Selection	5.1.2
/ZCLAMP	Zero Clamping	5.4.1.2
/INHIBIT	Instruction Pulse Prevention	5.3.1.4
/PREFA	Internal Location Selection Signal	5.3.3.2
/PREFB	Internal Location Selection Signal	5.3.3.2
/PREFC	Internal Location Selection Signal	5.3.3.2
/PREFD	Internal Location Selection Signal	5.3.3.2

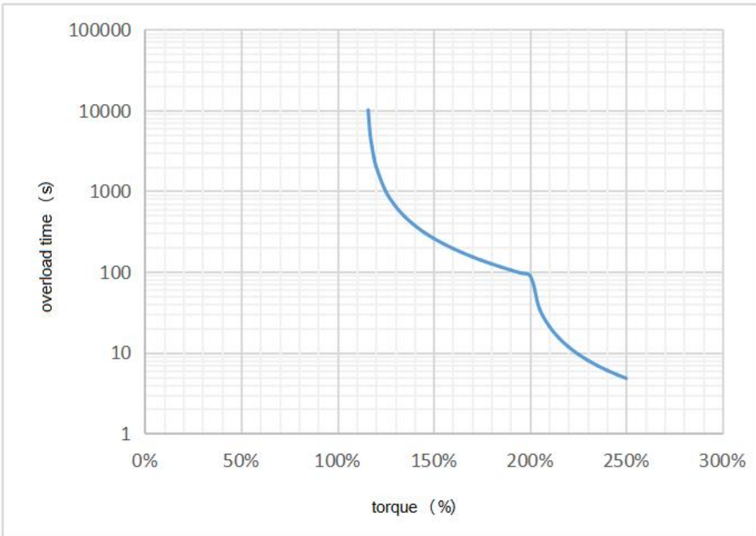
5.8.7 Overload Protection Time-Limit Curve

The overload protection time-limit curve is intended solely for alarm output determination and protection against overload operation. It is recommended to use it only during the continuous operating phase of the torque-speed curve, as specified in Appendix 9.

Applicable Model (Motor Code)			
5022	5822	5003	5803
50C3	58C3	5004	5804
50C4	58C4	4004	50C5
58C5	5011	5811	50D1
58D1	4011	4012	50D7
5012	50D2		



<table>
<tr><th>Applicable Model (Motor Code)</th><td rowspan="2">
</td></tr>
<tr><td>5072 5872 9072 9872</td></tr>
</table>

<table>
<tr><th>Applicable Model (Motor Code)</th><td rowspan="2">
</td></tr>
<tr><td>5033 9033 4031 4032
4042 5042 4044 5044
5078 5079 5077 5877
9077 9877</td></tr>
</table>

5.9 Weak Magnetic Control (Supported in versions 4030 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 mode, the motor speed must not exceed its maximum limit to prevent motor failure or damage to personnel and property.

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 EMF 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	give tacit consent to
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

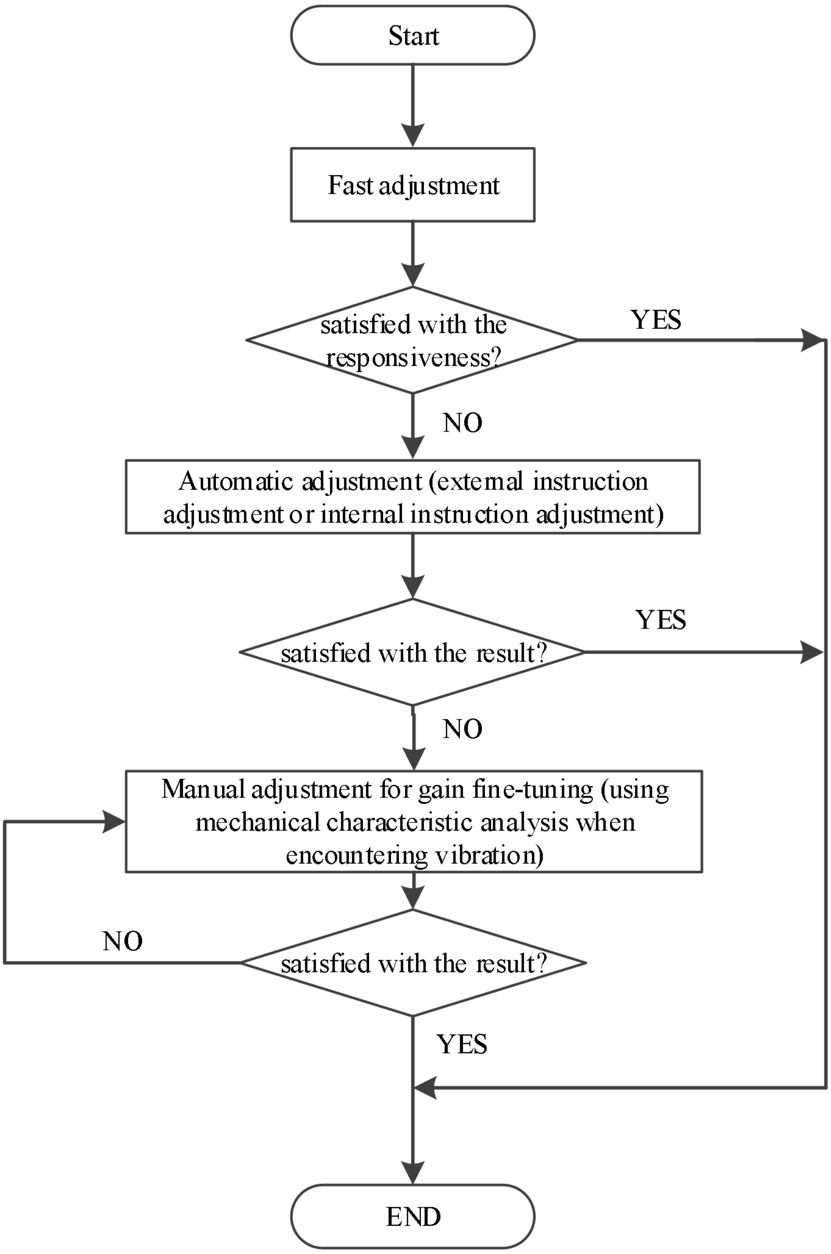
6. Adjustment of Servo Gain

6.1 Overview of Servo Gain Adjustment

6.1.1 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.



6.1.2 Differences Between Various Adjustments

Adjustment methods include adaptive and self-adjusting types, 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	autoadaptation	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 Inertia 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	

6.2 Estimation of Rotational Inertia

6.2.1 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 rotational inertia ratio (the ratio of load rotational inertia to motor rotor 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	Activate
P0-07	First Inertia Ratio	500	%	0 ~ 50000	at any time	immediately

6.2.2 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 during the estimation of 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 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.
- Starting with version 3700, the driver firmware has increased the maximum inertia ratio to 500 times (with a parameter upper limit of 50,000).

6.2.3 Operating Tools

The tools for estimating load moment of inertia are the driver panel and the XinJeServo host software.

Operation Tools	Restriction Item
Drive Panel	The driver firmware requires version 3700 or higher
XinJeServo Master Computer Software	All versions of the host software support it.

The driver firmware version can be viewed via U2-07.

6.2.4 Operating Procedures

1. Steps for Estimating Inertia of the Drive Panel

1. Parameter Configuration

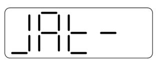
parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P2-15	Inertia Configuration Stroke	100	0.01 turn	1 ~ 300	at any time	immediately
P2-17	Inertia identification and the maximum speed determined through internal command-based self-adjustment	/	rpm	0 ~ 65535	at any time	immediately
P2-18	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.

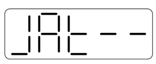
2. Inertia identification implementation

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 identification.

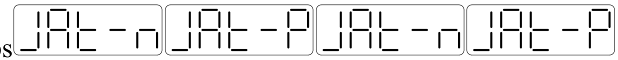
The servo enters the BB state and displays parameter F0-07:



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.

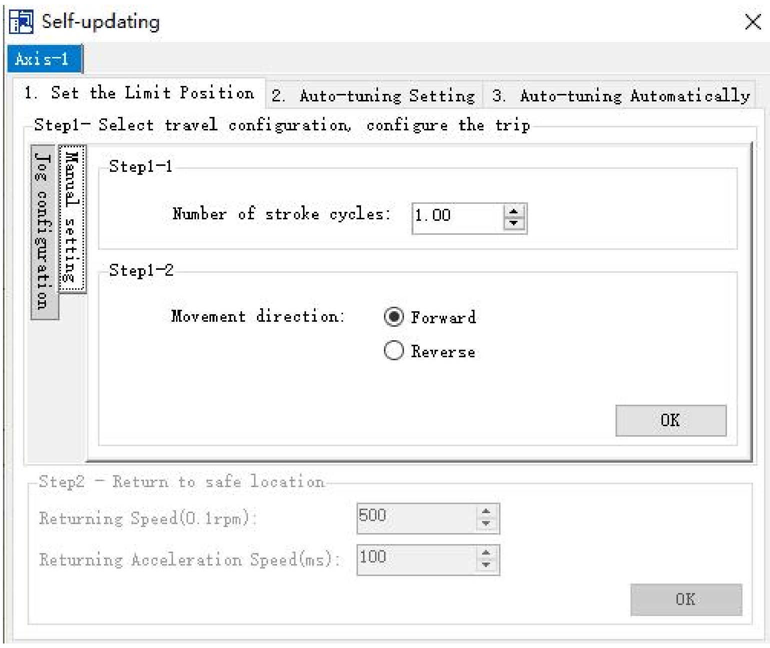
- Panel Inertia Identification Error Alarm

error code	meaning	Possible Causes and Solutions
Err-1	Motor torque saturation	① Initial inertia is too low; in adaptive mode, switch to high-inertia mode (P2-03.3=1); in self-settling mode, the initial inertia value for inertia identification (P2-18) is adjusted to twice the current value. ② The maximum speed is too high (P2-17), but it should not fall below 500 rpm; an instruction speed that is too low 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; an excessively low target speed 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 Overtravel has occurred.
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 distance may 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 enabled. When this

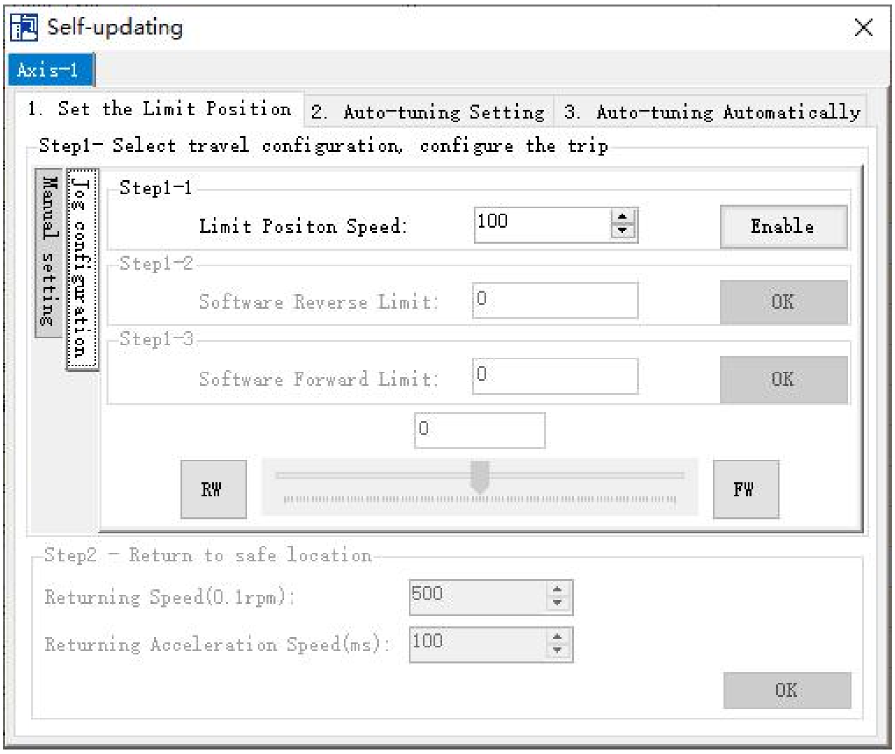
error code	meaning	Possible Causes and Solutions
		function is activated, it will automatically switch to P/PI control, triggering Alarm Err-4 during inertia compensation execution. ② The load connected to the motor exhibits excessive deviation from its inertia, preventing the driver from accurately estimating the inertia. It is recommended to replace the motor with one that matches the required inertia 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 unhandleable 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. XinJeServo Inertial Estimation Steps

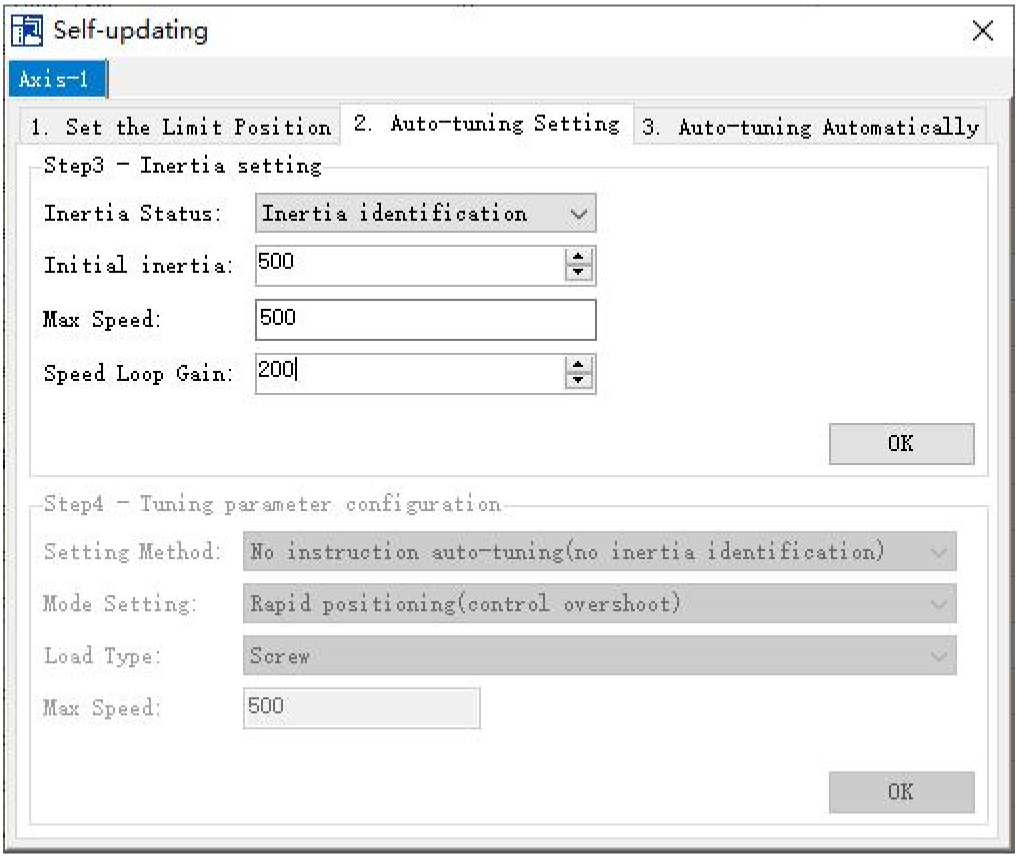
1. On the XinJeServo main menu screen, click [Gain Adjustment];

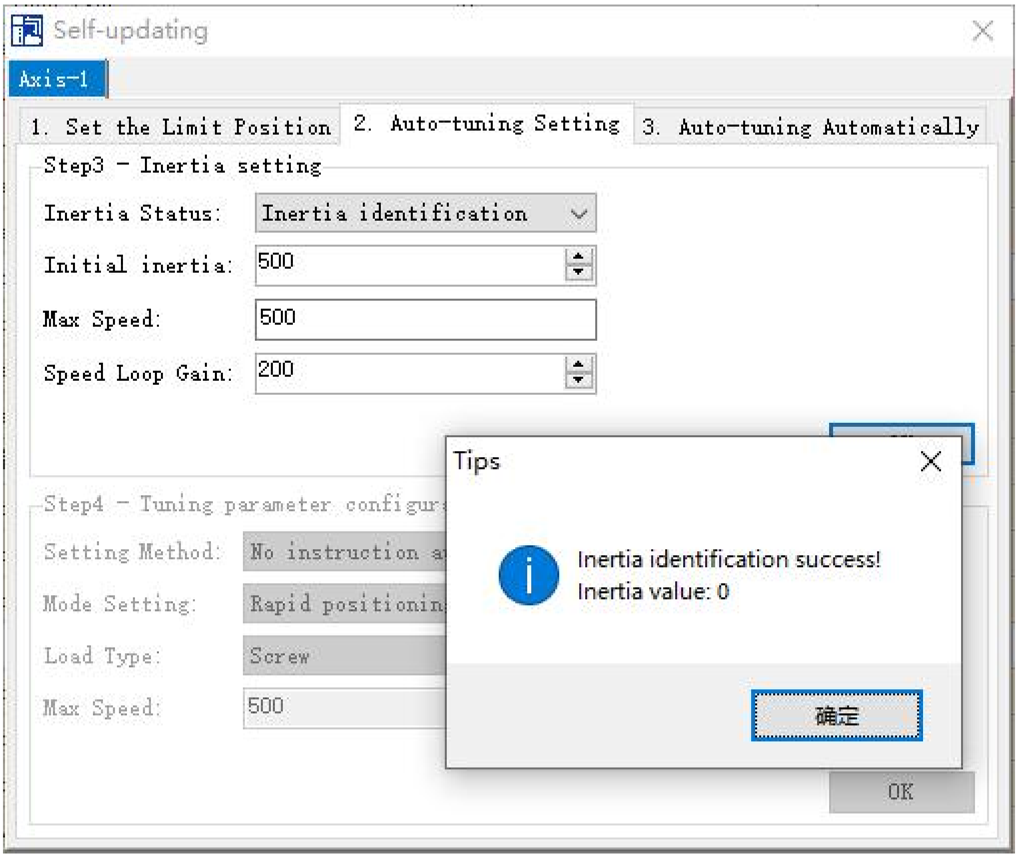


2. Select [Dynamic Configuration] or [Manual Setting] to configure the inertia estimation travel distance;



3. Configure the settings interface;





- If you close the self-adjustment interface directly at this point, the driver will only configure the inertia ratio parameter.
- For detailed instructions on using XinJeServo's estimated inertia, refer to the XinJeServo help documentation.

6.3 Quick Adjustment

6.3.1 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.

6.3.2 Quick Adjustment Steps

1. Determine the load inertia using either the drive panel or the XinJeServo host software, refer to Section 6.2 for 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

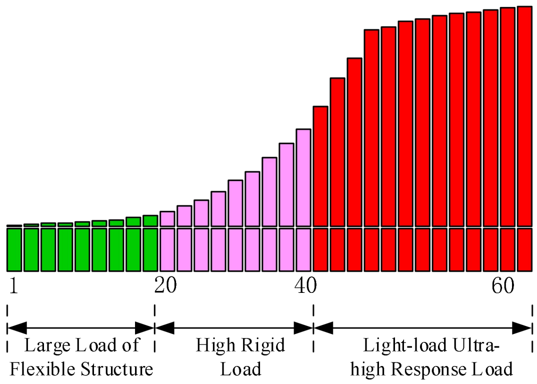
→ P2-01.0

6.3.3 Rigid Grade Corresponding to Gain Parameters

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	Model Ring Gain P2-49
0	15	50000	24	1326	24
1	20	39789	32	995	32
2	25	31831	40	796	40
3	30	26526	48	663	48
4	35	22736	56	568	56
5	45	17684	72	442	72
6	60	13263	96	332	96
7	75	10610	120	265	120
8	90	8842	144	221	144
9	110	7234	176	181	176
10	140	5684	224	142	224
11	180	4421	288	111	288
12	250	3183	400	80	400
13	300	2653	480	66	480
14	350	2274	560	57	560
15	400	1989	640	50	640
16	500	1592	800	40	800

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	Model Ring Gain P2-49
17	600	1326	960	33	960
18	750	1061	1200	27	1200
19	900	884	1440	22	1440
20	1150	692	1840	17	1840
21	1400	568	2240	14	2240
22	1700	468	2720	12	2720
23	2100	379	3360	9	3360
24	2500	318	4000	8	4000
25	2800	284	4480	7	4480
26	3100	257	4960	6	4960
27	3400	234	5440	6	5440
28	3700	215	5920	5	5920
29	4000	199	6400	5	6400
30	4500	177	7200	5	7200
31	5000	159	8000	5	8000

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. After using vibration suppression to eliminate vibration, you may proceed with additional increases. The following are recommended stiffness levels for different loads for reference only.



High-load flexible structures: refer to equipment with synchronous belt configurations and significant load inertia.

High-rigidity load: refers to mechanisms such as lead screws or direct-drive systems, i.e., equipment with strong mechanical rigidity.

Light-load ultra-high-response load: refers to equipment with very low load inertia, sufficient mechanical stiffness, and requiring rapid response.

Drive Power	Default Parameters	Corresponding rigidity level
100w ~ 750w	P1-00=300 P1-01=2653 P1-02=480 P2-35=66 P2-49=480	13
1kw~3kw	P1-00=180 P1-01=4421 P1-02=288	11

Drive Power	Default Parameters	Corresponding rigidity level
	P2-35=111 P2-49=288	

6.3.4 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 6.7 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.

6.4 Automatic Adjustment

6.4.1 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 behavior based on mechanical characteristics during operation.

Automatic adjustment (external command self-setting) is a function that automatically optimizes parameters based on operational commands from the upper-level device.

The automatic adjustments are as follows:

- Load rotational inertia
- Gain Parameters (Speed Ring, Position Ring, Model Ring Gain)
- Filter (passband filter, torque command filter)

6.4.2 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.
- Due to low mechanical rigidity, vibrations occur during operation, resulting in failed detection and positioning.
- The operating range is small, 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.

6.4.3 Operating Tools

Both internal command self-setting and external command self-setting can be performed via the driver panel and the XinJeServo host software.

Calibration Mode	Operation Tools	Restriction Item
Internal commands are set after calibration.	XinJeServo Master Computer Software	All versions of the host software support it.
External commands are set after the initial configuration.	Drive Panel	The driver firmware requires version 3700 or higher

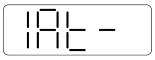
The driver firmware version can be viewed via U2-07.

6.4.4 Internal Instructions for Self-Setting Operation Steps

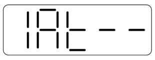
1. Self-Calibration Steps for the Drive Panel

1. Perform inertia identification by following the driver panel inertia estimation procedure outlined in Step 6.2.4 of the rotational inertia estimation section.

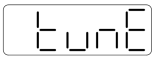
2. Enter parameter F0-09 and display "iat-";



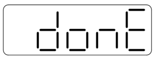
3. Press and hold the ENTER key; the panel will display "iat--", indicating that the servo is enabled.



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 mode.

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.

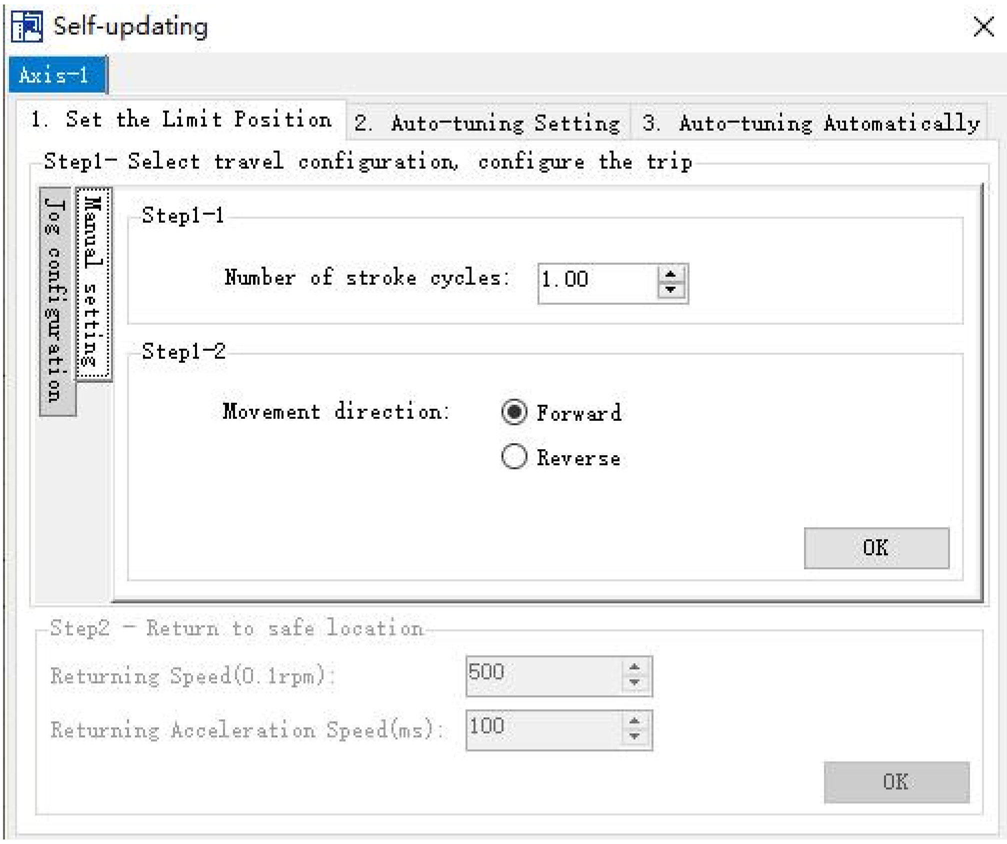
- Error alarm on the self-tuning process panel

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

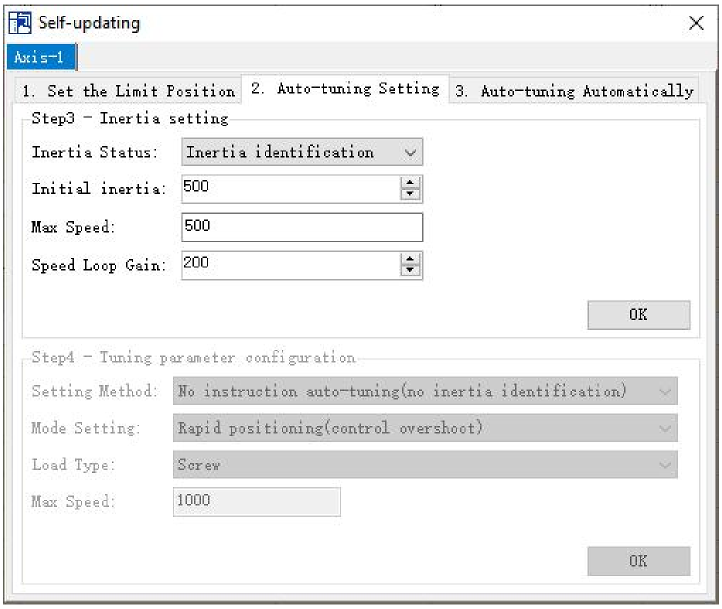
Err-2	Over-range/alarm occurred during the self-tuning process	Ensure the journey does not exceed limits or trigger alarms before resetting
Err-6	The drive is not in the "bb" state when performing the operation.	Confirm the current status of the drive
Err-7	An alarm occurred in the driver during the calibration process.	The drive has an alarm.

II. XinJeServo Self-Calibration Steps

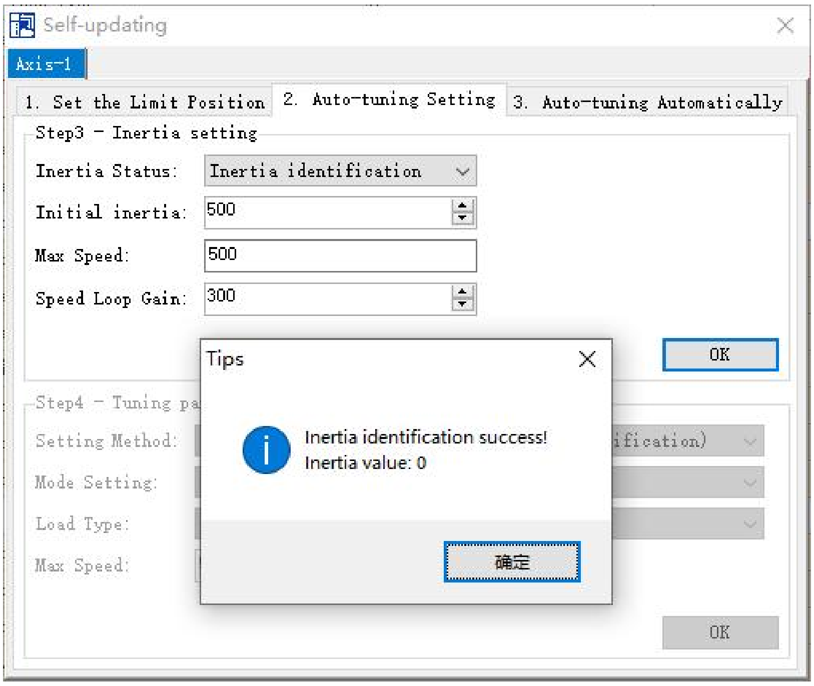
1. On the XinJeServo main menu screen, click [Gain Adjustment];
2. Select [Dynamic Configuration] or [Manual Setting] to configure the inertia estimation travel distance;



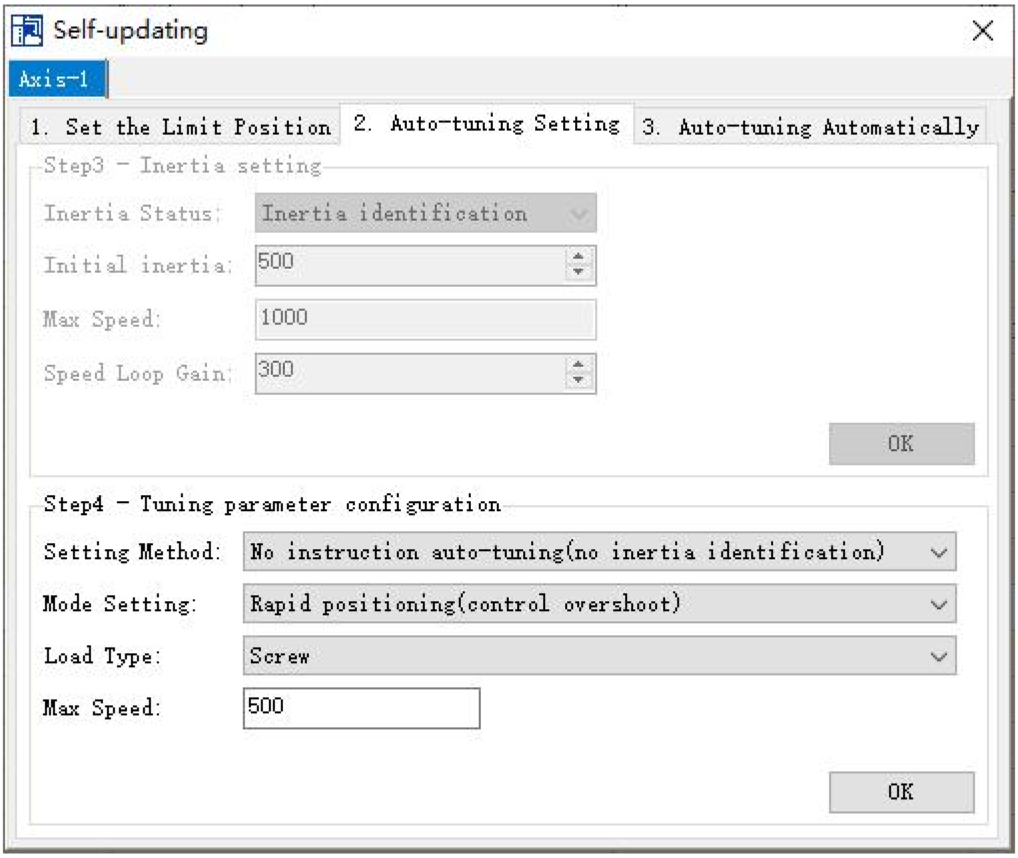
3. Configure the settings interface;



4. Click [Confirm] to start calculating the inertia;



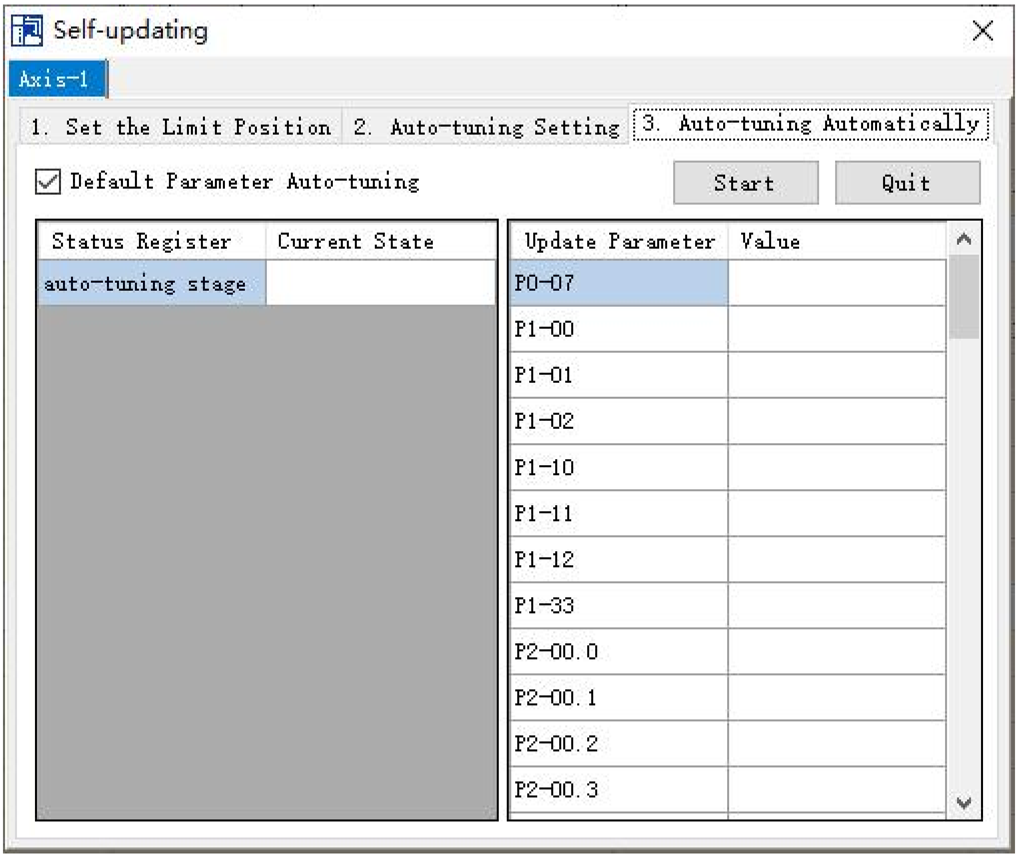
5. Adjust parameter settings;



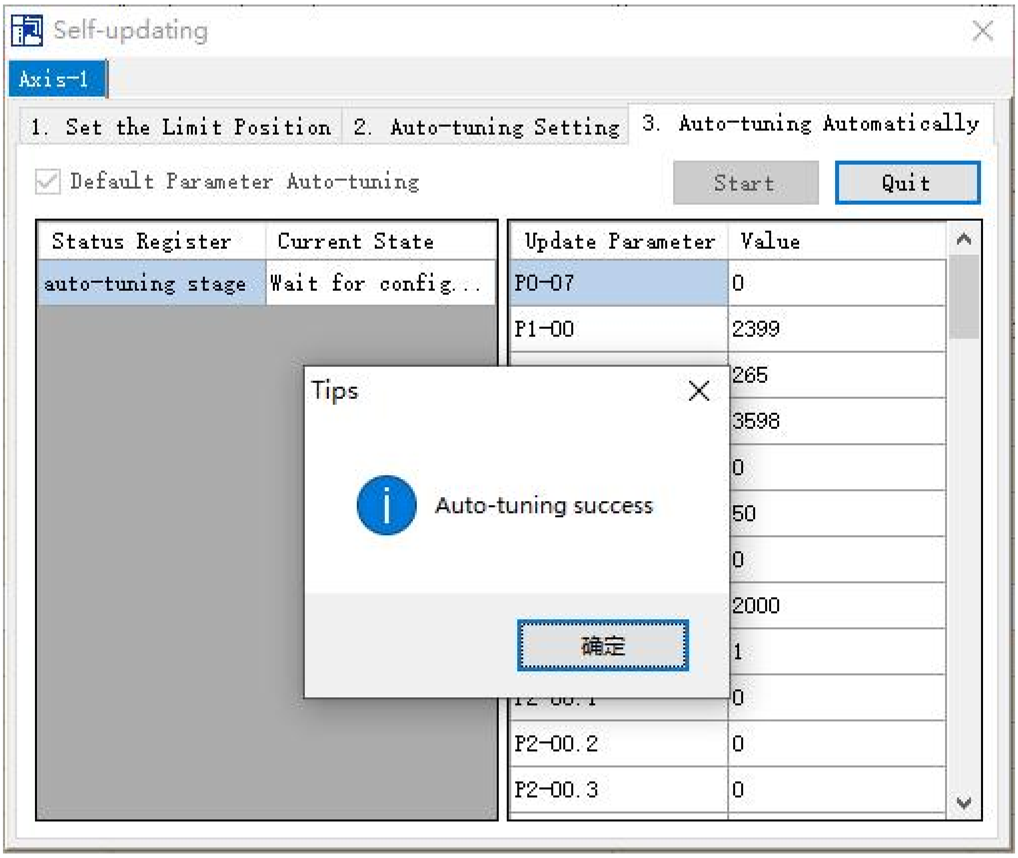
Calibration Method	explain
soft	Make gentle gain adjustments. In addition to gain adjustment, the notch filter is automatically adjusted.
quick positioning	For dedicated positioning adjustments. In addition to gain adjustment, it automatically adjusts the model loop gain and notch filter.
quick positioning (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. Wait for the calibration to complete.

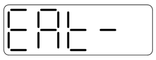


6.4.5 External Command-Based Self-Setting Operation Steps

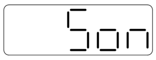
1. Self-Calibration Steps for the Drive Panel

1. Perform inertia identification by following the driver panel inertia estimation procedure outlined in Step 6.2.4 of the rotational inertia estimation section.

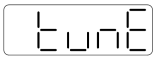
2. When entering parameter F0-08, the display shows Eat-(External Reference Auto-tuning);



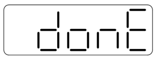
3. Short-press the ENTER key: If enabling is not enabled, the panel will display "Son" and flash; wait for enabling to activate. If enabling is already enabled, proceed.
Go to this step;



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.

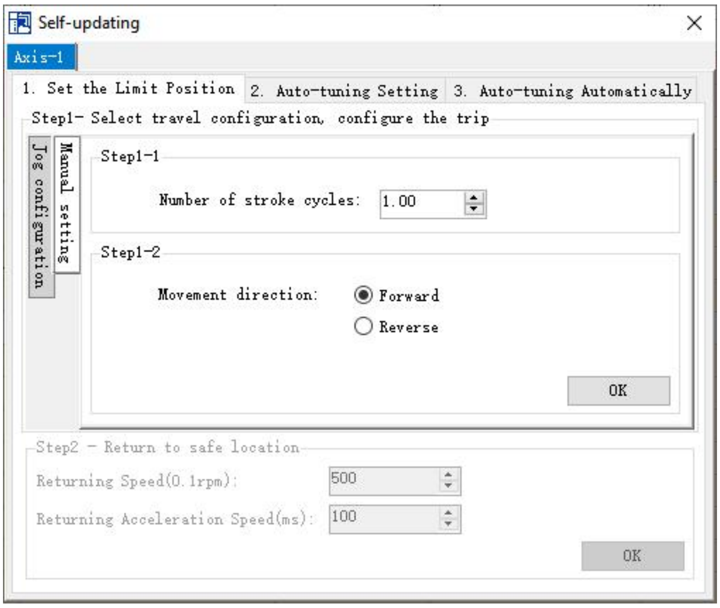
During the calibration process, pressing STA/ESC briefly at any time will terminate the operation and apply the gain parameters at the time of termination.

- Error alarm on the self-tuning process panel

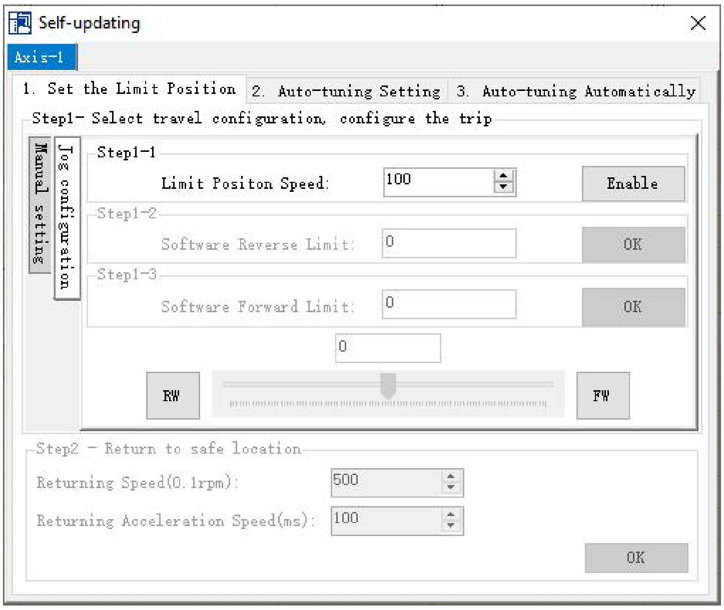
error code	meaning	Possible Reasons
Err-1	Search for optimal gain failed	The moment of inertia ratio is too high; the mechanism rigidity is too low
Err-2	① Over-range/alarm occurred during the calibration process ② External command setting/vibration suppression mode: Servo function is enabled during the setting process	Ensure the journey does not exceed limits or trigger alarms before 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 triggered an alarm
Err-8	The positioning completion signal is unstable.	The instruction interval is too short

II. XinJeServo Self-Calibration Steps

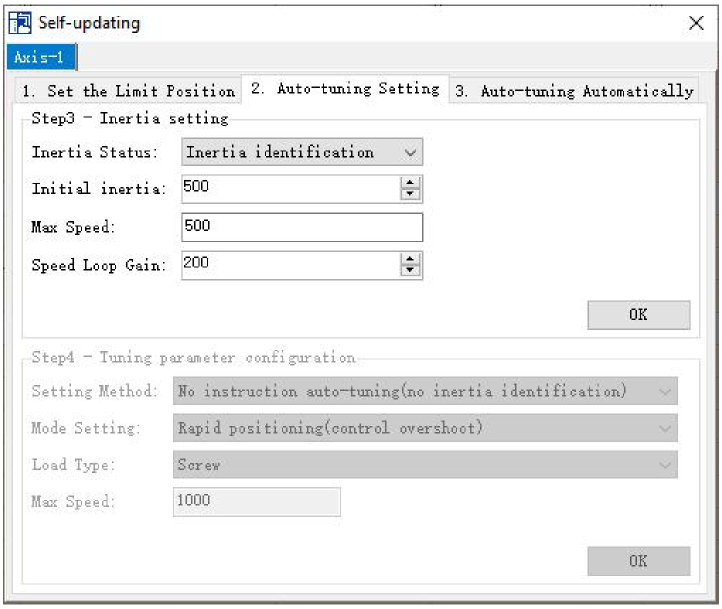
1. On the XinJeServo main menu screen, click [Gain Adjustment];



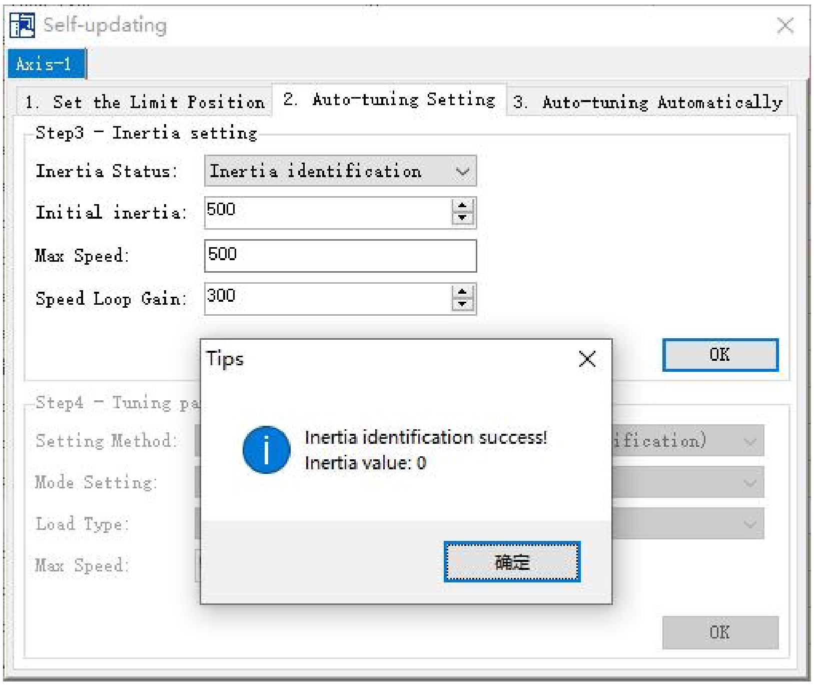
2. Select [Dynamic Configuration] or [Manual Setting] to configure the inertia estimation travel distance;



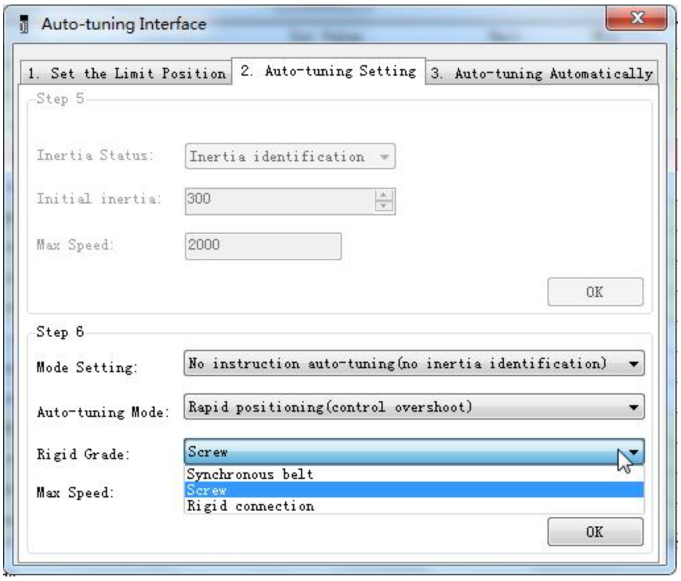
3. Configure the settings interface;



4. Click [Confirm] to start calculating the inertia;



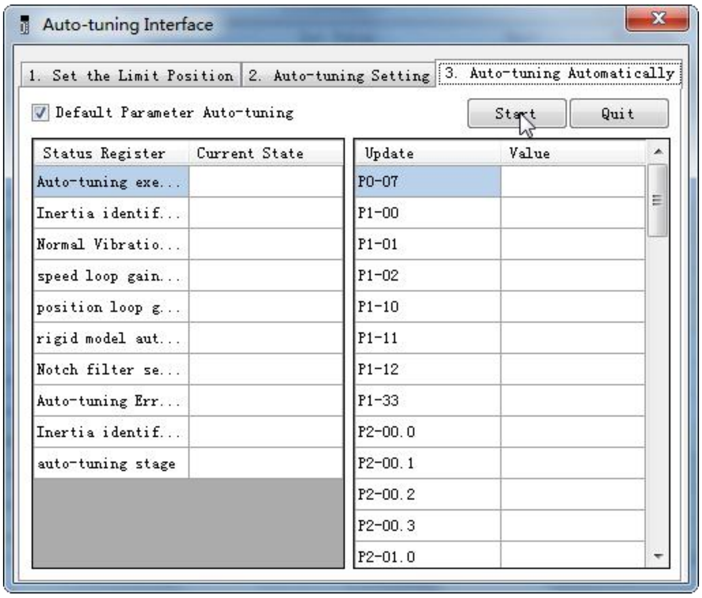
5. Adjust parameter settings;



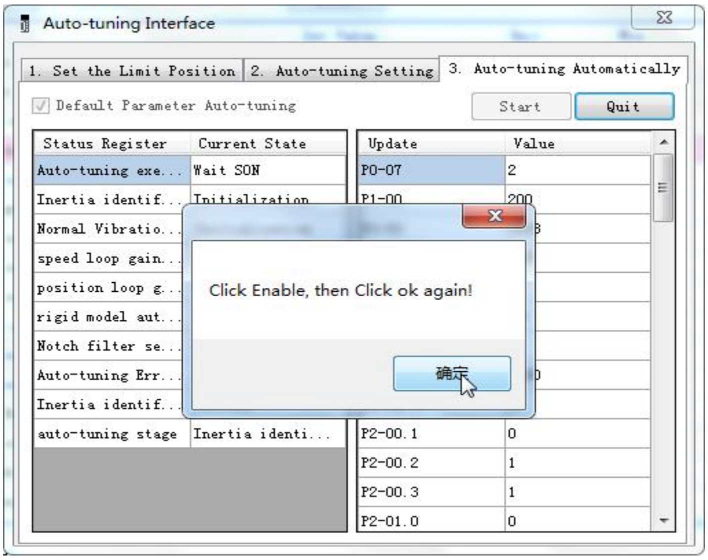
Calibration Method	explain
soft	Make gentle gain adjustments. In addition to gain adjustment, the notch filter is automatically adjusted.
quick positioning	For dedicated positioning adjustments. In addition to gain adjustment, it automatically adjusts the model loop gain and notch filter.
quick positioning (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.

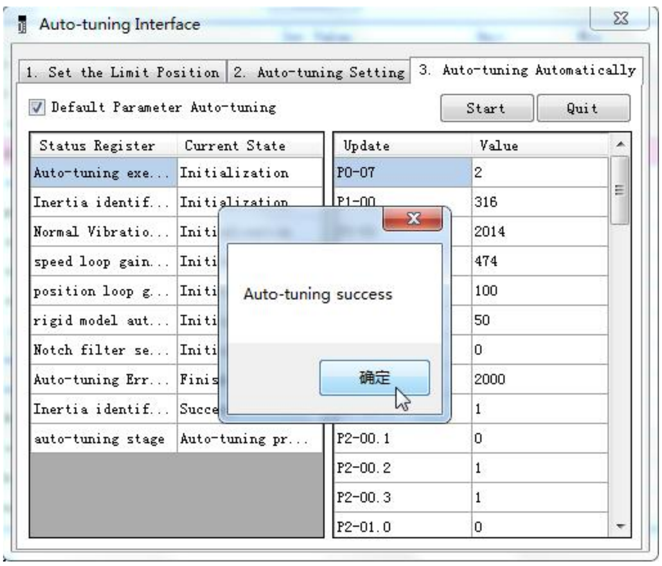
6. Begin calibration;



7. After enabling the servo, click OK;



8. After calibration is complete, click OK.



6.4.6 Relevant Parameters

The following parameters may be modified during automatic adjustment. Do not change them manually.

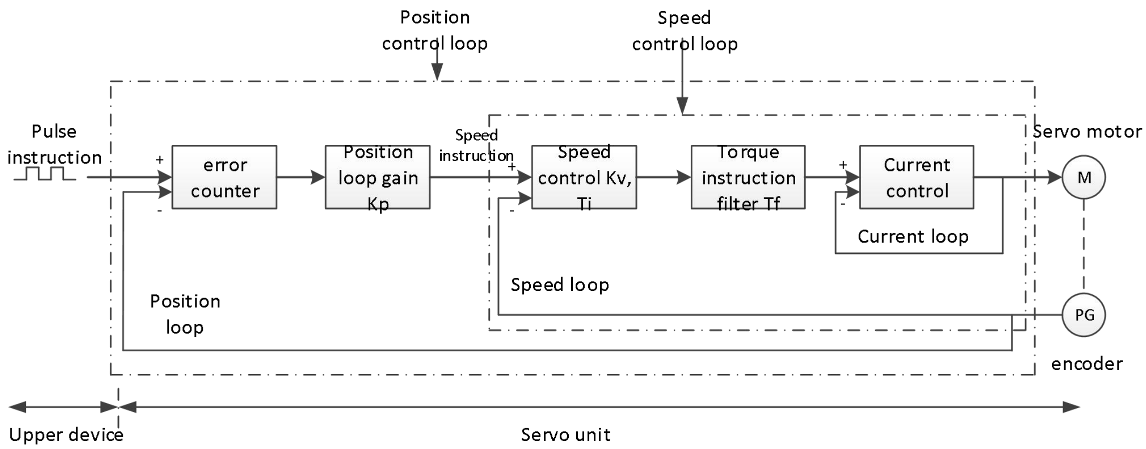
<table>
<tr><th>parameter</th><th>name</th><th>parameter attribute</th><th>After the calibration is completed, the values have an impact on the gain.</th></tr>
<tr><td>P0-07</td><td>First Inertia Ratio</td><td rowspan="27">Gain Performance parameter</td><td rowspan="27">have</td></tr>
<tr><td>P1-00</td><td>First Speed Loop Gain</td></tr>
<tr><td>P1-01</td><td>First-speed loop integral time constant</td></tr>
<tr><td>P1-02</td><td>First-position ring gain</td></tr>
<tr><td>P2-00.0</td><td>Disturbance Observer Switch</td></tr>
<tr><td>P2-01.0</td><td>Adaptive Mode Switch</td></tr>
<tr><td>P2-35</td><td>Torque command filtering time constant 1</td></tr>
<tr><td>P2-41</td><td>Disturbance observer gain</td></tr>
<tr><td>P2-47.0</td><td>Model Loop Switch</td></tr>
<tr><td>P2-49</td><td>Model Ring Gain</td></tr>
<tr><td>P2-55</td><td>Model Speed Feedforward Gain</td></tr>
<tr><td>P2-60.0</td><td>Active Vibration Suppression Switch</td></tr>
<tr><td>P2-61</td><td>Active vibration suppression frequency</td></tr>
<tr><td>P2-62</td><td>Active vibration suppression gain</td></tr>
<tr><td>P2-63</td><td>Active vibration suppression damping</td></tr>
<tr><td>P2-64</td><td>Active vibration suppression filtering time 1</td></tr>
<tr><td>P2-65</td><td>Active vibration suppression filtering time 2</td></tr>
<tr><td>P2-66</td><td>The second group uses active vibration suppression damping techniques.</td></tr>
<tr><td>P2-67</td><td>Second group of active vibration suppression frequencies</td></tr>
<tr><td>P2-69.0</td><td>First notch switch</td></tr>
<tr><td>P2-69.1</td><td>Second suppression switch</td></tr>
<tr><td>P2-71</td><td>First notch frequency</td></tr>
<tr><td>P2-72</td><td>First notch attenuation</td></tr>
<tr><td>P2-73</td><td>First notch bandwidth</td></tr>
<tr><td>P2-74</td><td>Second absorption frequency</td></tr>
<tr><td>P2-75</td><td>Second absorption attenuation</td></tr>
<tr><td>P2-76</td><td>Second absorption band width</td></tr>
<tr><td>P2-17</td><td>Inertia identification and the maximum speed determined through internal command-based self-adjustment</td><td rowspan="3">Calibration Configuration parameter</td><td rowspan="3">not have</td></tr>
<tr><td>P2-86</td><td>Set the manual operation mode</td></tr>
<tr><td>P2-87</td><td>Minimum limit for the adjustment movement</td></tr>
</table>

parameter	name	parameter attribute	After the calibration is completed, the values have an impact on the gain.
P2-88	Maximum limit for the adjustment movement		
P2-89	Maximum speed during the adjustment movement		
P2-90	Set-up acceleration and deceleration time		

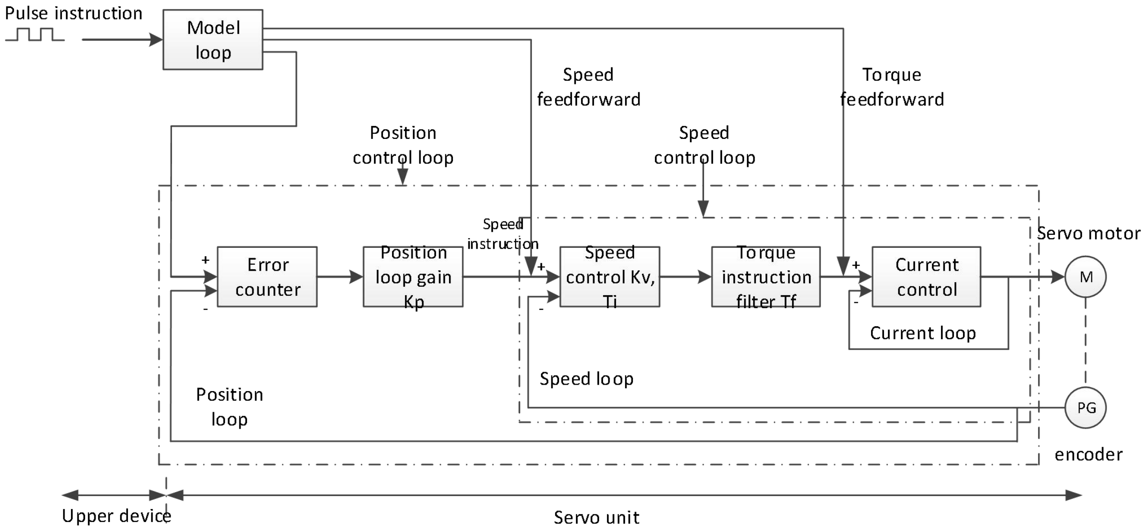
Values P2-60 to P2-63 are automatically adjusted during the self-calibration process and cannot be modified manually by users; doing so may cause system instability.

6.5 Manual Adjustment

6.5.1 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.

6.5.2 Example of Adjustment Steps

In position mode, if the soft mode (P2-02.0=1) is selected during self-calibration, 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)

6.5.3 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	Activate
P1-00	Speed Loop Gain	300	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 integral time constant approximately satisfy the following relationship:

P1-00 × P1-01 = 636620

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P1-01	Speed loop integral time constant	2653	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	Activate
P1-02	Position Loop Gain	480	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	Activate
P2-35	Torque command filtering time constant 1	66	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

When using the first set of gain parameters, P2-35 is effective; when using the second set, P2-36 is effective.

- Model Ring Gain

When the model loop is active (P2-47.0 = 1), the servosystem's responsiveness is determined by its model loop gain. Increasing this gain enhances responsiveness and shortens 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	unit	Set Range	revise	Activate

		Settings				
P2-49	Model Ring Gain	480	0.1Hz	10 ~ 20000	at any time	The server has not started.

6.6 Adaptive Adjustment

6.6.1 Overview

The adaptive function enables stable response through automatic adjustment regardless of machine type or load fluctuations. Servo ON automatically initiates the adjustment process.

6.6.2 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 it down urgently at any time.

6.6.3 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	revise	Activate
P2-01	n.□□□0	Adaptive Close	n.□□□0	servo bb	Power On Again
	n.□□□1	Adaptive Open			

6.6.4 Momentum Mode and Related Parameters

The adaptive default setting uses 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	revise	Activate
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	revise	Activate
P2-05	Adaptive Speed Loop Gain	400 Notes 1	servo bb	Power On 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 servo drives of 750 W or less, the default value is 400; for other power ratings, 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.

6.6.5 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 a large moment of inertia, some parameters still need to be adjusted. The recommended parameters are as follows (all modified parameters were set under the default parameters).

Motor Housing	inertia	parameter
40～90 Base	Within 20 times the inertia	Adaptive Low-Inertia Mode (Default Parameter)

Motor Housing	inertia	parameter
	Inertia of 20 to 30 times	Change P2-08 to 50 and P2-12 to 40
	Inertia of 30 to 40 times	Change P2-08 to 50, P2-12 to 40, and P2-07 to 10
	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 the adaptive high-inertia mode or modify P2-08=40, P2-12=50, P2-07=50
110/130 Machine 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 the 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 the adaptive high-inertia mode or modify P2-08=40, P2-12=50, P2-07=50

Parameters with high 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.

6.6.6 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 readily induce oscillations.
P2-08/P6-08	Speed Observer Gain	60/40	30 ~ 60	Reducing P2-08 while increasing P2-12 can significantly enhance the

parameter Small Inertia / Large Inertia	name	Windows default	Reference Angle Section Range	effect
P2-12/P6-12	Adaptive Mode Stabilizes the Maximum Inertia Ratio	30/50	30 ~ 60	system's inertia capacity, but it will compromise responsiveness, with a substantial impact on response performance.
P2-10	Adaptive Mode Speed Loop Integration Time Coefficient	500	200 or more	Adjust as needed; generally 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 improves resistance to disturbances, 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.

6.6.7 Parameters whose adaptive validity 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 integral 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

6.7 Vibration Suppression

6.7.1 Overview

Mechanical systems possess a specific resonant frequency. When the servo gain is increased, sustained vibrations may occur near this resonance 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.

6.7.2 Operating Tools

Adjustment Method	Operation Tools	control model	Refer to the operational steps for guidance.	Restriction Item
Adaptive Mode	XinJeServo Mechanical Property Analysis	In Position Mode	6.7.4 Vibration Suppression (Host Computer Software)	All versions of the host software support it.
Self-Calibration Mode	Panel Vibration Suppression Operation	In Position Mode	6.7.3 Vibration Suppression (Panel)	The driver firmware requires version 3700 or higher
Self-Calibration Mode	XinJeServo Mechanical Property Analysis	In Position Mode	6.7.4 Vibration Suppression (Host Computer Software)	All versions of the host software support it.
Self-Tuning/Adaptive Mode	Panel Vibration Suppression Operation	In Position Mode	6.7.6 Vibration Suppression (easyFFT)	The driver firmware requires version 3730 or higher

The driver firmware version can be viewed via U2-07.

6.7.3 Vibration Suppression (Panel)

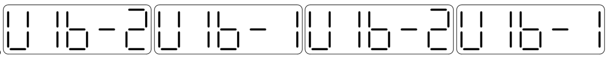
The panel vibration suppression system features two operating modes: Mode 1 (vib-1) and Mode 2 (vib-2).

- Two Differences in Vibration Suppression Mechanisms

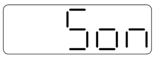
Vibration Suppression Mode	show	changed parameters
pattern 1	vib-1	Only changes vibration suppression-related parameters
pattern 2	Vib-2	Changes vibration suppression parameters and speed loop gain

The following describes the steps:

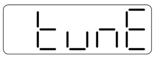
1. In self-calibration mode, select parameter F0-10 to display vib-1 on the panel, or select F0-11 to display vib-2.

perhaps 

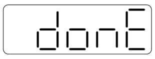
2. Press and hold the ENTER key; the panel will display "Son" and flash. At this point, manually enable it.



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). Phase

For parameter details, see Section 6.7.7 on Bandpass Filters.

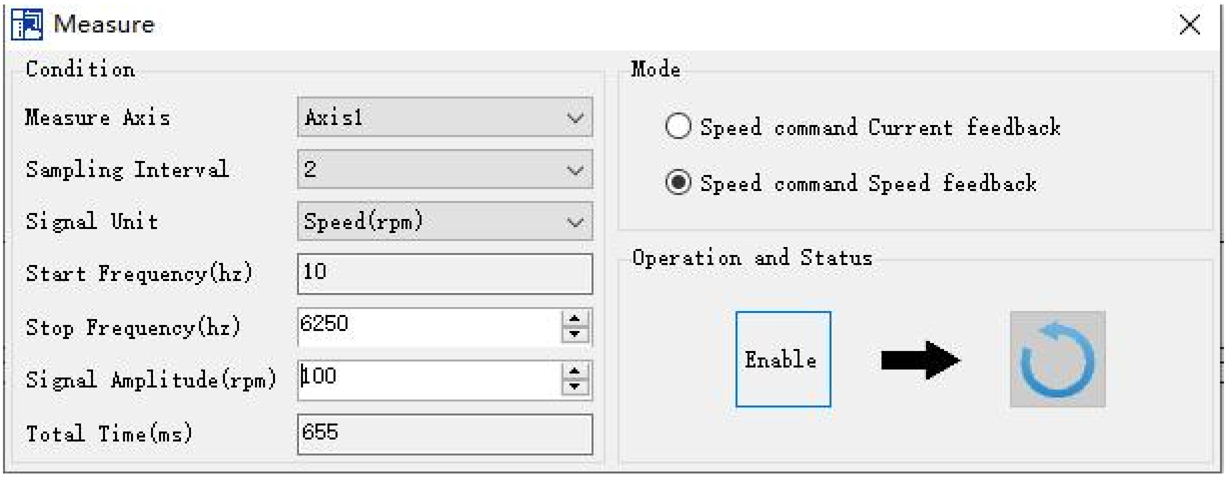
- Panel error alarm for vibration suppression process

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 resetting Confirm that enabling is not disabled during the calibration process
Err-3	Current Non-Position Control Mode	Self-adjust in location mode

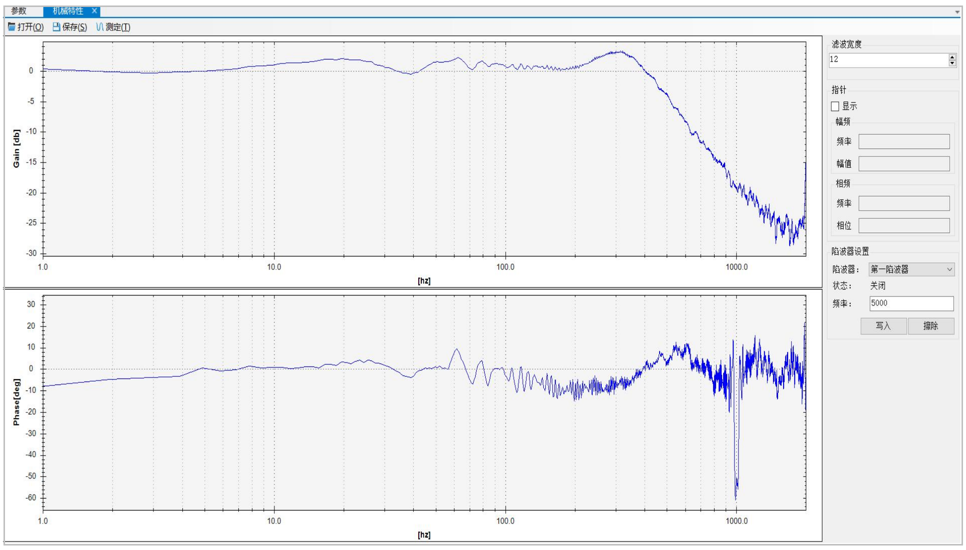
Err-4	Adaptive feature is not turned off	Change P2-01.0 to 0 before performing self-calibration
Err-7	An alarm occurred in the driver during the calibration process.	The drive has triggered an alarm
Err-8	The positioning completion signal is unstable.	The instruction interval is too short

6.7.4 Vibration Suppression (Host Computer Software)

1. Open the XinJeServo host software and select Mechanical Properties;
2. Click [Measure];



3. Configure the test conditions, then click [Execute];
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 6.7.7 Band-stop Filter for details.

Taking the above figure as an example, mechanical analysis reveals a resonance frequency of 328 Hz; therefore, the third notch filter can be employed with the following parameters: P2-69 = n·1000, P2-77 = 328.

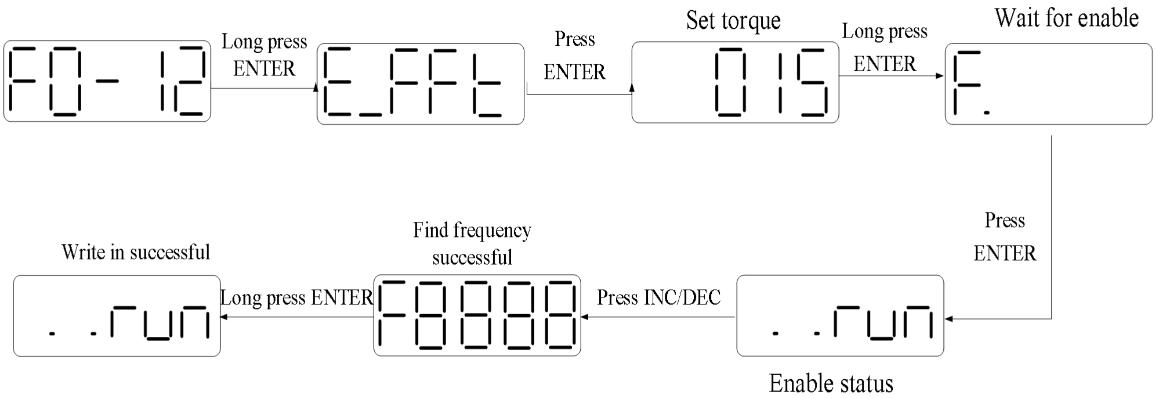
> Whether in adaptive or self-tuning mode, using mechanical characteristic analysis constitutes manual notch setting. If multiple resonance points exist, configure the third to fifth notch filters sequentially.

6.7.5 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 6.7.7 Notch Filters.

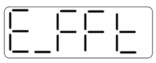
6.7.6 Vibration Suppression (EasyFFT)

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:

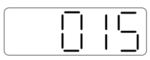


The following describes the steps:

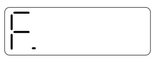
1. For F0−12, press and hold [ENTER] to enter the EasyFFT mode, where "E_FFt" will be displayed;



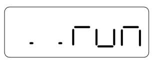
2. Press [ENTER] to enter the torque setting interface, where the currently set torque value (i.e., the value of P6-89) will be displayed. Use [INC] or [DEC] to adjust the torque command; when increasing the value, increment it gradually to avoid severe equipment vibration.



3. After setting the torque command, press and hold [ENTER] to enter the "Prepare for Activation" phase; the interface will display "F.".

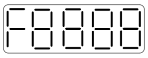


4. Press [ENTER] to enable and display "...run";

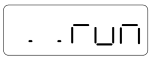


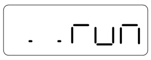
5. Press [INC] and [DEC] to switch between forward and reverse rotation, then search for the resonant

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 resonance frequency again. Once identified, hold [ENTER] to set the displayed resonance frequency in the driver's notch filter.

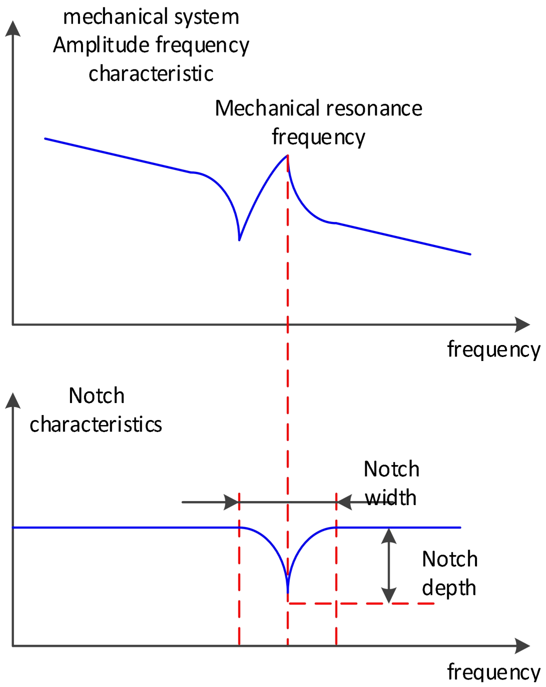




Press and hold the STA/ESC key to return to the previous step; tap [STA] to exit.

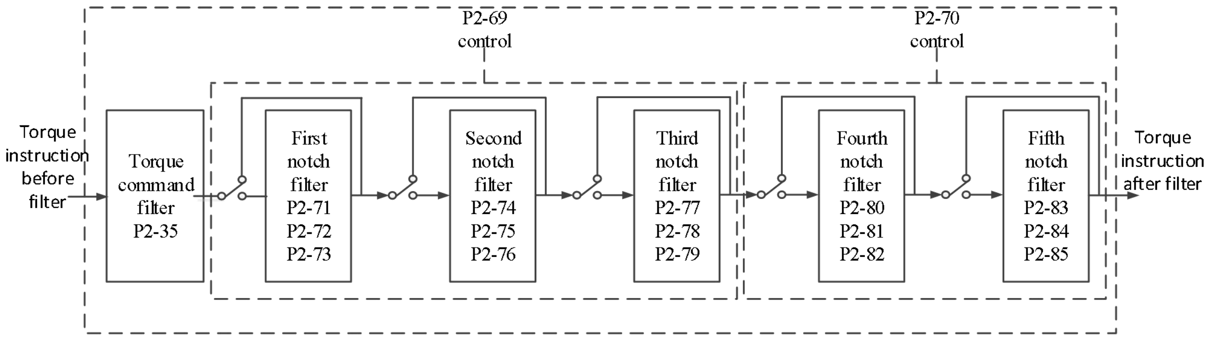
6.7.7 Passband Filter

A notch filter suppresses mechanical resonance by reducing 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:



Sloppeter 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	Activate
P2-69	n.□□□0	The first notch is closed	n.□□□0	at any time	immediately
	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 choke is open			
P2-70	n.□□□0	The fourth absorber is turned off.	n.□□□0	at any time	immediately
	n.□□□1	The fourth notch filter is turned on			
	n.□□0□	The fifth filter is turned off.	n.□□0□	at any time	immediately
	n.□□1□	The fifth filter is turned on			

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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

Parameter	Meaning	Factory settings	Unit	Set range	Revise	Activate
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
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 takes priority 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.

6.8 Benefit Adjustment Application Features

6.8.1 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; this parameter 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 self-tuning mode is set to Soft; it turns on automatically when the self-tuning mode is set to Fast Positioning or Fast Positioning (Control Overlap).

Self-Calibration Mode

parameter		meaning	Factory Settings	revise	Activate
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.

loadtype	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	For dedicated positioning adjustments. 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.

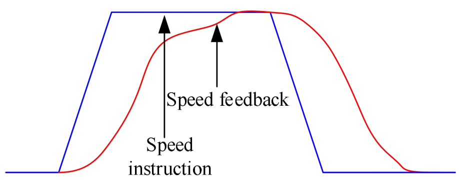
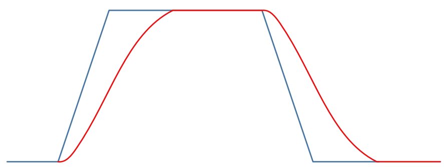
parameter		meaning	Factory Settings	revise	Activate
P2-02	n.□□□1	soft	n.□□□3	at any time	immediately
	n.□□□2	quick positioning			
	n.□□□3	Quick Localization (Control Overlap)			

Model Ring Function Switch

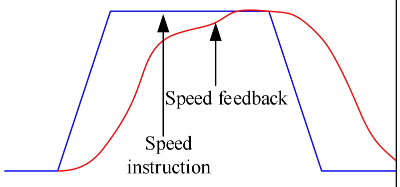
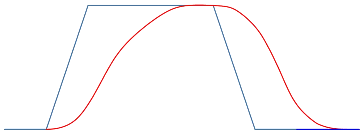
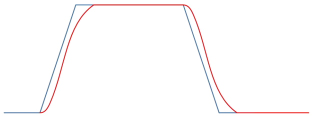
parameter		meaning	Factory Settings	revise	Activate
P2-47	n.□□□0	Model loop closed	n.□□□0	at any time	immediately
	n.□□□1	Model loop enabled			

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 Ring Function Off (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
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: Stable operation and fast response

The above curve diagram only illustrates the parameter effects and does not represent the actual operational curve.

6.8.2 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-Tuning 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	Activate
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	Activate

P2-41	Disturbance observer gain	85	%	0 ~ 100	at any time	immediately

6.8.3 Gain Adjustment Parameters

parameter	meaning	Factory Settings	unit	Set Range	revise	Activate
P1-00	First Speed Loop Gain	<=20P7： 300 >=21P0： 200	0.1Hz	10~20000	servo bb	immediately
P1-01	First-speed loop integral time constant	<=20P7：2122 >=21P0：3183	0.01ms	15~51200	servo bb	immediately
P1-02	First-position ring gain	<=20P7： 300 >=21P0： 200	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

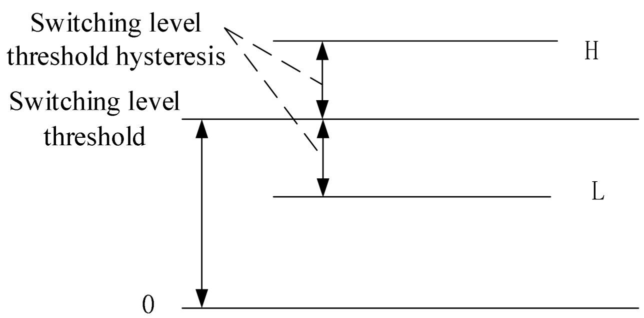
6.8.4 Gain Switching

<table>
<tr><th colspan="2">parameter</th><th>meaning</th><th>Factory Settings</th><th>revise</th><th>Activate</th></tr>
<tr><td rowspan="2">P1-14</td><td>n.□□□X</td><td>n.□□□X: Gain switching function switch
0: SI terminal gain switching is effective (gain switching parameters are not applied)
1: Perform gain switching according to the gain switching conditions
2: Reserve</td><td rowspan="2">0</td><td rowspan="2">at any time</td><td rowspan="2">immediately</td></tr>
<tr><td>n.□□X□</td><td>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</td></tr>
</table>

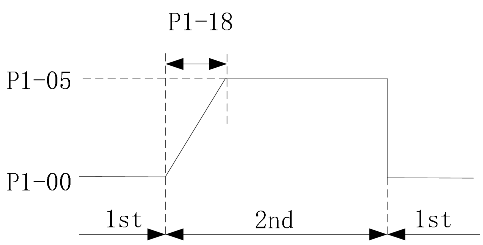
parameter		meaning	Factory Settings	revise	Activate
		4: Significant variations in speed commands 5: [retained] -Fixed to the first gain 6: Significant positional deviation 7: Position Command 8: Localization completed 9: Actual speed is high A: Position command + actual speed			
P1-15		Gain switching 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" is shown in the figure below:

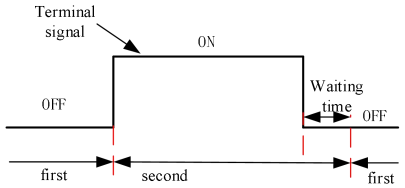
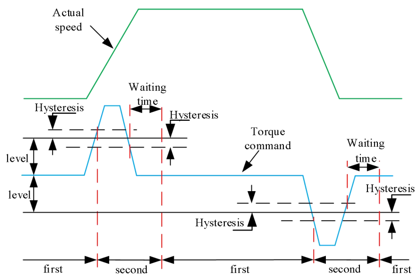
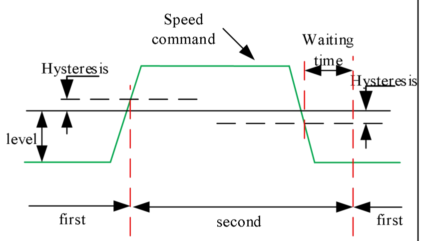


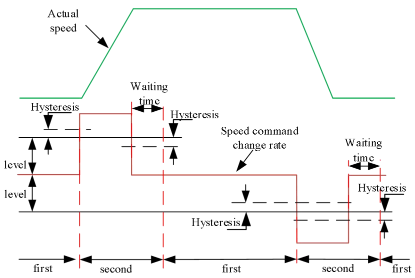
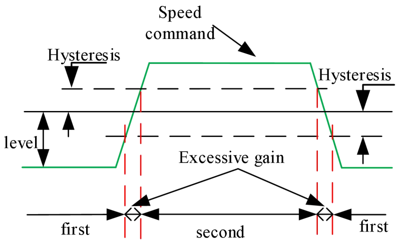
3) Explanation of "Position Gain Switching Time":

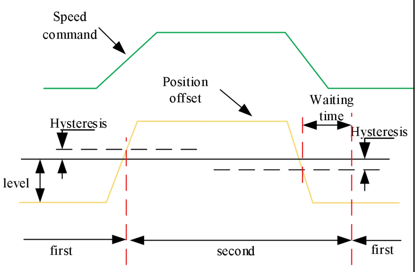


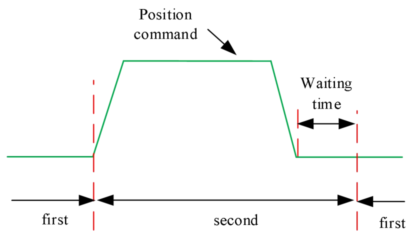
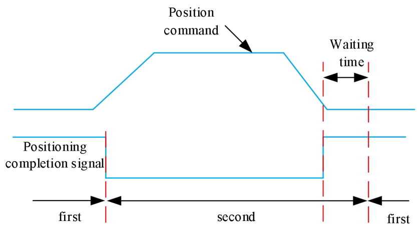
4) Explanation of Gain Switching Conditions

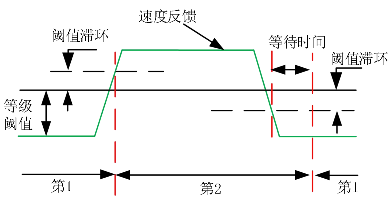
Gain Switching Condition Settings				relevant parameter		
P1-14.1	condition	diagrammatic sketch	remarks	P1-15 wait time	P1-16 grade threshold	P1-17 threshold hysteresis

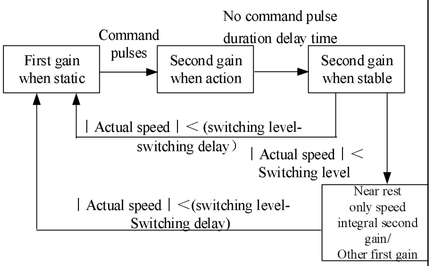
Gain Switching Condition Settings				relevant parameter		
0	First gain fixed	-	-	of no avail	of no avail	of no avail
1	Terminal Switching		Use the G-SEL signal for gain switching: The G-SEL signal is invalid; Group 1 gain The G-SEL signal is active; Group 2 gain	valid	of no avail	of no avail
2	Torque 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 (%)
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	valid	valid	valid

Gain Switching Condition Settings				relevant parameter		
			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.			
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 (level minus hysteresis) [10 rpm/s] for the entire duration of P1-15, the system returned to the first gain setting.	valid	valid (10rpm/s)	valid (10rpm/s)
5	Speed command high/low threshold [not supported yet]		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.	of no avail	valid (rpm)	valid (rpm)

Gain Switching Condition Settings				relevant parameter		
			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 was below (level + hysteresis) [rpm], the system returned to the first gain level. The gain gradually adjusted until the absolute value reached (level － hysteresis) [rpm], at which point the gain fully reverted 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. Upon the last application of the	valid	valid (Encoder Unit)	valid (Encoder Unit)

Gain Switching Condition Settings				relevant parameter		
			second gain setting, if the absolute value of position deviation remains below (level-hysteresis) [encoder units] for a duration sufficient to maintain state P1-15, revert to the first gain setting.			
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	of no avail	of no avail
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	valid	of no avail	of no avail

Gain Switching Condition Settings				relevant parameter		
			gain application, if the positioning completion status remains unchanged throughout the waiting period P1–15, 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 setting, when the absolute value of the actual speed exceeded (level + hysteresis) [rpm], switch to the second gain setting. During the previous second gain application, when the absolute value of the relative speed remained below (level-hysteresis) [rpm] and P1-15 continued to maintain this condition, return to the first gain setting.	valid	valid (rpm)	valid (rpm)

Gain Switching Condition Settings				relevant parameter		
A	Position Command + Actual Speed		Only valid in Position mode (other modes are set to gain 1): When applying the first gain setting, switch to the second gain if the position command is not 0. During the previous second gain application, when the position command was set to 0, the system maintained the second gain 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 less than (level-hysteresis loop)[rpm], the speed integration	valid	valid (rpm)	valid (rpm)

Gain Switching Condition Settings				relevant parameter		
			also returns to the first speed-loop integration time constant (P1-02).			

6.8.5 Switching between Speed Loop PI and PI modes

6.8.5.1 Switching Between Speed Control Modes

parameter		meaning	Factory Settings	revise	Activate
P1-26	n.□□□0	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	0	servo bb	immediately
	n.□□0□	0: Clear the ASR score 1: Keep points unchanged and do not accumulate them			
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

6.8.5.2 IP Control Selection

parameter		meaning	Factory Settings	revise	Activate
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.

6.9 Benefits Adjustment Related Matters

6.9.1 When load shaking occurs

The following reasons can cause load fluctuation:

1. The command is not smooth enough when the load inertia is too high.

Countermeasure: 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

Countermeasure: ① Reduce the gain parameter;
② Optimize the commands of the upper-level device to reduce command acceleration.

6.9.2 When vibration occurs

The following reasons can cause machine vibration:

1. Vibration caused by inappropriate servo gain

Countermeasure: Reduce gain

2. Mechanical resonance point

Countermeasure: Perform mechanical characteristic analysis or manually set the notch parameters.

6.9.3 When Noise Occurs

In Adaptive Mode:

1. Caused by inappropriate servo gain
Countermeasure: Reduce the adaptive control bandwidth (P2-19).

In self-tuning 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 section 6.9.2 for handling vibration occurrences.

7. Police Report Analysis

7.1 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	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	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); the grid voltage is low.	√	√	deny	servo run
			Bus voltage is too low; ② Power loss in the driver causes the bus voltage to drop below the required level.	○	√	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
	2	E-082	Encoder Zero Position Deviation Protection 1	√	√	deny	servo off

Alarm Code		confirm code	explain	attribute			Servo status when an alarm occurs
Major Category	subd			history	Can be deleted	Do you want to power on the device to activate the alarm clearance?	
	3	E-083	Speed command exceeded limits	√	√	deny	servo off
09	2	E-092	The analog signal Tref exceeds the zero calibration 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
	1	E-111	P+ Current Overcurrent Protection	√	√	deny	servo off
	2	E-112	U-phase current overcurrent protection	√	√	deny	servo off
	3	E-113	V-phase current overcurrent protection	√	√	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
	6	E-166	Motor brake malfunctions during shutdown (supported in versions 4030 and above)	√	√	deny	servo off
	7	E-167	Abnormal opening of motor brake (supported in versions 4030 and above)	√	√	deny	servo off
20	0	E-200	Braking resistor overload	√	√	deny	servo run
22	0	E-220	Absolute value servo encoder communication error	√	√	deny	servo run
	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

Alarm Code		confirm code	explain	attribute			Servo status when an alarm occurs
Major Category	subd			history	Can be deleted	Do you want to power on the device to activate the alarm clearance?	
	6	E-226	The TAMA optical system has been equipped with a temperature alarm function.	√	√	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 electrical angle deviation protection	√	√	deny	servo off
24	0	E-240	Time-series error in encoding 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
	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	√	○	deny	servo off
	1	E-311	Motor code lost	√	○	yes	servo off
	2	E-312	The motor parameters have been corrupted during reading.	√	○	deny	servo off
	3	E-313	Encoder software version does not match	√	○	deny	servo off
	4	E-314	The encoder software version is not supported	√	○	deny	servo off

Alarm Code		confirm code	explain	attribute			Servo status when an alarm occurs
Major Category	subd			history	Can be deleted	Do you want to power on the device to activate the alarm clearance?	
	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

7.2 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 within that category.

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
EEEE	1	EEEE1	Communication error between the panel and the CPU	① Significant fluctuations in power supply voltage; low voltage causes panel refresh failure. ② The panel program is corrupted.	① Ensure stable power supply with consistent voltage. ② After power outage and restart, if the alarm persists, contact your agent or Manufacturer.
	2	EEEE2			
	3	EEEE3			
	4	EEEE4		① Significant fluctuations in power supply voltage; low voltage causes panel refresh failure. ② The panel program is corrupted. ③ Communication enters a infinite loop	① Ensure stable power supply with consistent voltage. ② After power outage and restart, if the alarm persists, contact your agent or Manufacturer. ③ Remove the communication terminals before running to confirm;
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	① Program corrupted ② Device damage	Contact the agent or Manufacturer
	4	E-014	FPGA access error	① Program corrupted ② Hardware damage ③ The intensity of external interference is too high	Contact the agent or Manufacturer
	5	E-015	Program execution	Program malfunction	Contact the agent or

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
			error		Manufacturer
	6	E-016	hard error	① Program corrupted ② Hardware damage ③ The intensity of external interference is too high	① Check the input voltage for any phase loss or excessively low supply voltage. ② Contact the agent or Manufacturer
	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	① Check whether the parameter settings meet the requirements ② 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 L1 and L3. ② Turning the power back on immediately after a power outage will trigger an alarm E-024. ③ Reset Parameters
	5	E-025	Erasing FLASH	Parameter saving failed	Contact the agent or

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
			Error	during power outage	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; ② Contact the agent or Manufacturer
03	0	E-030	The bus voltage U0-05 exceeds the preset threshold value. Machine powered by 220 V (U0–05 ≥ 402 V)	The grid voltage is too high.	Check the power grid voltage fluctuations. The normal voltage range for a 220V driver is 200V – 240V. If significant voltage fluctuations occur, use a proper voltage source and regulator.
				Excessive load rotational inertia (insufficient regenerative capacity)	① Connect an external braking resistor; specify the resistance values as detailed in Chapter 1.4 (220 V: bus voltage U0-05 = 392 V for discharge initiation, U0-05 = 377 V for discharge termination). 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

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					Chapter 1.4 for selection guidelines
				The acceleration and deceleration times are too short.	Extend acceleration and deceleration times
				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%. If it exceeds 220 V + 10%, check the supply voltage; if normal, the servo BB 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)	An alarm is triggered during normal power-on when the grid voltage is too low.	① Check the grid voltage fluctuations: The normal voltage range for a 220V driver is 200V – 240V. If significant voltage fluctuations are observed, use 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 is 220 V ± 10%. If <220 V ± 10%, check the supply voltage; if

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					normal, the servo BB 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 return for repair.
	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 an extended period	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; when module temperature U0-06 ≥ 45 ° C, the fan activates.
				Fan damage	Change the fan
	1	E-061	Motor overheating	An alarm is triggered when the motor temperature exceeds	① Check whether the motor fan is abnormal

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
				140°C.	② Contact the Manufacturer's technical support
	3	E-063	Thermistor wire break alarm	The thermistor in a motor with a power rating of 11 kW or higher has broken. ② Alarm triggered when a motor with power below 11 kW is mistakenly turned on due to a broken wire.	Check the connection of the external thermistor; Shielded thermistor wire break alarm: P0-69.1=1
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, adjust them to match and power on again.
				UVW wiring error	Check the UVW wiring of the motor; ensure it is connected in the correct 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 position it at U0-10. Slowly rotate the motor shaft manually to verify normal value changes: one direction shows

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					increasing values while the other shows decreasing values (displayed in a 0－9999 cycle range).
				parameter setting	An alarm will be triggered when the actual speed exceeds the value of P3-21/P3-22.
	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 phase sequence. ② Check the encoder zero position; contact the Manufacturer's technical support.
	3	E-083	Speed command exceeded limits	The speed command in position mode exceeds the set value of 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 exceeds the zero calibration limit.	Error in analog signal zeroing operation	Set the zero point without applying analog voltage
	3	E-093	The analog signal Vref's zero calibration value exceeds the allowed limit.	Error in analog signal zeroing operation	Set the zero point without applying analog voltage
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 in locked rotor condition; ② Reduce the position-given speed; ③ Increase the deviation pulse limit value P0-23.

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
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 drive U3-70 matches that on the motor label. If they do not match, adjust them to match and power on again.
				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 Measure the UVW phase-to-phase resistance of the motor to ensure balance; if any imbalance is detected, 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 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 operation	Increase acceleration and deceleration time
				Encoder Problem	① Check the encoder cable or replace it; ② Set the servo driver to BB

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					mode and position it at U0-10. Slowly rotate the motor shaft manually to verify normal value changes: one direction shows increasing values while the other shows decreasing values (displayed in a 0－9999 cycle range).
	1	E-111	P+ Current Overcurrent Protection	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 Measure the UVW phase-to-phase resistance of the motor to ensure balance; if any imbalance is detected, 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 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 operation	Increase acceleration and deceleration time
				Encoder Problem	① Check the encoder cable or

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					replace it; ② Set the servo driver to BB mode and position it at U0-10. Slowly rotate the motor shaft manually to verify normal value changes: one direction shows increasing values while the other shows decreasing values (displayed in a 0－9999 cycle range).
	2	E-112	U-phase current overcurrent protection	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 Measure the UVW phase-to-phase resistance of the motor to ensure balance; if any imbalance is detected, 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 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

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
				operation	
				Encoder Problem	① Check the encoder cable or replace it; ② Set the servo driver to BB mode and position it at U0-10. Slowly rotate the motor shaft manually to verify normal value changes: one direction shows increasing values while the other shows decreasing values (displayed in a 0－9999 cycle range).
	3	E-113	V-phase current overcurrent protection	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 Measure the UVW phase-to-phase resistance of the motor to ensure balance; if any imbalance is detected, 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 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	Run the motor with an empty shaft to identify any load issues

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
				blockage.	
				Instant alarm during rapid start/stop operation	Increase acceleration and deceleration time
				Encoder Problem	① Check the encoder cable or replace it; ② Set the servo driver to BB mode and position it at U0-10. Slowly rotate the motor shaft manually to verify normal value changes: one direction shows increasing values while the other shows decreasing values (displayed in a 0－9999 cycle range).
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, adjust them to match and power on again.
				Overload condition: the actual operating torque exceeds the rated torque and persists during prolonged continuous operation. (Check the actual operating torque on monitor U0-02; if the motor operates normally without seizing or vibration, a value consistently above 100 on U0-02	Increase the capacity of the drive and motor. Extend acceleration and deceleration times and reduce load. Monitor U0-00 for overspeed operation.

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
				indicates improper motor selection.)	
				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.	Measure the voltage at the brake lever terminals to determine whether the brake is open. Determine the brake control method; it is recommended to use a servo BK brake signal for control. If not servo-controlled, Note the timing between brake release and motor operation.
				There are wiring errors in the encoder and power lines, or there are broken wires or loose connectors with weakened pins.	Check the wiring of the U, V, and W power lines for potential phase sequence errors. Use a multimeter to check whether all encoder wires are properly connected and there are no broken connections. Check for any looseness at the connector, monitor machine vibration, and inspect the connector for 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;	On-site servo cross-test results indicate either motor shaft misalignment or motor failure:

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					F1-01 fails during trial operation, while F1-00 cannot rotate at constant speed when operated manually. Replace the drive or motor, and return the faulty unit to the Manufacturer for repair.
	5	E-165	Blockage Prevention and Turnaround Alarm The system will trigger an alarm if the current motor output torque exceeds P3-38/P3-39 (internal forward/reverse torque limits), lasts for P0-74 ms, and the rotational speed falls below P0-75 (1 rpm).	① The machinery experiences impact, sudden weight increase, or distortion; ② The motor operates when the brake is not released; ③ The parameter settings are unreasonable.	① Eliminate mechanical distortion factors and reduce 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 relationship 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.
	6	E-166	Motor brake malfunctions during shutdown (supported in versions 4030 and above)	The brake lever is not released. ② The gravity load parameter P9-40 is improperly set.	Measure the voltage at the brake lever terminals to determine whether the brake is open. Reset gravity load parameter P9-40
	7	E-167	Abnormal opening of motor brake (supported in versions 4030 and above)	The brake is not closed	Measure the voltage at the brake caliper terminals to determine how to activate the brake.
20	0	E-200	Braking resistor overload	The grid voltage exhibits significant fluctuations, resulting in	Improve input voltage

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
				excessively high voltage levels.	
				The braking resistor is selected to be too small in size.	Replace with a higher-power brake discharge resistor (reference resistance value: 1.4 ohms)
				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%. If it exceeds 220 V ± 10% (i.e., 380 V ± 10%), check the supply voltage; if the supply voltage is normal, the servo is in operational status— monitor U0-05. If the measured voltage on the multimeter × 1.414 <U0-05 (within an error margin of 10 V), the servo driver is faulty and requires replacement.
22	0	E-220	Absolute value servo encoder communication error	Motor mismatch error	Check if the motor matches correctly
				The encoder wire is not connected or has poor contact.	Check if the value of U0-54 increases rapidly; if so, determine that the encoder circuit is disconnected. Disconnect the driver power supply and check the encoder cable connections for loose wires. Use a multimeter to test for continuity. After resolving the issue, power on the device again. ① Hot swapping is strictly

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					prohibited. ② For applications requiring tank chains, use dedicated cables.
				The received encoder data contains errors, and the number of errors exceeds the value set in the encoder error retry count register P0-56 (for versions 3770 and later, set error counts to P0-68.0–P0-68.1).	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; insulate encoder wires with magnetic rings; avoid using welding machines or other devices that generate significant interference.
	1	E-221	Too many CRC error occurrences in encoder communication	The received encoder data contains errors, and the number of errors exceeds the value set in the encoder error retry count register P0-56 (for versions 3770 and later, set error counts to P0-68.0–P0-68.1).	The encoder is subjected to interference; isolate the source of interference.
	2	E-222	Absolute servo encoder low battery 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).
				Power-on alarm for the new device	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

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					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 motor, 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 multi-turn 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 the standard encoder cable and perform cross-testing.
				This is usually due to issues with the encoder itself or unstable power supply to the encoder.	② The encoder itself is faulty; the servo motor needs to be replaced.
	6	E-226	The TAMA optical system has been equipped with a temperature alarm function.	① The encoder temperature is too high; ② The alarm temperature setting for the P0-77 encoder is too low;	① Measure the current encoder temperature and dissipate heat from encoders with excessively high temperatures; ② Adjust the alarm temperature threshold for the P0-77 encoder; ③ P0-77 = 0 (shielded);
	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.	When the battery is depleted, unplugging the encoder cable may trigger this alarm.
	8	E-228	Absolute value servo encoder value overflow	The motor runs in one direction continuously, and the encoder data value exceeds the limit (overflows).	① Set F1-06 to 1 and clear the absolute encoder's revolution count;

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					② Setting P0-79 to 2 will disable this alarm.
	9	E-229	Encoder electrical 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	Time-series error in encoding 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	① The total time required for P9-15 to return to the origin	① Increase P9-15 ② Ensure that the direction of

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
				when its value is not zero exceeds the time set in P9-15. ② Incorrect settings for the original function parameters of the new device	the mechanical displacement (P9-19, P9-20) is opposite to the direction 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 handling mode is set to alarm.	To avoid immediate alarm when exceeding the limit, change the signal processing method for over-limit conditions.
	1	E-261	Out-of-range signal connection error	When the motor is running forward, it encounters a reverse overtravel signal. 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	① Reduce inertia or use a brake motor; ② Increase the timeout duration P0 to 30
	4	E-264	Excessive vibration	① Oscillation induced by external forces ② High load inertia, incorrect load inertia ratio settings, or excessively low gain cause oscillation during positioning.	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 speed curve; When the first three peaks and

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					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 first peak speed values after the completion of the pulse command consecutively reach or exceed 300 rpm for three times, a drive alarm is triggered. This issue should be resolved using either Method ① or Method ② as described above. ④ Contact the Manufacturer's technical support
	5	E-265	The motor is vibrating excessively.	The machine is vibrating.	Check the motor installation.
28	0	E-280	Failed to read motor parameters	Request to read EEPROM failed	① After professional verification, the drive unit and motor are compatible and can be used together. ② Check the connection status of the encoder wires; test their continuity or replace them if necessary. ③ Check whether the driver and motor are functioning properly by replacing them with new components. If issues are identified with either the driver

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
					or the motor itself, return the unit to the Manufacturer for inspection.
	1	E-281	An error occurred while writing data to the encoder EEPROM.	EEPROM write request 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.
31	0	E-310	The drive and motor power are mismatched	For example, a 750 W drive with a 200 W motor.	Match the correct motor and driver. After professionals confirm their compatibility and interoperability, use a self-update tool to write the motor parameters. Upon successful writing, set P0-53 to 1 (to disable the automatic motor 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	The motor parameters have	Parameter CRC check failed	Once professionals have confirmed the compatibility

Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
			been corrupted during reading.		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 You can use the self-update tool to update 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. The motor parameters will then be stored in the driver for proper operation, 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.

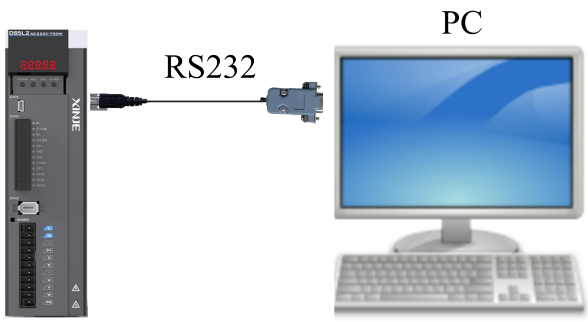
Big Class	Small Class	Confirm Code	Explain	Possible reasons	Resolvent
	6	E-316	Automatic code reading error	The automatically read motor code does not match the one set in P0-33.	Check the U3-70 model and motor housing identification plate (MOTOR CODE). ① If both values match, change the motor code of P0-33 or set P0-33 to 0 for automatic reading of the motor code; ② If the two values differ, contact the Manufacturer's technical support.

8. Modbus-RTU Communication

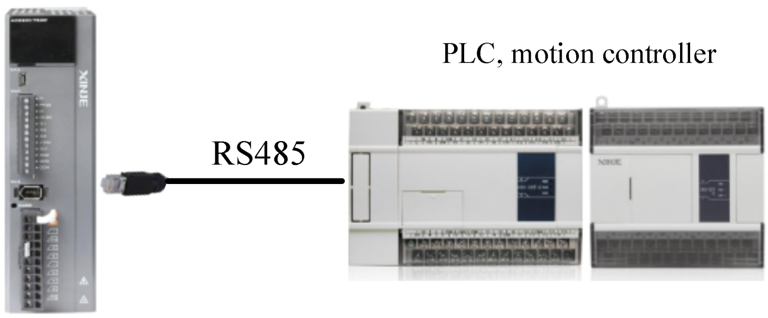
Our company provides users with the RS485 communication interface, widely used in industrial control systems. The protocol employed is the MODBUS standard; servos can communicate as slaves with host devices (such as PLC controllers or PCs) that share the same communication interface and protocol. This interface also supports connection to human-machine interfaces, enabling 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.

8.1 Communication Wiring

1. RS-232 Communication Wiring

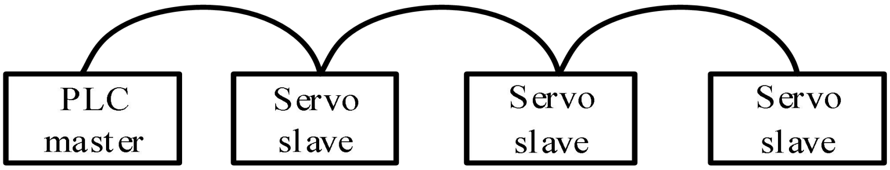


2. RS-485 Communication Wiring

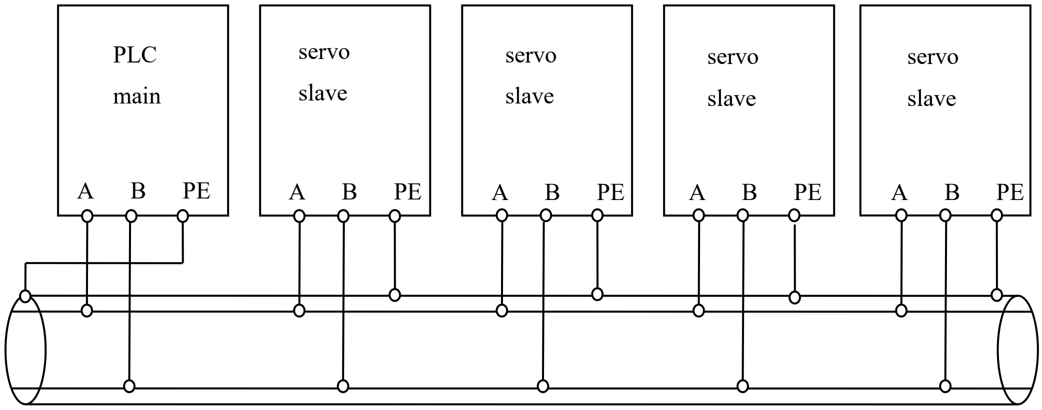


3. Communication between PLC and multiple servo motors (all servo drives and motors are properly grounded)

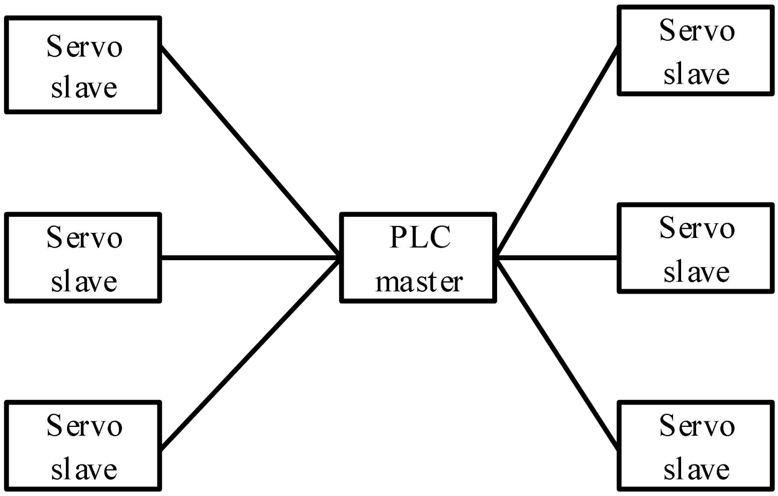
(1) Recommended approach: Hand-in-hand strategy



(2) Generally recommended: Branch structure



(3) Not recommended: Star-shaped connection structure



8.2 Communication Parameter Settings

1. RS485 Communication Parameter Settings

parameter	meaning	Factory Settings	Set Range	revise	Activate
P7-00	RS485 Station Number	1	0~100	servo bb	immediately

parameter	Parameter Functions	Set Unit	Factory Settings	Applicable Mode	revise	Activate
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	Activate
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	Activate
P7-10	RS232 Station Number	1	0~100	servo bb	immediately

<table>
<tr><th>parameter</th><th>Parameter Functions</th><th>Set Unit</th><th>Factory Settings</th><th>Applicable Mode</th><th>revise</th><th>Activate</th></tr>
<tr><td rowspan="4">P7-11</td><td>Communication Configuration</td><td>-</td><td>n.2206</td><td>whole</td><td>servo bb</td><td>immediately</td></tr>
<tr><td>parameter setting</td><td>Functionality Overview</td><td>Factory Settings</td><td colspan="3">Set Range</td></tr>
<tr><td>n.□xxx</td><td>check bit</td><td>0</td><td colspan="3">0: No validation
1: Odd Check
2: Parity Check</td></tr>
<tr><td>n.x□xx</td><td>stop bit</td><td>0</td><td colspan="3">0: 2 digits
2: Position 1</td></tr>
</table>

	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

8.3 Communication Protocol

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 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 according to specific network requirements.

8.3.1 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, parity check)

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.

8.3.2 Structure of Communication Information

1、RTU pattern

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 access 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 revolutions to 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 they 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.

8.4 Communication Examples

8.4.1 Communication Example with Xinja PLC

The Xinje PLC communicates with two Xinje drivers via 485 interface to read the motor's rotational speed and set its torque limits.

1. Hardware wiring

When using the AB terminals of the Xinje PLC for 485 communication, connect the driver's CN4 port via an Ethernet cable, and route pins 485-A and 485-B to the corresponding AB terminals on the PLC.

2. Parameter Settings

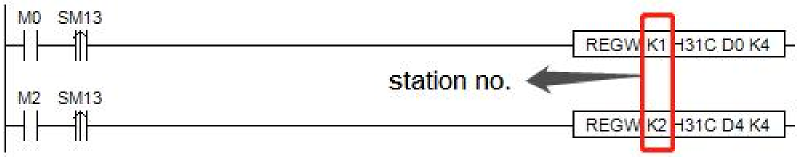
Align the communication parameters of both the drive and the PLC, including baud rate, parity, data bits, and slave configuration. Both the Xinje PLC and servo units utilize the standard MOBUS-RTU communication protocol (19200 bps, 1-8-1 parity).
Set the parameters as follows:
P7-00 Station Numbers 1, 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

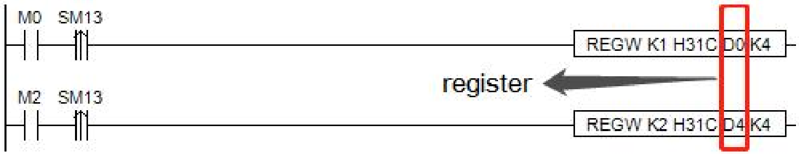
In the program, write instructions must specify the station number, communication address, and the register containing the data to be stored.

1) Station number: Value set for the servo driver P7-00. K1 indicates P7-00 set to 1; K2 indicates P7-00 set to 2.

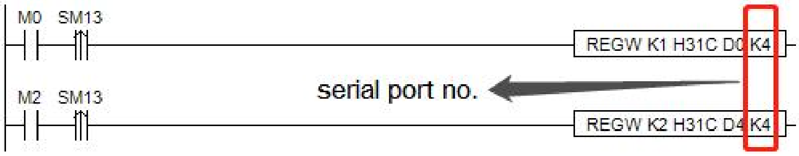


2) Communication Address: The address of the slave station; for specific register addresses, refer to Appendix 4, the Modbus Address Correspondence Table.

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 of Functional Parameters for Group P

Modification and Effective Date:

"○" indicates changes 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 does not take 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:

PX-XX=n. x x x x

PX-XX.0
PX-XX.1
PX-XX.2
PX-XX.3

P0-XX：

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process Scope	Activate Opportunity	Suit Scope	Refer to Chapters and sections
P0-01	Control Mode 1 1: Internal Torque Mode 3: Internal Speed Mode 5: Internal Position Pattern 6: External Pulse Position Pattern 7: External Pulse Speed Mode	-	6	1~10	○	1|3|5|6|7	5.1.1
P0-02	Control Mode 2 (same as above)	-	6	1~10	○	1|3|5|6|7	5.1.1
P0-03	Enable Mode 0: Disabled 1: IO Enable 2: Software Enablement 3: XNET Bus enabled	-	1	0~3	○	1|3|5|6|7	5.2.2
P0-04	Rigidity Level	-	<=20P7： 13 >=21P0：	0~31	▵	1|3|5|6|7	6.3.3

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process Scope	Activate Opportunity	Suit Scope	Refer to Chapters and sections
			11				
P0-05	Rotation Direction Definition 0: Normal Mode 1: Anti-pattern	-	0	0~1	●	1|3|5|6|7	5.2.3
P0-07	First Inertia Ratio	1%	200	0~50000	√	1|3|5|6|7	6.2.1
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 Time	-	F	0~F	●	6|7	5.3.2
P0-09.3	Input Pulse Instruction Filtering Pre-allocation	-	0	0~7	●	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
P0-11 ~ P0-12	Number of instruction pulses per cycle 0: Use electronic gear ratio Non-zero: Number of command pulses required for the motor to complete one rotation	1 pul	10000	0~99999999	○	5|6	5.3.1.1
P0-13	Electronic Gear Molecule	-	1	0~65535	√	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	0.01 ms	100	0~10000	○	7	5.4.3.3
P0-23	Pulse Deviation Limit	0.01 turn	2000	0~65535	√	5|6	5.3.1.6
P0-24	Discharge Resistance Power Protection Method 0 – Cumulative Discharge Time 1: Average Power Mode 1 2: Average Power Mode 2 (imperfect, not recommended)	-	0	0~1	○	1|3|5|6|7	5.2.6
P0-25	Discharge resistance power value	W	By Device Model Settings	1~65535	○	1|3|5|6|7	5.2.6

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process Scope	Activate Opportunity	Suit Scope	Refer to Chapters and sections
P0-26	Discharge resistance value	Ω	By Device Model Settings	1~500	○	1|3|5|6|7	5.2.6
P0-27	Server Gateway enables shutdown mode 0: Stop freely and maintain free operation after stopping 1: Stop freely and maintain the DB state after stopping 2: Reduce speed and stop; maintain free-running state after stopping 3: Reduce speed and stop; maintain DB state after stopping 4: DB stops; remains in free-running state after stopping 5: Stop the DB; maintain its state after stopping	-	0	0~5	○	All	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|3|5|6|7	5.2.4
P0-29	Servo Alarm Stop Mode 0: Stop freely and maintain free operation after stopping 1: Stop freely and maintain the DB state after stopping 2: DB/Slow down and stop; maintain free operation after stopping 3: DB/Decelerate and stop; maintain DB state after stopping 4: DB stops; remains in free-running state after stopping 5: Stop the DB; maintain its state after stopping	-	2	0~2	○	All	5.2.4
P0-30	Stop timeout time	1ms	20000	0~65535	○	1|3|5|6|7	5.2.3
P0-31	Stop Time of Reduction	1ms	25	0~5000	○	1|3|5|6|7	5.2.3

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process Scope	Activate Opportunity	Suit Scope	Refer to Chapters and sections
P0-33	Motor Code Setting	-	0	0~ffff	●	1|3|5|6|7	-
P0-53	Automatic Reading Motor Parameters Alarm Shielding Switch 0: Do not block alarms 1: Prevent the display of valid motor parameter alarms that have not been read	-	0	0~1	●	1|3|5|6|7	-
P0-55	Open-loop rotation speed	-	0	-6000~6000	●	1|2|3|4|5|6|7	-
P0-56	Number of encoder communication attempts	-	10	1~65535	●	1|2|3|4|5|6|7	-
P0-68 xx□□	Number of alarms for sequential continuity errors during encoding data update	-	0x05	0x01~0xFF	●	1|2|3|4|5|6|7	-
P0-68 □□xx	E-241 Alarm Filtering Count	-	0	0~0xFF	●	1|2|3|4|5|6|7	-
P0-69	Fan Switch (P0-69.0) 0: Turn on the fan when temperature exceeds 45°C; turn off it when temperature drops below 42°C (with a hysteresis range of 3°C). 1: Turn on the fan when enabled; turn it off when disabled 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	-	1 1	0~1 0~1	√	1|3|5|6|7	-
P0-74	Turn-off alarm time	ms	By Device Model	0~5000	√	1|3|5|6|7	5.8.1
P0-75	Turn-off alarm speed	rpm	50	5~9999	√	1|3|5|6|7	5.8.1

Parameter	Functional description	Unit	Leave the factory Windows default	Short-cut process Scope	Activate Opportunity	Suit Scope	Refer to Chapters and sections
P0-77	Encoder Alarm Temperature (Supported in version 4030 and above)	℃	0	0~127	√	All	-
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|3|5|6|7	5.7.1
P0-80	Motor Thermal Power Protection Method 0-Current Protection 1-Average Thermal Power Protection 2. Analog Thermal Power Protection	-	2	0~2	●	1|3|5|6|7	-
P0-86.2	Motor Thermal Power Protection Method 0-1 Internal Parameters	-	0	0~1	●	1|2|3|4|5|6|7	-
P0-92 ~ P0-93	32-bit electronic gear ratio molecule P0-11 to P0-14 are valid when set to 0. P0-92*1 + P0-93*10000	-	1	1~9999 0~65535	○ (pattern 5) √ (pattern 6)	5|6	5.3.1.1
P0-94 ~ P0-95	The 32-bit electronic gear ratio is determined by its denominator. P0-11 to P0-14 are valid when set to 0. P0-94*1 + P0-95*10000	-	1	1~9999 0~65535	○	5|6	5.3.1.1

P1-XX:

Parameter	Functional description	Unit	Factory default value	Span	Activate Opportunity	Scope of application	Consult Chapters and sections
P1-00	First Speed Loop Gain	0.1Hz	<=20P7: 300	10~20000	√	1|3|5|6|7	6.5.3

Parameter	Functional description	Unit	Factory default value	Span	Activate Opportunity	Scope of application	Consult Chapters and sections
			>=21P0： 200				
P1-01	First-speed loop integral time constant	0.01ms	2653	15~51200	√	1|3|5|6|7	6.5.3
P1-02	First-position ring gain	0.1/s	480	10~20000	√	1|3|5|6|7	6.5.3
P1-05	Second Speed Loop Gain	0.1Hz	200	10~20000	√	1|3|5|6|7	6.8.4
P1-06	Second speed loop integration time constant	0.01ms	3300	15~51200	√	1|3|5|6|7	6.8.4
P1-07	Second Position Ring Gain	0.1/s	200	10~20000	√	1|3|5|6|7	6.8.4
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	6.8.4
P1-15	Gain switching wait time	-	5	0~1000	√	1|2|3|4|5|6|7	6.8.4
P1-16	Gain Switching Level Threshold	-	50	0~20000	√	1|2|3|4|5|6|7	6.8.4
P1-17	Gain switching level hysteresis	-	30	0~20000	√	1|2|3|4|5|6|7	6.8.4
P1-18	Position loop gain switching time	-	3	0~1000	√	1|2|3|4|5|6|7	6.8.4
P1-22	Speed Command Filter Selection 0: First-order low-pass filter 1: Sliding Average Filter	-	0	0~1	○	3|7	5.4.1.4
P1-23	Speed Command Filter Time Parameter	0.1ms	0	0~65535	○	3|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

Parameter	Functional description	Unit	Factory default value	Span	Activate Opportunity	Scope of application	Consult Chapters and sections
P1-26.0	Speed Control Mode Switching Conditions		0	0~4	△	|3|4|5|6|7	6.8.5
P1.26.1	Switching between speed control modes with integral hold selection		0	0、1	△	|3|4|5|6|7	6.8.5
P1-27	Mode Switch – Torque Command Threshold	%	200	0-800	△	|3|4|5|6|7	6.8.5
P1-28	Mode Switch – Speed Command Threshold	rpm	0	0-10000	△	|3|4|5|6|7	6.8.5
P1-29	Mode Switch – Acceleration Threshold	rpm/s	0	0-30000	△	|3|4|5|6|7	6.8.5
P1-30	Mode Switch – Position Deviation Threshold	Command Unit	0	0-10000	△	|3|4|5|6|7	6.8.5
P1-31	I-P Control Switching Threshold	%	100	0-100	△	3|4|5|6|7	6.8.5
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	Activate opportunity	suit scope	consult chapters and sections
P2-00.0	Disturbance Observer Switch 0: Close 1: Open	-	0	0~1	○	1|3|5|6|7	6.1.4
P2-01.0	Adaptive Mode Switch 0: Close 1: Open	-	0	0~1	●	1|3|5|6|7	6.6.3
P2-01.1	Adaptive Level 0: High Response	-	By Device Model	0~1	●	1|3|5|6|7	-

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
	1: Low Noise						
P2-02.0	Self-Calibration Mode 1: Soft 2: Quick Location 3: Rapid localization and overshoot control	-	3	1~3	√	1|3|5|6|7	6.1.3
P2-02.2	Load Type (valid only during self-tuning) 1: Synchronous Belt 2: Screw rod 3: Rigid Connection	-	2	1~3	√	1|3|5|6|7	6.1.3
P2-03.2	I-P control switch	-	0	0、1	●	|3|4|5|6|7	6.8.5
P2-03.3	Adaptive Load Type 0: Low Inertia Mode 1: High Inertia Mode	-	0	0~1	●	1|3|5|6|7	6.6.4
P2-05	Adaptive Mode Speed Loop Gain （ standard ）	0.1Hz	<=20P7：400 >=21P0：200	1~65535	○	1|3|5|6|7	6.6.4
P2-07	Adaptive Mode Inertia Ratio (Standard)	%	0	0~10000	○	1|3|5|6|7	6.6.4
P2-08	Adaptive Mode Speed Observer Gain (Standard)	Hz	20P1/20P2/ 20P4/20P7：60 >=21P5：40	10~1000	○	1|3|5|6|7	6.6.4
P2-12	Adaptive Mode Maximum Inertia Ratio (Standard)	-	30	1~10000	○	1|3|5|6|7	6.6.4
P2-15	Maximum travel distance for inertia identification	0.01r	100	1~300	√	1|3|5|6|7	6.2.4
	Internal instruction: Set to maximum travel distance			1~3000			
P2-16	Adaptive Mode Motor Rotor Inertia Coefficient	-	100	10~1000	○	1|3|5|6|7	6.2.4
P2-17	Inertia identification and the maximum speed determined through internal command-based self-adjustment	rpm	0	0~65535	√	1|3|5|6|7	6.2.4

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
P2-18	Initial inertia ratio for inertia identification	%	500	1~20000	√	1|3|5|6|7	6.2.4
P2-19	Adaptive Mode Bandwidth	%	20P1：100 20P2/20P4：70 >=20P7：50	1~100	○	1|3|5|6|7	6.2.4
P2-35	Torque command filtering time constant 1	0.01ms	66	0~65535	√	1|3|5|6|7	6.5.3
P2-36	Torque command filtering time constant 2	0.01ms	100	0~65535	√	1|3|5|6|7	6.5.3
P2-41	Disturbance torque compensation coefficient (effective in non-adaptive mode)	%	85	0~100	√	1|3|5|6|7	6.1.4
P2-47.0	Model Loop Switch 0: Close 1: Open	-	1	0~f	√	1|3|5|6|7	6.1.3
P2-49	Model Ring Gain	0.1Hz	480	10~20000	△	3|5|6|7	6.5.3
P2-60.0	Active Vibration Suppression Switch 0: Close 1: Open	-	0	0~1	√	3|5|6|7	6.4.6
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|5|6|7	6.4.6
P2-61	Active vibration suppression frequency	0.1Hz	1000	10~20000	√	1|3|5|6|7	6.5
P2-62	Active vibration suppression gain	%	100	1~1000	√	1|3|5|6|7	6.4.6
P2-63	Active vibration suppression damping	%	100	0~300	√	1|3|5|6|7	6.4.6
P2-64	Active vibration suppression filtering time 1	-	0	-5000~5000	√	1|3|5|6|7	6.4.6

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
P2-65	Active vibration suppression filtering time 2	-	0	-5000~5000	√	1|3|5|6|7	6.4.6
P2-66	The second group uses active vibration suppression damping techniques.	-	0	0~1000	√	1|3|5|6|7	6.4.6
P2-67	Second group of active vibration suppression frequencies	Hz	20000	10~50000	√	1|3|5|6|7	6.4.6
P2-69.0	Sloshing Filter 1 Switch	-	0	0~1	√	1|3|5|6|7	6.4.6
P2-69.1	Sloshing Filter 2 Switch	-	0	0~1	√	1|3|5|6|7	6.4.6
P2-69.3	Sloshing Filter 3 Switch	-	0	0~1	√	1|3|5|6|7	-
P2-70.0	Sloshing Filter 4 Switch	-	0	0~1	√	1|3|5|6|7	-
P2-70.1	Sloshing Filter 5 Switch	-	0	0~1	√	1|3|5|6|7	-
P2-71	First notch frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-72	First notch attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-73	First notch bandwidth	Hz	0	0~1000	√	1|3|5|6|7	6.7.7
P2-74	Second absorption frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-75	Second absorption attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-76	Second absorption band width	Hz	0	0~1000	√	1|3|5|6|7	6.7.7
P2-77	Third absorption frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-78	Third waveguide attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-79	Third absorption band width	Hz	0	0~1000	√	1|3|5|6|7	6.7.7
P2-80	Fourth absorption frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-81	Fourth absorption wave attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
P2-82	Fourth absorption band bandwidth	Hz	0	0~1000	√	1|3|5|6|7	6.7.7
P2-83	Fifth absorption frequency	Hz	5000	50~5000	√	1|3|5|6|7	6.7.7
P2-84	Fifth: Waveform attenuation	0.1dB	71	50~1000	√	1|3|5|6|7	6.7.7
P2-85	Fifth absorption band bandwidth	Hz	0	0~1000	√	1|3|5|6|7	6.7.7

P3-XX：

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate 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 speed limit reference value; the actual speed limit depends on the external analog speed limit. 2: Speed Feedforward	-	0	0~2	○	1	5.5
P3-05	Default Speed 1	rpm	0	-9999~9999	√	3	5.4.2
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	Version 3720 and earlier: 0 Version 3730:200	0~65535	○	3|7	5.4.1.1
P3-10	deceleration time	ms	Version 3720 and earlier: 0 Version 3730:200	0~65535	○	3|7	5.4.1.1
P3-11	Speed command sliding average filter time	ms	0	0~65535	√	1|2|3|4|5|6|7	5.4.1.4

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
	(supported in version 3770 and later)						
P3-12	Zero-speed Clamping Mode	-	0	0~3	○	3|7	5.4.1.2
P3-13	Zero-speed clamping speed	rpm	10	0~300	○	3|7	5.4.1.2
P3-14	Positive maximum speed command limit	rpm	4000	0~10000	○	1|3|5|6|7	5.8.3
P3-15	Reverse Maximum Speed Command Limit	rpm	4000	0~10000	○	1|3|5|6|7	5.8.3
P3-16	Internal forward speed limit during torque control	rpm	2000	5~10000	√	1	5.5.1.2
P3-17	Internal reverse speed limit during torque control	rpm	2000	5~10000	√	1	5.5.1.2
P3-18	Click Speed	rpm	100	0~1000	○	1|3|5|6|7	4.4.2
P3-19	Positive Warning Speed	rpm	3000	0~10000	○	1|3|5|6|7	5.8.5.4
P3-20	Reverse Warning Speed	rpm	3000	0~10000	○	1|3|5|6|7	5.8.5.4
P3-21	Positive alarm speed	rpm	4000	0~10000	○	1|3|5|6|7	-
P3-22	Reverse Alarm Speed	rpm	4000	0~10000	○	1|3|5|6|7	-
P3-23	T-REF Function Allocation 0: As torque command input 1: As a necessary condition for external torque limit input, the minimum value is valid when compared with P3-28/P3-29. 2: Torque Feedforward	-	0	0~2	○	1|3|5|6|7	-
P3-28	Internal forward rotation torque limit	%	By Device Model	0 – Motor overload factor	√	1|3|5|6|7	5.8.2
P3-29	Internal reverse rotation torque limit	%	By Device Model	0 – Motor overload factor	√	1|3|5|6|7	5.8.2

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
P3-30	External forward torque limit	%	By Device Model	0 – Motor overload factor	√	1|3|5|6|7	5.8.2
P3-31	External Reverse Torque Limit	%	By Device Model	0 – Motor overload factor	√	1|3|5|6|7	5.8.2
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
P3-38	Internal positive signal for flow reversal prevention and alarm Torque Limitation	%	By Device Model	0 – Motor overload factor	√	1|3|5|6|7	5.8.2
P3-39	Prevent blockage and activate an internal alarm; reverse the situation. Torque Limitation	%	By Device Model	0 – Motor overload factor	√	1|3|5|6|7	5.8.2
P3-37	Torque mode switching delay	ms	40	0~9999	√	1	-
P3-51	Method for determining the internal torque mode 0-Parameter Values Given 1-Selection of External Terminals (Supported in version 4030 and above)	-	0	0~1	○	1	5.6.1.1

P4-XX：

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
P4-00.0	Number of Z-positive 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	Activate opportunity	suit scope	consult chapters and sections
P4-00.1	Is the Origin Search feature enabled? 0: Not enabled 1: Enable	-	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
P4-01	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 2: Disable absolute positioning (supported in versions 4030 and above)	-	0	0~1	○	5	5.3.3.1
P4-03.1	Set the step mode based on the given internal location pattern 0: Switch steps when the signal is 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: Select terminal/PREFA (P5-57), /PREFB (P5-58), /PREFC (P5-59), or /PREFD (P5-60) by specifying the section number (available from 1 to 16).	-	0	0~6	○	6	5.3.3.1
P4-03.2	Set the internal location to wait mode based on the specified pattern 0: Waiting for positioning to complete 1: Do not wait for positioning to	-	0	0~1	○	5	5.3.3.1

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportu nity	suit scope	consult chapters and sections
	complete						
P4-04	Number of valid segments	-	0	0~35	○	5	5.3.3.2
P4-10 ~ P4-11	First pulse segment	1pul	0	-327689999 ~327679999	√	5	5.4.3
P4-12	First Paragraph Speed	0.1rpm	0	0~65535	√	5	5.4.3
P4-13	First acceleration time	1ms	0	0~65535	√	5	5.4.3
P4-14	First deceleration period	1ms	0	0~65535	√	5	5.4.3
P4-16	adjust the time	1ms	0	0~65535	√	5	5.4.3
P4-10+ (n-1) *7 ~ P4-16+ (n-1) *7	Pulse parameters for paragraphs 1 through 35 (where n indicates the position index)	-	-	-	√	5	5.4.3

P5-XX：

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate 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|3|5|6|7	5.7.5.2
P5-04	Detection speed at the same speed	rpm	50	0~10000	√	1|3|5|6|7	5.7.5.3
P5-05	Detection speed reached	rpm	1000	0~10000	√	1|3|5|6|7	5.4.1.3

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
P5-06	Position close to the output width	Command Unit	50	1~65535	√	5|6	5.3.1.3
P5-07	Servo-off delay time	ms	500	0~65535	○	1|3|5|6|7	5.2.5
P5-08	Brake Command Output Speed	rpm	30	20~10000	○	1|3|5|6|7	5.2.5
P5-09	Brake Command Wait Time	ms	500	0~65535	○	1|3|5|6|7	5.2.5
P5-10	Custom Output 1 Trigger Condition	-	0	0~ffff	√	1|3|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|3|5|6|7	5.7.5.7
P5-12	Select Custom Output 1 Method	-	0	0~3	√	1|3|5|6|7	5.7.5.7
P5-13	Set Custom Output 1 Hysteresis Loop	Related to trigger conditions	0	0~65535	√	1|3|5|6|7	5.7.5.7
P5-14	Custom Output 2 Trigger Condition	-	0	0~ffff	√	1|3|5|6|7	5.7.5.7
P5-15	Value to compare with the trigger condition for Custom Output 2	Related to trigger conditions	0	-9999~9999	√	1|3|5|6|7	5.7.5.7
P5-16	Select Custom Output 2 Method	-	0	0~3	√	1|3|5|6|7	5.7.5.7
P5-17	Set Custom Output 2 Hysteresis Loop	Related to trigger conditions	0	0~65535	√	1|3|5|6|7	5.7.5.7
P5-18	SI Filtering Time Factor	-	1	0~10000	√	1|3|5|6|7	5.7.4.1
P5-19	Z-phase output hold time	ms	2	1~65535	√	1|3|5|6|7	5.7.6.1
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: Apply a positive signal	-	01	0~ff	√	1|3|5|6|7	5.2.2

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
	to terminal SI3 04: Input a positive signal from the SI4 terminal 05: Input a positive signal from the SI5 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 15: Input the reverse signal from terminal SI5						
P5-20.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-21.0~1	/P/ – Proportional action command for the P/CON ratio	-	00	0~ff	√	1|3|5|6|7	5.8.6.1
P5-21.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-22.0~1	/P-OT: Forward drive is prohibited	-	03	0~ff	√	1|3|5|6|7	5.2.4
P5-22.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-23.0~1	-N/OT: Reverse drive is prohibited	-	04	0~ff	√	1|3|5|6|7	5.2.4
P5-23.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-24.0~1	/ALM-RST: Alert cleared	-	02	0~ff	√	1|3|5|6|7	5.7.6.2
P5-24.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.11
P5-25.0~1	/P-CL: External torque limit for forward rotation	-	00	0~ff	√	1|3|5|6|7	5.8.2
P5-25.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
P5-26.0~1	-N/CL: External torque limit on the reverse side	-	00	0~ff	√	1|3|5|6|7	5.7.2
P5-26.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-27.0~1	/SPD-D: Internal Speed Direction Selection	-	00	0~ff	√	1|3|7	5.4.2
P5-27.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|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 selection setting Old Return Mode: /SPD-B: Reverse direction to find the origin	-	00	0~ff	√	3|5	5.4.2
P5-29.2	SI Terminal Filtering Time	ms	0	0~f	√	3|5	5.7.4.1
P5-30.0~1	/C-SEL: Selection of control mode	-	00	0~ff	√	1|3|5|6|7	5.1.2
P5-30.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-31.0~1	In internal speed mode/external pulse speed mode: /ZCLAMP: Zero Clamping Internal Location Mode: -Z-CLAMP: Skip the current section number	-	00	0~ff	√	Zero Clamping: 3|7 Skip current section: 5	5.4.1.2
P5-31.2	SI Terminal Filtering Time	ms	0	0~f	√	3|7	5.7.4.11

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
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|3|5|6|7	6.6.7
P5-36.2	SI Terminal Filtering Time	ms	0	0~f	√	1|3|5|6|7	5.7.4.1
P5-37	/COIN_HD: Positioning completed and maintained 00: Do not output to terminals 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

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
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|7	5.7.5.3
P5-40	/TGON: Rotation Detection	-	0000	0~ffff	√	1|3|5|6|7	5.7.5.2
P5-41	/S-RDY: Ready	-	0000	0~ffff	√	1|3|5|6|7	5.7.5.1
P5-42	/CLT: Torque Limit	-	0000	0~ffff	√	1|3|5|6|7	5.7.2
P5-43	/VLT: Speed Limit Detection	-	0000	0~ffff	√	1	5.5.1.3
P5-44	/BK: Brake Interlock	-	0000	0~ffff	○	1|3|5|6|7	5.2.5
P5-45	/WARN： warn	-	0000	0~ffff	√	1|3|5|6|7	5.8.5.4
P5-46	/NEAR： be close to	-	0000	0~ffff	√	1|3|5|6|7	5.3.7
P5-47	/ALM： report to the police	-	0002	0~ffff	√	1|3|5|6|7	5.8.5.5
P5-48	/Z: Encoder Z signal output	-	0000	0~ffff	√	1|3|5|6|7	5.8.5.6
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|7	5.4.1.3
P5-52	/USER1: Custom Output 1	-	0000	0~ffff	√	1|3|5|6|7	5.7.5.7
P5-53	/USER2: Custom Output 2	-	0000	0~ffff	√	1|3|5|6|7	5.7.5.7
P5-54	Return to the origin to complete the signal	-	0000	0~ffff	√	5|6	
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

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
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	-
P5-70	/SRDY: Output Condition Selection 0: After the drive unit is initialized, this terminal becomes conductive 1: This terminal will only conduct when enabled	-	0	0~1	√	1|3|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	5.4.3.8
P5-73	/JOG-N	-	0000	0~ff	√	5	5.4.3.8

P6-XX：

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	suit scope	consult chapters and sections
P6-05	Adaptive Mode Speed Loop Gain (High Inertia)	0.1Hz	200	1~65535	○	1|3|5|6|7	6.6.4
P6-07	Adaptive Mode Inertia Ratio (High Inertia)	%	50	0~10000	○	1|3|5|6|7	6.6.4

P6-08	Adaptive Mode Speed Observer Gain (High Inertia)	Hz	40	10~1000	○	1|3|5|6|7	6.6.4
P6-12	Adaptive Mode Maximum Inertia Ratio (High Inertia)	-	50	1~10000	○	1|3|5|6|7	6.6.4

P7-XX：

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	scope of application	consult chapters and sections
P7-00	RS485 Station Number	-	1	0~100	○	1|2|3|4|5|6|7|8|9|10	8.2
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	Baud rate	06	0~16	○	1|2|3|4|5|6|7|8|9|10	8.2

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	scope of application	consult chapters and sections
	10：768000 11：1M 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|8|9|10	8.2
P7-01.3	RS485 Check Bit 0: No validation 1: Odd Check 2: Parity Check	check bit	2	0~2	○	1|2|3|4|5|6|7|8|9|10	8.2
P7-02	RS485 Communication Protocol 1: Modbus RTU Protocol	-	1	1~255	○	1|2|3|4|5|6|7|8|9|10	8.2
P7-03	Xnet Synchronous Sampling Time	1ms	9	1~500	○	10	5.6.2.1
P7-04	Xnet Slave Data	-	15	1~500	○	10	5.6.2.1
P7-05	Number of Xnet slaves	-	10	1~20	○	10	5.6.2.1
P7-06	Number of retry attempts for communication timeout	Next	10	1~500	○	10	5.6.2.1
P7-08	Position Deviation Compensation Threshold	-	0	0~0	√	10	5.6.2.1
P7-09	Number of position deviation compensation	-	0	0~0	√	10	5.6.2.1

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	scope of application	consult chapters and sections
	attempts						
P7-10	RS232 Station Number	-	1	0~100	√	1|2|3|4|5|6|7|8|9|10	8.2
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 0A：192000 0B：256000 0C：288000 0D：384000 0E：512000 0F：576000 10：768000 11：1M 12：2M	Baud rate	06	0~16	√	1|2|3|4|5|6|7|8|9|10	8.2

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	scope of application	consult chapters and sections
	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|8|9|10	8.2
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|8|9|10	8.2
P7-20	Return to Zero Direction (Bus)	-	1	-9999~99999	√	10	5.6.2.1
P7-21	Filtering time after reset completion (bus)	ScanA Cycle	400	1~65535	√	10	5.6.2.1

P8-XX：

parameter	functional description	unit	leave the factory Windows default	short-cut process scope	Activate opportunity	scope of application	consult chapters and sections
P8-25	Panel Selection Options	-	0	0~2	▲	1|2|3|4|5|6|7	4.2

P9-XX：

parameter	functional description	unit	Factory Default Value	span	Effectiveness Time	scope of application	consult chapters and sections
P9-11.0	Return to the origin and find the number of Z-phase points	-	0	0~f	○	5|6	5.3.1.9
P9-11.1	New Origin Trigger Method	-	0	0~2	○	5|6	5.3.1.9

parameter	functional description	unit	Factory Default Value	span	Effectiveness Time	scope of application	consult chapters and sections
	0: Prohibit returning to the origin 1: Trigger the return to origin via the SI terminal 2: In this original mode, upon initial power-on activation, it immediately returns to the starting state.						
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
P9-12	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	-	0	-9999~9999	○	5|6	5.3.1.9
P9-20	High-value number of quantitative pulses	-	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
P9-33	Absolute rotation mode pulse count per revolution	Encoder Pulse	0	0~65535	○	5|6	5.7.8

parameter	functional description	unit	Factory Default Value	span	Effectiveness Time	scope of application	consult chapters and sections
	(0–65535) (Supported in version 4030 and above)						
P9-34	Absolute Position Rotation Mode: Number of pulses per revolution (0－65536) × 2^16 (Supported in version 4030 and above)	Encoder Pulse	0	0~65535	○	5|6	5.7.8
P9-35	Absolute Position Rotation Mode: Number of pulses per revolution (0－65536) × 2^32 (Supported in version 4030 and above)	Encoder Pulse	0	0~65535	○	5|6	5.7.8
P9-36	Absolute Position Rotation Mode: Number of pulses per revolution (0–65536) × 248 (Supported in version 4030 and above)	Encoder Pulse	0	0~65535	○	5|6	5.7.8
P9-37	Absolute Position Rotation Mode Gear Ratio Fraction (-supported in versions 4030 and above)	-	65535	1~65535	○	5|6	5.7.8
P9-38	Absolute Position Rotation Mode Gear Ratio (Supported in versions 4030 and above)	-	1	1~65535	○	5|6	5.7.8
P9-39	Enable brake protection detection 0: Disabled 1: Enable (Supported in version 4030 and above)	-	0	0~1	√	1|3|5|6|7	5.2.4
P9-40	Gravity Load Detection Value (Supported in version 4030 and above)	%	0	0~300	√	1|3|5|6|7	5.2.4
P9-41	Gravity load identification enables functionality.	-	0	0~1	√	1|3|5|6|7	5.2.4

parameter	functional description	unit	Factory Default Value	span	Effectiveness Time	scope of application	consult chapters and sections
	(Supported in version 4030 and above)						
P9-42	Abnormal opening of the brake mechanism during rotation displacement	0.01 turn	200	25~65535	√	1|3|5|6|7	5.2.4
P9-43	Encoder Under-Voltage Warning Threshold	0.001V	3000	2000~40000	○	1|3|5|6|7	-

PE-XX: (Supported in version 4030 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 Monitoring Status for Group U

U0-XX：

Monitoring Number	content		unit
U0-00	Current speed of the servo motor		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 State 2		-
U0-23	Output Signal State 1		-
U0-24	Output Signal Status 2		-
U0-25	Input Pulse Frequency	(0000～9999）*1	Hz

Monitoring Number	content		unit
U0-26		(0000～9999) *10000	
U0-41	Instantaneous output power		1W
U0-42	Average Output Power		1W
U0-43	Instantaneous thermal power		1W
U0-44	Average Thermal Power		1W
U0-49	Position Feedforward		1 Instruction Unit
U0-50	Speed Feedforward		rpm
U0-51	Torque Feedforward		% specified
U0-52	Instantaneous bus capacitor power		1W
U0-53	Average busbar capacitive power		1W
U0-54	Encoder Error Count		-
U0-55	Discharge power during instantaneous regenerative braking		1W
U0-56	Average regenerative braking discharge power		1W
U0-57	Absolute encoder current position feedback: 32-bit low		Encoder Position
U0-58			
U0-59	Absolute encoder current position feedback: high 32 bits		Encoder Position
U0-60 (Direction Signs)			
U0-62	Xnet Communications is awaiting synchronization of frame status information due to interference.		-
U0-63	Xnet Communications is waiting for the synchronization frame status to receive the data frame.		-
U0-64	The Xnet communication system is awaiting responses to data frame status-related interference issues.		-
U0-65	The Xnet communication is awaiting the data frame status and has received the synchronization frame.		-
U0-66	Xnet Communication CRC verification error		-
U0-67	Xnet Communication UART Error		-
U0-68	Xnet Communication Timeout Count		-
U0-69	Communication Encoder Timeout Count		-
U0-79	Encoder CRC Error Count		-
U0-80	Internal Location Mode Error Section Number		-
U0-81	Internal Position Mode Current Paragraph Number		-
U0-82	Original value of analog input V-REF		-
U0-83	Original value of analog input T-REF		-
U0-88	Read/Write Motor Parameter Result Flag		-
U0-89	Real-time speed feedback (display range: -99.99 to 99.99 rpm)		0.01rpm
U0-90	Maximum position deviation at the starting point in static state		-
U0-91	Number of turns in the absolute value motor circuit		-

Monitoring Number	content		unit
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 Signs)		(-32768~32767) *248	

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	0.1℃
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 after this power-on	-
U1-14	Total Number of Historical Alarms	-
U1-15	Total Number of Historical Warnings	-
U1-16	Recent Second Alarm Code	-
U1-17	The latest 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 is the 7th one.	-
U1-22	The latest alarm code is the 8th one.	-
U1-23	The latest alarm code is the 9th one.	-

Monitoring Number	content	unit
U1-24	The latest alarm code (10th occurrence)	-
U1-25	The latest alarm code is the 11th one.	-
U1-26	The latest alarm code for the 12th occurrence	-
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 alarm code for the 16th occurrence	-
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 5th warning code	-
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-on)	hour
U2-10	Total runtime (from the first power-on)	minute
U2-11	Total runtime (from the first power-on)	second
U2-12	Current runtime (from the last power-on)	hour

Monitoring Number	content		unit
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
U2-18	Total number of turns in the motor	(0000～9999) *1	Circle
U2-19		(0000～9999) *10000	Circle
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		-
U2-24	Firmware generation time: hours/minutes		-
U2-33	Maximum bus voltage (supported in versions 4030 and above)		V
U2-34	Maximum busbar instantaneous current (supported in versions 4030 and above)		0.01A
U2-35	Maximum bus voltage time (supported in versions 4030 and above)		hour
U2-36	Maximum bus voltage time (supported in versions 4030 and above)		minute
U2-37	Maximum bus voltage time (supported in versions 4030 and above)		second
U2-38	The latest modified motor code (supported in versions 4030 and above)		-
U2-39	The most recent modified motor code (supported by versions 4030 and above)		-
U2-40	The latest motor code with three revisions (supported by versions 4030 and above)		-
U2-41	Time of the most recent motor code update (supported in versions 4030 and above)		hour
U2-42	Time of the most recent motor code update (supported in versions 4030 and above)		hour
U2-43	Time of the most recent third revision of the motor code (supported by version 4030 and above)		hour
U2-44	Maximum IPM temperature (supported in versions 4030 and above)		0.1℃
U2-45	Maximum IPM temperature at current moment (supported in versions 4030 and above)		0.01A
U2-46	Maximum IPM temperature recording time (supported in versions 4030 and above)		hour
U2-47	Maximum IPM temperature recording time (supported in versions 4030 and above)		minute
U2-48	Maximum IPM temperature recording time (supported in versions 4030 and above)		second

Monitoring Number	content	unit
U2-49	Historically highest torque current (supported in versions 4030 and above)	0.01A
U2-50	Maximum torque current duration in history (supported in versions 4030 and above)	hour
U2-51	Maximum torque current duration in history (supported in versions 4030 and above)	minute
U2-52	Maximum torque current duration in history (supported in versions 4030 and above)	second

U3-XX：

Monitoring Number	content	unit
U3-00	Motor code for automatic reading	-
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：

<table>
<tr><th>Monitoring Number</th><th colspan="2">content</th><th>unit</th></tr>
<tr><td>U4-10</td><td colspan="2">Resonance frequencies detected by fast FFT</td><td>Hz</td></tr>
<tr><td>U4-16</td><td colspan="2">Cumulative value of continuous overload operation for thermal power protection (supported in version 3770 and later)</td><td>-</td></tr>
<tr><td>U4-17</td><td colspan="2">Cumulative instantaneous overload operation value for thermal power protection (supported in version 3770 and later)</td><td>-</td></tr>
<tr><td>U4-18</td><td colspan="2">SI Terminal Active Status</td><td>-</td></tr>
<tr><td>U4-19</td><td colspan="2">SO Terminal Active Status</td><td>-</td></tr>
<tr><td>U4-20</td><td rowspan="4">Unit for rotational load single-turn position encoder</td><td>(0000～65535) *1</td><td rowspan="4">Encoder Pulse</td></tr>
<tr><td>U4-21</td><td>(0000～65535) *2^16</td></tr>
<tr><td>U4-22</td><td>(0000～65535) *2^32</td></tr>
<tr><td>U4-23</td><td>(0000～65535) *2^64</td></tr>
<tr><td>U4-24</td><td rowspan="2">Rotation Load Single-Loop Position Command Unit</td><td>(0000～9999) *1</td><td rowspan="2">Command Unit</td></tr>
<tr><td>U4-25</td><td>(0000～9999) *10000</td></tr>
</table>

<table>
<tr><td>U4-26</td><td>Number of rotations for the rotating load</td><td>(0000～65535) *1</td><td>-</td></tr>
<tr><td>U4-27</td><td rowspan="2">Linear Load Position Command Unit</td><td>(-9999～9999) *1</td><td rowspan="2">Command Unit</td></tr>
<tr><td>U4-28</td><td>(-9999～9999) *10000</td></tr>
</table>

Appendix 3. Content of Auxiliary Functions for Group F

Function Code	explain	Reference Chapter
F0-00	Clear Alert	4.2.6
F0-01	Restore Factory Settings	4.2.6
F0-02	Clear Position Deviation	4.2.6
F0-07	Panel Inertia Identification	6.2.4
F0-08	Panel External Instructions from Calibration Process	6.4.5
F0-09	Internal instructions within the panel are automatically configured during setup.	6.4.4
F0-10	Panel Vibration Suppression 1	6.7.3
F0-11	Panel Vibration Suppression 2	6.7.3
F0-12	Panel vibration suppression (fast FFT)	6.7.6
F1-00	Click	4.2.6
F1-01	pilot run	4.2.6
F1-02	Current Sampling Zeroing	4.2.6
F1-05	Software Enablement	4.2.6
F1-06	Absolute encoder position reset	5.7.6
F2-09	Communication Setting Number	5.4.3.6

Appendix 4. Modbus Address Correspondence Table

1. Address Matching Rules

The following explains the allocation rules for servo Modbus addresses; refer to these rules for parameter addresses not covered elsewhere.

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 one; 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 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	0x0800~0x0863	The Modbus addresses start at 0x0800 and increase sequentially by one; for example, the Modbus address corresponding to P8-25 is 0x019.
P9-00~P9-xx	0x0900~0x0963	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 1; 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 by one; for example, the Modbus address corresponding to U2-08 is 0x1208.
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.

2. Example Address

- 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
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

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
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			

- Monitoring Status Address Group U

Parameter	Modbus address	Parameter	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
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

Parameter Number	Modbus address		Parameter Number	Modbus address	
	hexadecimal	decimal system		hexadecimal	decimal system
U1-05	0x1105	4357	U2-05	0x1205	4613
U1-06	0x1106	4358	U2-06	0x1206	4614
U1-07	0x1107	4359	U2-07	0x1207	4615
U1-08	0x1108	4360	U2-08	0x1208	4616
U1-09	0x1109	4361	U2-09	0x1209	4617
U1-10	0x110A	4362	U2-10	0x120A	4618
U1-11	0x110B	4363	U2-11	0x120B	4619
U1-12	0x110C	4364	U2-12	0x120C	4620
U1-13	0x110D	4365	U2-13	0x120D	4621
U1-14	0x110E	4366	U2-14	0x120E	4622
U1-15	0x110F	4367	U2-15	0x120F	4623
U1-16	0x1110	4368	U2-16	0x1210	4624
U1-17	0x1111	4369	U2-17	0x1211	4625
U1-18	0x1112	4370	U2-20	0x1214	4628
U1-19	0x1113	4371			
U1-20	0x1114	4372			
U1-21	0x1115	4373			
U1-22	0x1116	4374			
U1-23	0x1117	4375			
U1-24	0x1118	4376			
U1-25	0x1119	4377			

Parameter 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) 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 4.2.

Q3: How to change the enable status parameter?

）。

5.2.2 Servo Enable Settings).

Q4: How to restore initialization?

Set P5-20 to 0000 to disable the effect; set F0-01 to 1.

Q5: What drivers currently support the bus mode?

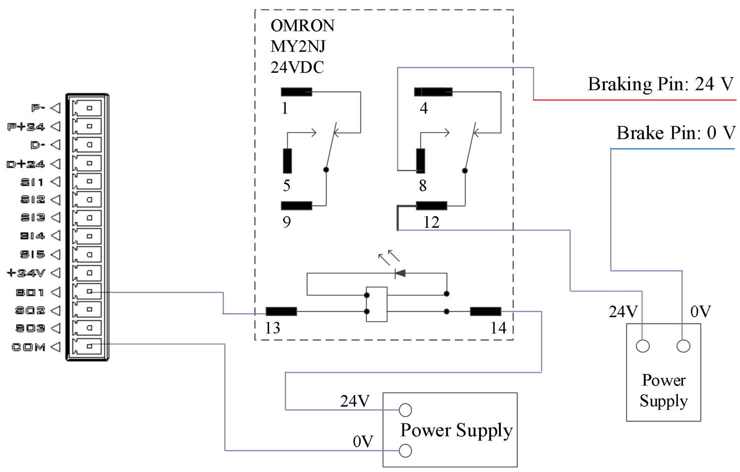
1) The DS5E series supports Xnet communication, with maximum support for 20 axes.

2) The DS5C supports EtherCAT communication, supporting up to 32 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, it uses SO1 to control the brake engagement, i.e., P5-44 = n.0001.

2) Extend the servo OFF delay time P5-07 (default: 500 ms; may be adjusted 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. (only to modes 2, 4, 6, and 7.) For the internal speed mode (mode 3), you can adjust the positive or negative value of the speed setting.

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. P5-30=0002 and SI2 are designated as mode switching terminals: when no signal is received at SI2, operation follows the preset mode in P0-01; when a signal is present at SI2, operation follows the preset mode in P0-02.

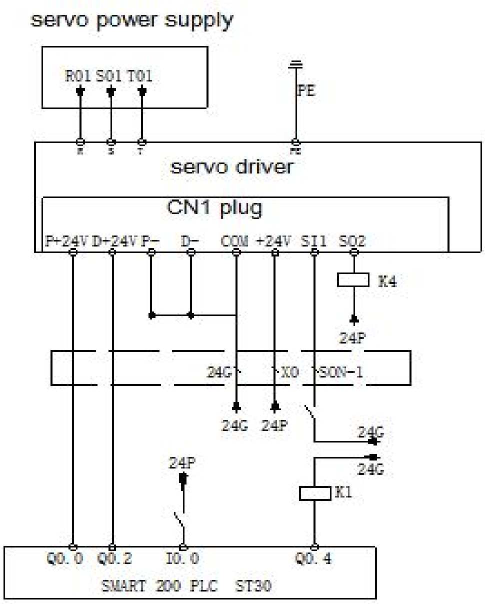
The SI2 terminal signal must be set to the ON state for switching to occur.

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?

1) NPN low-level output PLC: Connect the Y0 pulse to P-, Y1 terminal to D-, and +24 V to P+24 and D+24 (using a Xinje PLC as example).

2) PNP high-level output PLC: Pulse pin Q0.0 connects to P+24, direction pin Q0.2 connects to D+24, and 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?1.4.1

1) The servo interface features P+, D, and C terminals, with a shorting strip connecting P+ and D (using an internal resistor). If the internal resistor specification is insufficient, replace it with an external resistor; refer to Section 1.4.1 for the required specifications.

① P+, D, C interfaces: Remove the shorting strip between P+ and D, then connect the external braking resistor to P+ and C.

② Models with P+ and PB interfaces: Connect the external braking resistor to P+ or PB.

2) For version number parameter U2-07 <3700, set P0-24 = 1, P0-25 = power value, and P0-26 = resistance value.

For versions prior to 3700, set P0-24:0 enables the built-in resistor, while 1 enables the external resistor.

Q11: What is the service life of the tank chain line?

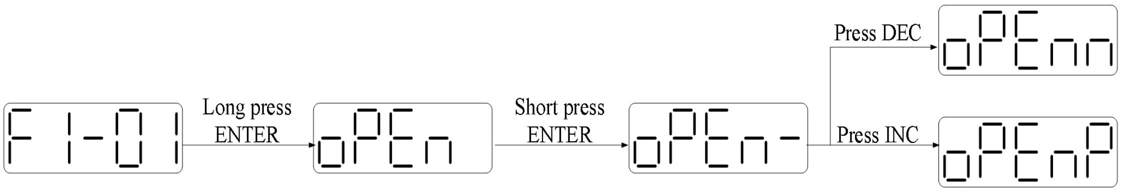
The number of bending cycles is 5 million, with a bending radius of 50 mm.

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 operation are displayed as follows:

state	panel display	state	panel display
Idle Status Display	JoG-	Forward Display	JoG-P
Enable Display	JoG--	Reverse Display	JoG-n

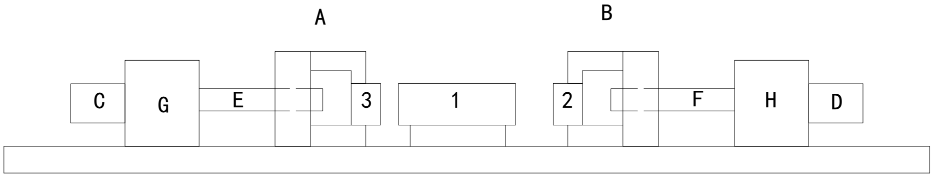
2. Integrate the motor with the mechanical components and perform debugging

A. Check the aircraft's heading direction; if it differs from required, turn off the servo, set parameter P0-05 to 1, then power on again to apply the change.

B. During operation, monitor the system's stability and responsiveness, and adjust the servo control parameters as needed.

Appendix 7. Case Studies

Mode 6: Pulse Sequence 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 conform 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 is 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. Determining Signals and Terminals

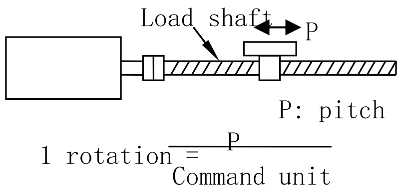
/COIN positioning completes output signal: SO1

/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	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 full 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 Limit: P3-29=150

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 0/1 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 Reverse Torque Limit	Set the source and value for servo torque limits. The default unit is a percentage of servo torque.
P5-44 Power Loss Brake/BK P5-07 Servo OFF Delay Time P5-08 Brake Command Output Speed P5-09 Brake Command 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 Pattern	Set Pulse Shape 0：CW/CCW 1：AB 2：P+D
P0-11 Set the number of pulses per motor revolution *1 P0-12 Sets the number of pulses per motor revolution * 10000 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 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-phase signals after the P4-00 passes through 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: Find the reference origin on the reversal side in position mode / SPD-B	Internal Position Return to Origin Settings Parameters
Any setting for position F2-09 35	Number of Communication Settings Sections
P5-72 JOG-P (-supported in versions 4030 and above) P5-73 JOG-N (-supported in versions 4030 and above) P3-18 Point Movement Speed	IO Point Movement Function Parameter Settings

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
P3-51 Internal Torque Mode Specification Method (Supported in version 4030 and above)	0: Parameter Values 1: External Terminal Selection
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	Speed Limitation under Torque Mode

P3-14 Forward Maximum Speed Limit (MAX Speed) P3-15 Reverse Maximum Speed Limit (MAX Speed)	
P5-27 Speed Direction Switching/SPD-D	Switch direction; defaults to n.0000. By applying a commutation signal via terminal SI2, P5-27 can be set to n.0002.

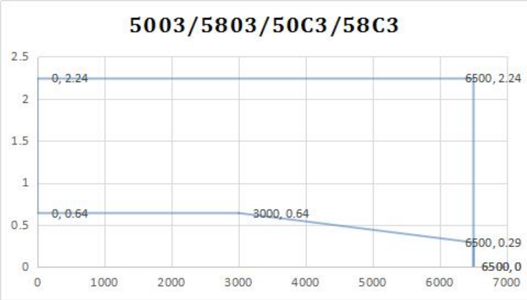
Appendix 8.5 Common Parameters for Internal Speed Control

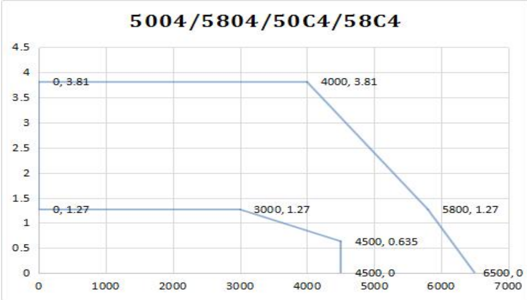
Internal Speed Control	
parameter	essentials
P0-01 Control Method Selection	Set to 3: Internal Speed Control Mode
P3-05 Internal Set Speed 1 P3-06 Internal Set Speed 2 P3-07 Internal Set Speed 3	Speed value setting for the internal 3-speed stage, in rpm
P5-28 Internal Speed Selection/SPD-A P5-29 Internal Speed Selection/SPD-B	The combination of terminals determines the corresponding section speed.
P5-27 Internal Speed Direction Selection/SPD-D	Switch direction, default is n.0000; By applying a commutation signal through 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 time in ms

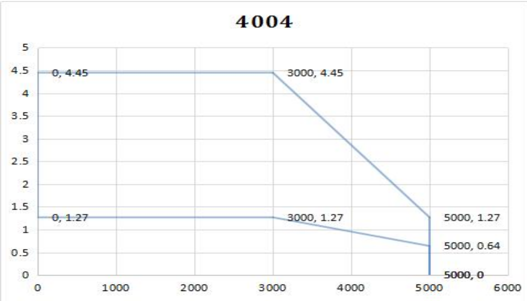
Appendix 8.6 Common Parameters for External Pulse Speed Control

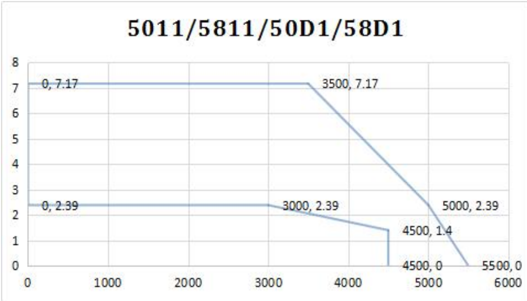
External Pulse Speed Control	
parameter	essentials
P0-01 Control Method Selection	Set to 7: External Pulse Speed Mode
P0-10 Pulse Instruction Pattern	Set Pulse Shape 0：CW/CCW 2：P+D
P0-15 Instruction pulse frequency at rated speed	Determine the linear relationship between the pulse frequency and rotational speed.
P0-16 Speed Command Pulse Filtering Time	When the instruction pulse frequency is relatively low, appropriately setting this parameter can reduce speed fluctuations.

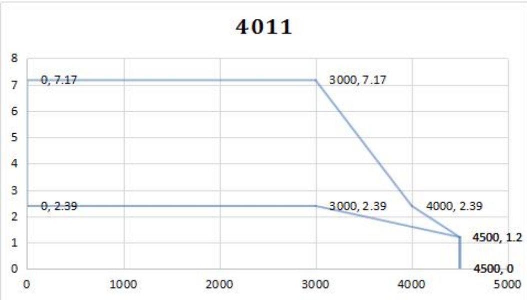
Appendix 9. Torque-speed characteristic curve

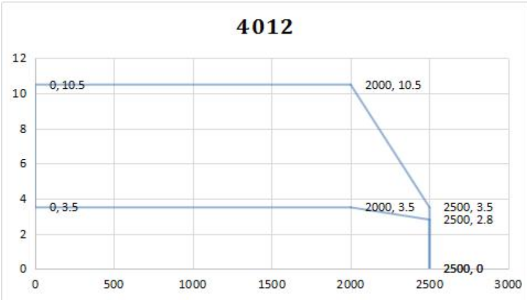


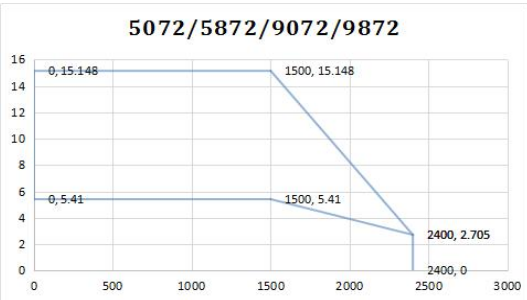


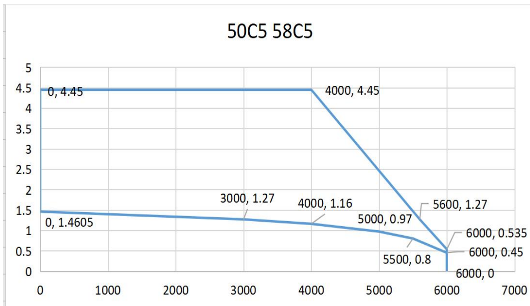


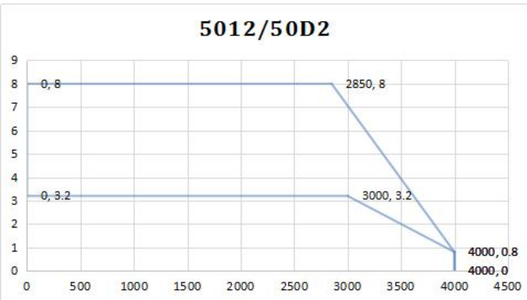


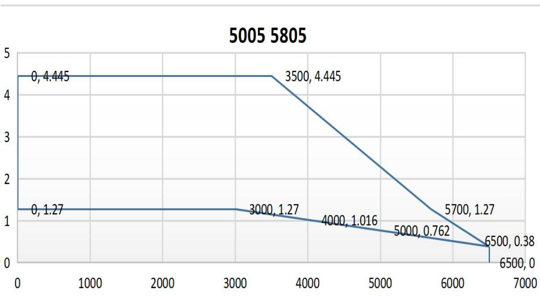


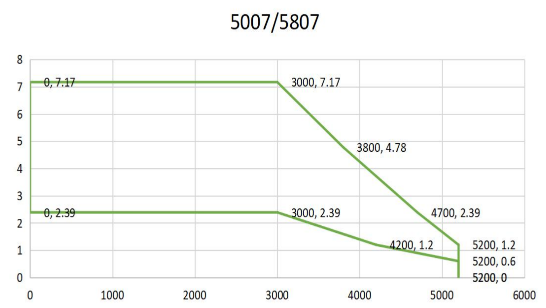











5007/5807
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3000, 7.17
3800, 4.78
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5000
6000
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