EL7-PNS Series AC Servo Drive

User Manual



Version Change Description

1. Reproduction of part or all of the contents of this book is prohibited.
2. The contents of this book are subject to change without prior notice.

Version	Update Date	Update Description
V1.0	2026-10	First release of the manual

Foreword

Thank you for purchasing Leadshine EL7-PNS series AC Servo drives. This manual will provide information on the EL7-PNS series servo products regarding product safety & specifications, installations & wiring, tuning & problem diagnostics.

Please contact us at tech@leadshine.com if you need further technical support.

Incorrect operation may cause unexpected accident, please read this manual carefully before using product.

- ✧ We reserve the right to modify equipment and documentation without prior notice.
- ✧ We won't undertake any responsibility with any customer's modification of product and the warranty of product will be canceled at the same time.

Safety Precautions

Please read the safety instructions carefully before using the products and pay attention to the safety signs.

	Might incur death or serious injury
	Might cause injury to operating personals or damage to equipment
	Might cause damage to equipment
	High voltage. Might cause electrocution to personals in contact
	Hot surface. Do not touch
	Protective Earth

Safety instructions

Warning

- ✓ The design of the product is not to be used in mechanical system which may incur health hazard.
- ✓ Users should be aware of the product safety precautions during design and installations of the equipment to prevent any unwanted accident.

Upon receiving

Caution

- ✓ The use of damaged or faulty product(s) is prohibited.
- ✓ Please refer to item checklist. If the labels don't match, please do not install.

Transportation

Caution

- ✓ Please provide storage and transportation under protected conditions.
- ✓ Do not stack the products too high up to prevent toppling.
- ✓ The product should be packaged properly during transportation,
- ✓ Do not hold the product by the cable, motor shaft or encoder while transporting it.
- ✓ The product should be protected from external forces and shock.

Installation

Caution

Servo drive and Motor:

- ✓ Do not install around combustibles to prevent fire hazard.
- ✓ Avoid vibration and impact.
- ✓ Do not install products that are damaged or incomplete.

Servo drive:

- ✓ Please install in electrical cabinet with sufficient protection from outside elements.
- ✓ Reserve sufficient gap as per the installation guide.
- ✓ Make sure to have good heat sinking.
- ✓ Avoid dust, corrosive gas, conductive object or fluid and combustibles.

Servo Motor:

- ✓ Make sure installation is tight to prevent it from loosening.
- ✓ Prevent fluid from leaking into motor and encoder.
- ✓ Protect motor from impact to avoid damaging encoder.
- ✓ Motor shaft should not bear the load beyond the limits as specified.

Wiring

Warning

- ✓ Participate installation personals should have sufficient training in product installation safety.
- ✓ Please power off and wait for 10 minutes to make sure a full discharge of electricity.
- ✓ Servo drive and motor must be connected to ground.
- ✓ Connect the cables only after servo drive motor installed correctly
- ✓ Make sure the wires are properly managed and insulation layer is not torn to prevent electrocution.

Caution

- ✓ Wiring must be correctly connected to prevent damage to product(s)

- ✓ Servo motor U, V, W terminal should be connected correctly and NOT connected directly to an AC power supply.
- ✓ Capacitor, inductor or filter shouldn't be installed between servo motor and servo drive.
- ✓ Connecting wires or any non-heat resistant components should be put near to heat sink of the servo drive or motor.
- ✓ The flyback diode which is connected in parallel to output signal DC relay must not be connected in reverse.

Tuning and running

Caution

- ✓ Make sure the wirings of servo drive and servo motor are installed and fixed properly before powering on.
- ✓ On the first time tuning of the product, it is recommended to run unloaded until all the parameter settings are confirmed to prevent any damage to the product or machine.

Usage

Caution

- ✓ Please install an emergency stop button on machine to stop operation Immediately if there is an accident.
- ✓ Please make sure machine is stopped before clearing an alarm.
- ✓ Servo drive must be matched with specified motor.
- ✓ Frequent restart of the servo system might incur damage to the product.
- ✓ Servo drive and motor will be hot to touch shortly after power off. Please be careful.
- ✓ Modification(s) to servo system is prohibited.

Error Handling

Warning

- ✓ Please wait for 5 minutes after powering off for the electricity to be fully discharged before uninstalling the cables.
- ✓ Participate maintenance personals should have sufficient training in maintenance and operation of this product series.

Caution

- ✓ Please handle the error before clearing an alarm.
- ✓ Keep away from machine after a restart upon alarm. Mechanical axis might suddenly move. Such hazard should be prevented during the utilization of the product.

Model Selection

Caution

- ✓ Rated torque of the servo motor should be higher than continuous designated torque when fully loaded.
- ✓ Load inertia ratio of the motor should be lower or equals to recommended value for specified models
- ✓ Servo drive must be matched with specified motor.

Warranty Information

Available for

Leadshine overseas warranty only covers Leadshine AC servo products that are obtained through **Leadshine certified sales channel outside of China**.

Warranty claim

- All Leadshine AC servo products (Servo drives and motors) overseas enjoy **18-month** warranty period.
- Due to unforeseen circumstances in different sales regions around the globe, we recommend users to seek technical support from directed sales channel as any warranty claim or repair services may be required.
- Please be informed that any maintenance/repair work that is outside of the warranty claim conditions might incur some charges and to be confirmed before product(s) is being sent in.
- The duration required for maintenance work to be done is to be confirmed after initial check-up but we reserve the right to prolong the repair duration if needed.
- Discontinued products within warranty period will be replaced with a product of similar specifications.

Steps to warranty claim

1. Visit Leadshine global site www.leadshine.com to look for local certified sales channel.
2. Contact designated sales channel to check if any fee might incur. May include repair fee, spare part cost or shipping cost.

Circumstances where warranty claim is not available

- Damage/Loss due to occurrence of natural or man-made disaster such as fire, flood or earthquake.
- Installation or wiring error
- If there is any modification done to the product
- Warranty label on products is torn or not existing
- Not a product bought from Leadshine certified global network of retailers/distributors.

Before warranty claim

- Please backup device parameters before any repair work/warranty claim. Leadshine and Leadshine certified retailers/distributors will not be held responsibilities for any data loss.
- If available, please send product back in original packaging or make sure it is well packaged to prevent any damage to the product during shipping.

Leadshine Technology Co.,Ltd. and its certified sales channel reserved the final right of the interpretation of the warranty information.

Table of Contents

Chapter 1 Introduction 9

1.1 Product Introduction 9
1.2 Model Number Structure 10
1.3 Driver Technical Specification 12
1.4 Driver ports and connectors 15
1.5 Motor ports and connectors 17

Chapter 2 Installation & Wiring 18

2.1 Servo Drive Installation 18
2.1.1 Servo drive installation environment 18
2.1.2 Servo Drive Dimension 18
2.2 Servo Motor Installation 20
2.2.1 Installation conditions 20
2.2.2 Precautions during installation 21
2.3 EL7-PNS Wiring Diagram 22
2.4 Servo Drive Ports 27
2.4.1 X1 30
2.4.2 Regenerative resistor selection and connections 34
2.4.3 Wiring connections for EL7-PNS series servo drives 42
2.4.4 Example of main circuit power supply wiring 45
2.5 Cable Selection 47
2.6Holding brake connection 54
2.7CN1 I/O Signal Port 55
2.7.1 Selection of I/O signal cable 56
2.7.2 Common input circuit 56
2.7.3 Common output circuit 60
2.7.5 DI signal function configuration 62
2.7.6 DO signal function configuration 64
2.8 CN2 Encoder 65
2.9 USB Type-C Tuning Port 66
2.10 CN3/CN4 PROFINET Communication Port 67
2.11 CN5 Frequency divider pulse output port 68
2.12 CN6 Safe Torque Off (STO) Port 70
2.13 Measures against electromagnetic interference 70
2.13.1 Grounding connection and other anti-interference wiring connections 71
2.13.2 Using line filter 71

Chapter 3 Parameter 73

3.1 Parameter List 73
3.1.1 Servo Driver Parameter 73
3.2 General Parameters 96
3.2.1【Class P00】Basic Settings 96
3.2.2【Class P01】Digital DIDO 107
3.2.3【Class P02】Virtual DIDO 110
3.2.3【Class P04】Fault parameters 113
3.2.4【Class P05】Monitor parameters 115
3.3 Basic Control 120
3.3.1【Class P10】Position Control 120
3.3.2【Class P11】Velocity Control 125
3.3.3【Class P12】Torque Control 128
3.4 Servo Control 129
3.4.1【Class P20】Gain Parameters 129
3.4.2【Class P21】Self-Tuning Parameters 136

3.4.2【Class P22】Filter Parameter 143
3.5 Basic Functions 148
3.5.1【Class P30】Homing Function 148
3.6 Advanced Functions 150
3.6.1【Class P41】Position Comparison Output 150
3.6.2【Class P42】Target Position Parameter 152
3.6.7【Class P47】Special Functions 1 161
3.7 Safety Functions 167
3.7.1【Class P50】STO Functions 167
3.8 Communication functions 168
3.8.1【Class P61】PROFINET Functions 168
3.9 System Parameters 171
3.9.1【Class PA0】Motor Parameters 171
3.9.2【Class PA1】Encoder Parameters 171
3.9.3【Class PA2】Driver Parameters 171
3.10 PN motion 174
3.10.1【Class PF3】 174

Chapter 4 Servo Drive Operation 178

4.1 Get Started with Driver Operation 178
4.1.1 Checklist before operation 178
4.1.2 Power On 178
4.1.3 Trial Run 178
4.1.4 Motor rotational direction settings 179
4.1.5 Holding Brake Settings 179
4.1.6 Servo Running 180
4.1.7 Servo stop 182
4.2 Front Panel 195
4.4 Panel Display and Operation 196
4.4.1 Panel Operation 196
4.4.2 Data Monitoring Mode 197
4.4.4 Auxiliary functions 209
4.5 Motion Studio 216
4.6 Pre-operation Preparation 217
4.7 Trial Operation 218
4.7.1 Panel JOG Operation 218
4.7.2 Debugging Software Trial Operation 220

Chapter 5 Application 222

5.1 Gain Adjustment 222
5.2 Inertia measuring function 225
5.2.1 Online inertia determination 225
5.2.2 Offline inertia determination 225
5.2.3 Auxiliary function to determine inertia on front panel 226
5.2.4 Inertia measuring using Motion Studio 227
5.3 Auto gain adjustment (Auto-tuning) 229
5.3.1 Single-parameter tuning function 229
5.3.2 One-click tuning function 240
5.3.3 Ltune Intelligent Tuning-Free Function 247
5.4 Auto gain adjustment (Rigidity Level Selection) 250
5.4.1 Overview 250
5.4.2 Operation Steps 251
5.5Manual gain adjustment (Basic) 258
5.5.1 Overview 258
5.5.2 Parameter adjustment under different control modes 261
5.5.3 Gain switching 263
5.6 Manual gain adjustment (Application) 268
5.6.1 Model following control 268
5.6.2 Zero tracking control 272

5.6.3 Feedforward gain 275
5.6.4 3rd Gain Switching 277
5.6.5 Friction compensation function 279
5.7 Vibration Suppression Function 281
5.7.1 Mechanical resonance suppression 281
5.7.2 End vibration suppression 286
5.7.3 Mechanical properties analysis 289
5.8 Multiturn absolute encoder 290
5.9 Functions 295
5.9.1 Motor overspeed alarm 295
5.9.2 Servo stop mode 295
5.9.3 Maximum Stop Time After Servo Disable 297
5.9.4 Maximum Stop Time After Servo Disable 298
5.9.5 Emergency Stop function 299
5.10 Black box 301
5.11 Position comparison 304

Chapter 6 PROFINET communication 313

6.1 Overview 314
6.2 Hardware Configuration 315
6.2.1 PN Port 315
6.2.2 Network Topology 315
6.3 Telegram Overview 317
6.3.1 Supported Main Telegrams 317
6.3.2 Supported Supplementary Telegrams 318
7.3.3 IO Data Signals 319
6.4 Control Word Definitions 321
6.4.1 STW1 Control Word 321
6.4.2 STW2 Control Word 323
6.4.3 G1_STW (used for telegrams 3/102/105) 323
6.4.4 POS_STW1/2 (used for telegram 111) 323
6.5 Status Word Definitions 325
6.5.1 ZSW1 Status Word 325
6.5.2 ZSW2 Status Word 327
6.5.3 G1_ZSW1 (used for telegrams 3/102/105) 327
6.5.4 POS_ZSW1/2 (used for telegram 111) 327
6.6 Homing Modes Supported by Telegram 111 329
6.6.1 Parameter 329

Chapter 7 Warning and Alarm 355

7.1 Servo drive warning 355
7.2 Warning Handling Methods 356
7.3 Servo drive alarm & PROFINET Communication Alarm 368
7.4 Alarm Handling 374
7.5 Alarm clearing 412

Chapter 8 STO Safety Function 413

8.1 Safety Notes 413
8.2 Overview 413
8.2.1 Document Purpose 413
8.2.2 Terms & Abbreviations 413
8.2.3 Safety Standards 414
8.2.4 Safety Performance 414
8.3 Terminal Introduction 415
8.3.1 I/O Signal Description 415
8.3.2 Electrical Specifications 415
8.4 Instructions for Use 417
8.4.1 Working Principle 417
8.4.2 Control Logic 417
8.4.3 Related Parameters 418

8.4.4 Wiring 419
8.5 Alarm Handling 420
8.5.1 Alarm Codes 420
8.5.2 Alarm Trigger Timing 423
8.5.3 Alarm Recovery Timing 424
8.5.4 STO Response Time 424
8.6 Verification and Confirmation 425
8.7 STO Certificate 425
About Us 426

Chapter 1 Introduction

1.1 Product Introduction

AC servo technology has become increasingly mature with continuously improved performance since its development in the early 1990s, and main applications encompass photovotaic systems, lithium battery manufacturing, automotive electronics,logistics and so on.
The EL7-PNS series has a power range of 400W~7500W and supports the PROFINET communication protocol. With the corresponding communication interface, multiple servo drives can operate in a networked configuration with a host computer (including controllers and PLCs). Additionally, the EL7-PNS series features the latest one-click auto-tuning function, offering stiffness table setting, inertia identification, and vibration suppression. It supports Type-C connection for debugging, making servo drive operation and commissioning simple and user-friendly. When paired with ELM2 series high-response servo motors (equipped with 23-bit multi-turn absolute encoders), the system operates reliably and smoothly, with a maximum speed loop bandwidth of up to 3.5kHz.

The EL7-PNS series AC servo system offers the following advantages:

- **Wide speed range and constant torque**

Speed ratio of 1: 5000, ensuring stable torque characteristics from low to high speeds.

- **High speed and high precision**

Servo motor maximum speed up to 6500rpm, supporting 23-bit multi-turn absolute encoders.

- **Simple and flexible control**

The working mode and operational characteristics of the servo system can be appropriately configured by modifying parameters to meet diverse requirements.

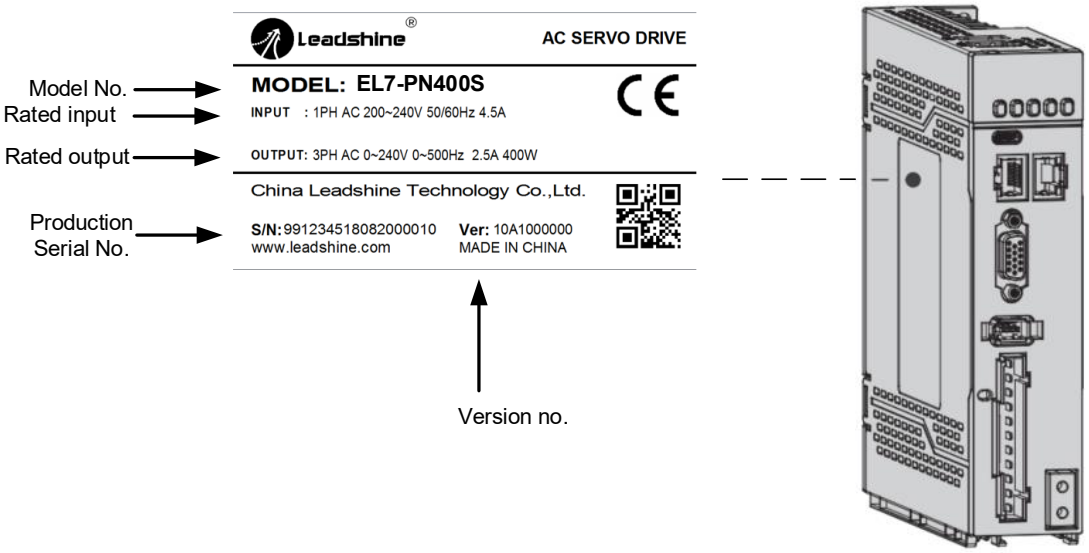
Note:
The maximum speed varies among different servo motor models.

1.2 Model Number Structure

Servo Drive model: EL7-PNS

EL7	-	PN	(a)	1500	S	(b)	T	-	(c)
I	-	II	III	IV	V	VI	VII	-	VIII
I	Series designature								
	EL7:	EL7 series							
II	Communication ports								
	RS:	Pulse and RS485							
	EC:	EtherCAT							
	PN:	PROFINET							
III	Industry code(not relevant to safety construction)								
	(a):	XXXXXXXXXX							
		The model number may include a "XXXXXXXXXX", Where"XXXXXXXXXX" can be blank or combination of any alphanumeric and/or symbols that represents Industry							
	(blank):	Standard model, not industry customized (default)							
IV	Rated power or current								
	400	400W (Input: 1PH AC 200~240V 50/60Hz 4.0A; output: 3PH AC 0~240V 0~500Hz 2.5A 400W)							
	750	750W (Input: 1PH AC 200~240V 50/60Hz 7.9A; output: 3PH AC 0~240V 0~500Hz 5.5A 750W)							
	1000	1000W (Input: 1PH AC 200~240V 50/60Hz 8.8A; output: 3PH AC 0~240V 0~500Hz 7.0A 1000W)							
	1500	1500W (Input: 1PH or 3PH AC 200~240V 50/60Hz 10.1A/6.4A; output: 3PH AC 0~240V 0~500Hz 9.5A 1500W)							
	2000	2000W (Input: 1PH or 3PH AC 200~240V 50/60Hz 12.8A/8.0A; output: 3PH AC 0~240V 0~500Hz 12A 2000W)							
	3000	3000W (Input: 3PH AC 200~240V 50/60Hz 14.8A; output: 3PH AC 0~240V 0~500Hz 22A 3000W)							
	5000	(Input: 3PH AC 200~240V 50/60Hz 18.4A; output: 3PH AC 0~240V 0~500Hz 27A 5000W)							
	1000	1000W (Input: 3PH AC 380~440V 50/60Hz 2.4A; output: 3PH AC 0~380V 0~500Hz 3.5A 1000W)							
	1500	1500W (Input: 3PH AC 380~440V 50/60Hz 3.6A; output: 3PH AC 0~380V 0~500Hz 5.4A 1500W)							
	2000	2000W (Input: 3PH AC 380~440V 50/60Hz 5.6A; output: 3PH AC 0~380V 0~500Hz 8.4A 2000W)							
	3000	3000W (Input: 3PH AC 380~440V 50/60Hz 7.9A; output: 3PH AC 0~380V 0~500Hz 11.9A 3000W)							
	4400	4400W (Input: 3PH AC 380~440V 50/60Hz 11.6A; output: 3PH AC 0~380V 0~500Hz 16.5A 4400W)							
	5500	5500W (Input: 3PH AC 380~440V 50/60Hz 15.8A; output: 3PH AC 0~380V 0~500Hz 20.8A 5500W)							
	7500	7500W (Input: 3PH AC 380~440V 50/60Hz 20.8A; output: 3PH AC 0~380V 0~500Hz 25.7A 7500W)							
V	Type								
	S:	Advanced Version (supports STO & Encoder output functions)							
VI	Product code(not relevant to product construction)								

	(b):	The model number may include a "XXXXXXXXXX", Where"XXXXXXXXXX" can be blank or combination of any alphanumeric and/or symbols that represents product code.	
VII	Voltage level		
	(blank):	220V	
	T:	380V	
VIII	Customer code (not relevant to safety construction)		
	(c):	XXXXXXXXXX	
		The model number may include a suffix "XXXXXXXXXX", Where "XXXXXXXXXX" can be blank or combination of any alphanumeric and/or symbols that represents customer identity.	



1.3 Driver Technical Specification

EL7-PNS 220V Models

Series	EL7-PN400S	EL7-PN750S	EL7-PN1000S	EL7-PN1500S	EL7-PN2000S	EL7-PN3000S	EL7-PN5000S
Rated power (W)	400	750	1000	1500	2000	3000	5000
Rated Current (Arms)	2.5	5.5	7.0	9.5	12.0	22.0	27.0
Peak Current (Arms)	9.5	16.6	21.0	31.1	36.0	55.0	67.5
Size (mm)	168*156*40	168*156*50		168*183*80		250*230*89	
Main Power Supply	Single phase AC 200V~240V, -10%~+10%, 50/60Hz			Single phase/Three phase AC 200V~240V, 10%~+10%, 50/60Hz		Three phase AC 200V~240V, 10%~+10%, 50/60Hz	
Control Circuit Power Supply	Single phase AC 200V~240V, -10%~+10%, 50/60Hz						

EL7-PNS 400V Models

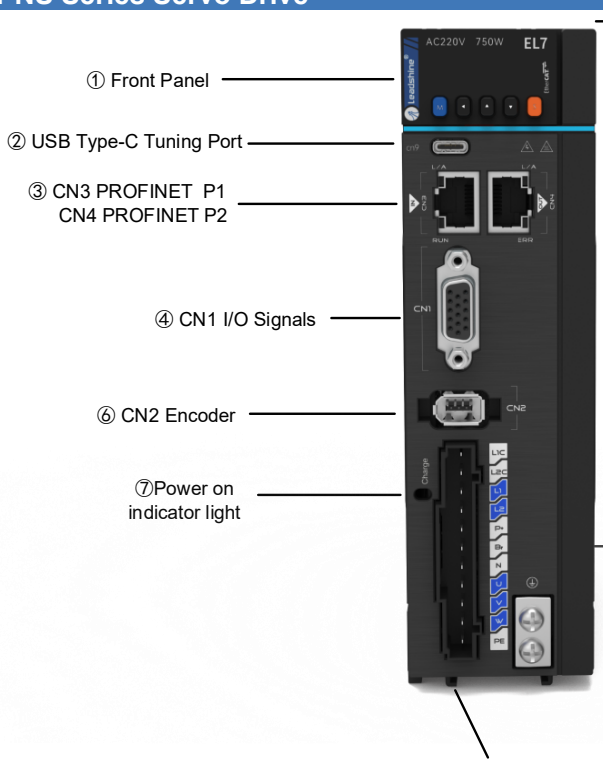
Series	EL7-PN1000 ST	EL7-PN1500 ST	EL7-PN2000 ST	EL7-PN3000 ST	EL7-PN4400 ST	EL7-PN5500 ST	EL7-PN7500 ST
Rated Power(W)	1000	1500	2000	3000	4400	5500	7500
Rated Current (Arms)	3.5	5.4	8.4	11.9	16.5	20.8	25.7
Peak Current (Arms)	10.6	14.0	20.0	30.0	38.9	51.6	63.6
Size (mm)	168*183*55		168*183*80		250*230*89		
Main Power Supply	Three phase AC 380V~440V, -10%~+10%, 50/60Hz						
Control Circuit Power Supply	Single phase AC 380V~440V, -10%~+10%, 50/60Hz						

Control mode		IGBT PWM sinusoidal wave drive
Control mode	**Position**	PROFINET communication given
	Velocity	
	Torque	
Encoder Feedback		RS485 protocol: 23-bit multiturn absolute magnetic/optical encoder
I/O	**Digital Input**	6 Digital Inputs (Supports NPN and PNP, DI4/DI5 supports probe input)
		1. Clear Alarm （A-CLR） 2. Positive limit switch (POT) 3. Negative limit switch (NOT) 4. Homing switch (HOME-SWITCH) 5. Emergency stop (E-Stop)
	Digital Output	3 Digital Outputs (2 double-ended，1single-ended)
		1. Alarm (ALM) 2. Servo ready (SRDY) 3. External brake off (BRK-OFF) 4. Positioning completed (INP) 5. Velocity at arrival (AT-SPEED) 6. Torque limiting command (TLC) 7. Zero speed position (ZSP) 8. Velocity coincidence (V-COIN) 9. Position command (P-CMD) 10. Velocity limit (V-LIMIT) 11. Velocity command (V-CMD) 12. Servo enabled (SRV-ST) 13. Homing done (HOME-OK) 14. Dynamic Brake Output 15. Z-Phase Output 16. New: Warning Output Signal
Communication Port	**USB Type-C**	Modbus USB2.0 (No need to connect driver to power supply)
	PROFINET	PROFINET(RJ45)，Communication up to 128 axes to a host
Software		Driver tuning through **Motion Studio** Ver.3.0 Parameters tuning in current loop, position loop, velocity loop; Modify I/O signal and motor parameters; Variables(velocity, position deviation, etc.) monitoring using step diagrams
Black Box		Used for error solving
Notch filter		2 sets automatic notch + 2 sets manual notch (Requirement Level 4)
Driver Front Panel		Five buttons, five-digit white LED display
Holding brake		Built-in (Excluding 11 kW–22 kW; excluding 400 W and below.)
Safety Protection		Overcurrent. Overvoltage. Undervoltage. Overheat. Overload. Overtravel. Single-Phasing. Regenerative resistor error. Position deviation error. Encoder feedback error. Excessive braking rate. EEPROM error
Safe Torque Off (STO) function		Available for all EL7-PNS series products
Adjustable Carrier Frequency		220V 1 kW and below, default 16 kHz; 380V 7.5 kW and below, default 8 kHz; 11–22 kW, default 4 kHz.
Serial Encoder		Supported
Position Compare Output		Supported
Zero tracking error		Supported
Warning Output		Supported (Warnings such as: Encoder battery low voltage, positive/negative limit, overload warning, torque limit warning, etc.)
Environment	**Temperature**	Operating temperature: 0℃ ~55℃ (not freezing) upper 45℃, please use at a reduced rate, and the rate will be reduced by 2% for every 1℃ increase. Storage temperature: -20 ~ 80℃ (no condensation) Do not store for more than 72 hours beyond 65℃.
	Humidity	Under 90%RH (Condensation free)

	Altitude	Up to 2000m above sea level No derating for use below 1000m 1% derating for every 100m above 1000m. For altitudes above 2000m, please contact the manufacturer!
	Vibration	Less than 0.5G (4.9m/s2) 10-60Hz (non-continuous working)
	Altitude	Up to 1000m(please reduce rate beyond 1000m)
	Impact	19.6m/s^2
	IP ratings	IP20

1.4 Driver ports and connectors

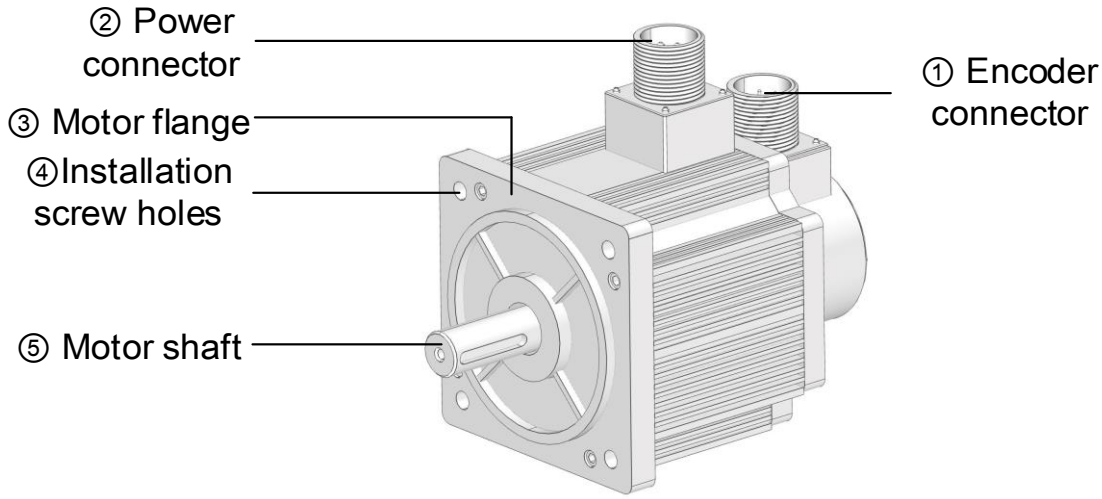
EL7-PNS Series Servo Drive



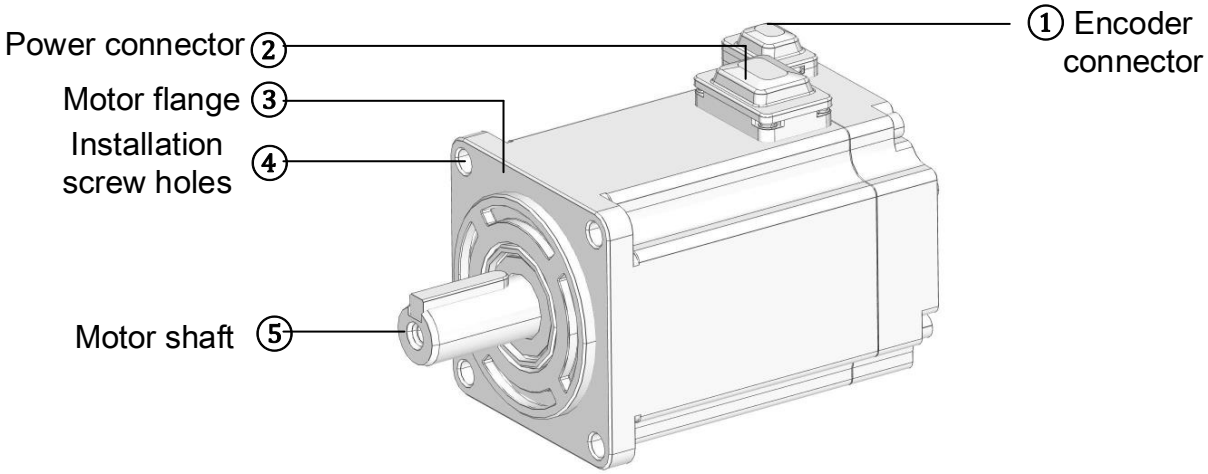
No.	Parts & Connectors	Description
①	Front Panel	Including a LED display and 5 buttons. LED display is used to display servo drive status and parameter settings. 5 buttons： **M** ： *To switch between different modes and parameters* ◀ ： *Switch between value* ▲ ： *Switch between sub-menus/Increase* ▼ ： *Switch between sub-menus/Decrease* **S** ： *Enter*
②	USB Type-C tuning port	Connect to computer for tuning of servo drive. Parameters of the servo drive can be modified without connecting to main power supply.
③	CN1 I/O signal	Probe input signal & other I/O signals terminals
④	CN3 PROFINET IN/ CN4 PROFINET OUT	Connect to master device or next/previous slave station
⑤	CN6 STO	Safe Torque Off (STO) port
⑥	CN2 Encoder	Connect to motor encoder
⑦	Power-on indicator light	Lights up when servo drive is connected to main power supply. *Please do not touch the power terminal Immediately after power off as the capacitor might require some time to discharge.*
⑨	L1C,L2C	Control power supply 220VAC
	L1, L2	Main power supply 220VAC
	P+, Br	Connect to regenerative resistor
	P+, N	Common DC bus terminals for multiple drivers
	U, V, W	Motor connector: Connect to U,V,W power terminals on servo motor
	PE	PE motor earth terminal: Connect to motor PE terminal
⑪	Battery Case Slot	When using the absolute value encoder, attach the battery pack here.

1.5 Motor ports and connectors

Motors with aviation connectors



Motors with direct connectors



Chapter 2 Installation & Wiring

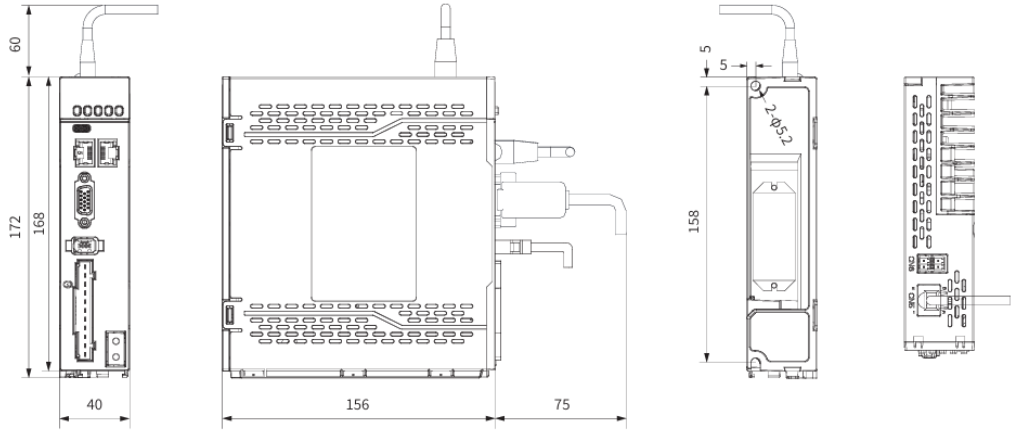
2.1 Servo Drive Installation

2.1.1 Servo drive installation environment

Temperature	Storage: -20-80℃ (Condensation free); Installation: 0-55℃ (Not frozen)
Humidity	Under 90%RH (Condensation free)
Altitude	Up to 1000m above sea level
Vibration	Less than 0.5G (4.9m/s2) 10-60Hz (non-continuous working)
Atmospheric	No corrosive gas, combustibles, dirt or dust.
IP ratings	IP20

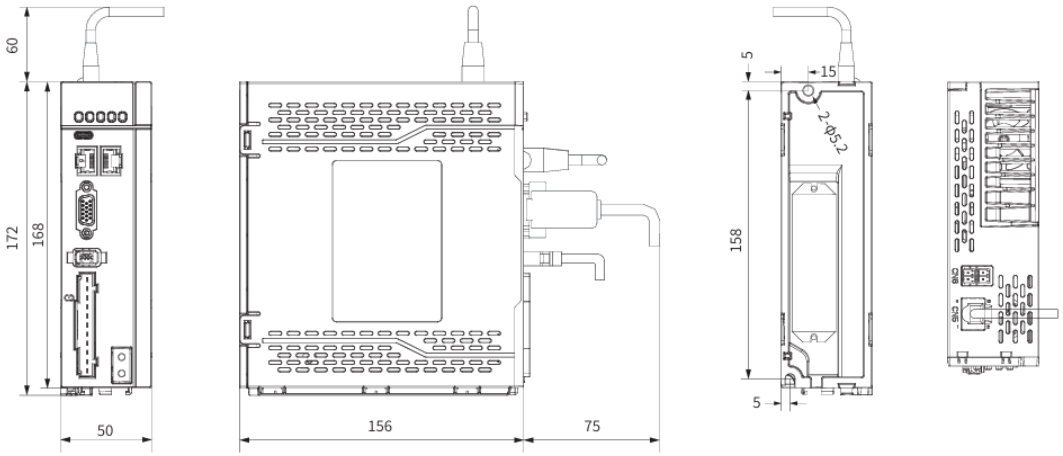
2.1.2 Servo Drive Dimension

400W- 220VAC Size A



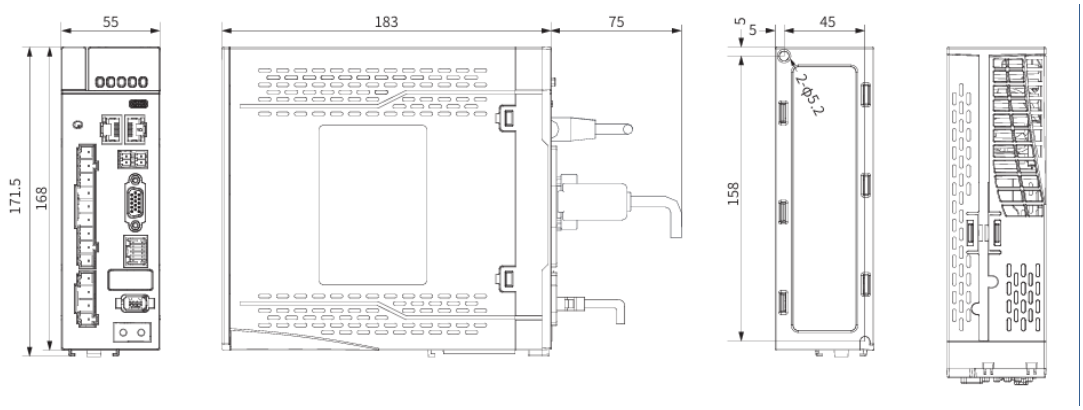
40mm x 156mm x 168mm

750W/1000W -220VAC Size B



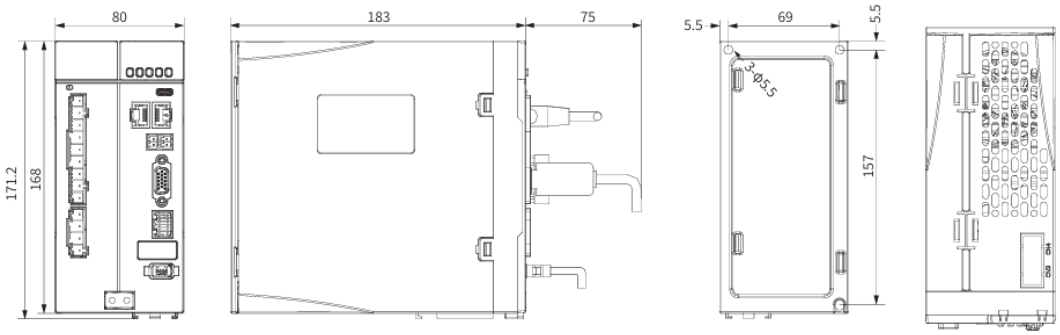
50mm x 156mm x 168mm

1000W/1500W -400VAC Size C



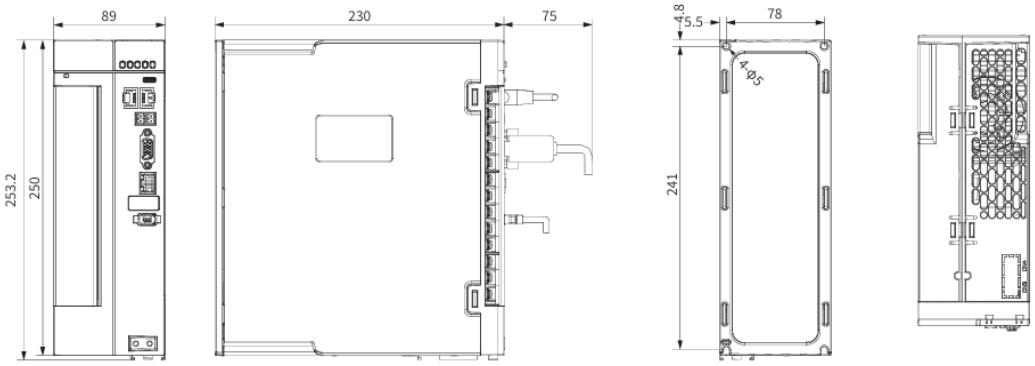
55mm×183mm×168mm

1500W/2000W -220VAC 2000W/3000W - 400VAC Size D



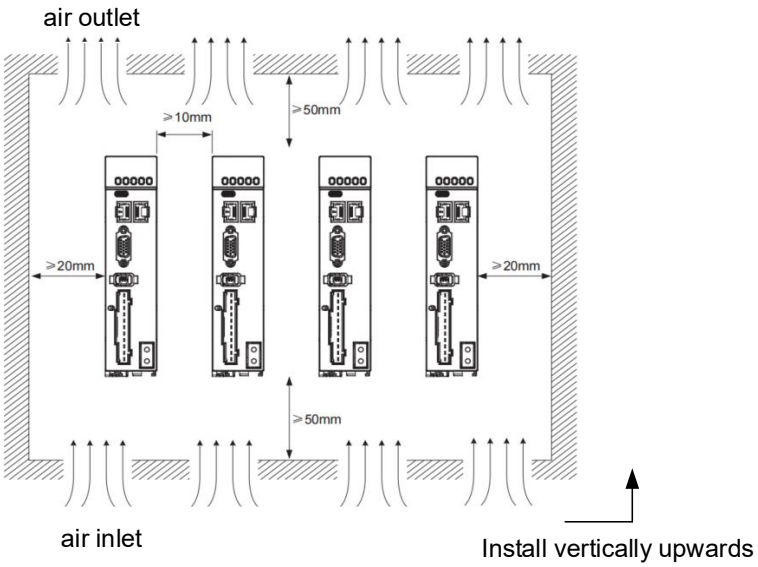
80mm×183mm×168mm

3000W/5000W -220VAC 4400W/5500W/7500W -400VAC Size E



89mm×230mm×250mm

Space requirement for installation for 100W~7500W drive
In order to ensure efficient heat dissipation, please leave at least 10mm installation space in between drivers. If drivers need to be mounted compactly, please leave at 1mm of installation space. Please keep in mind that under such conditions, the drivers can only run at 75% of actual load rate.



- ✓ **Installation method**
  Please install the driver vertical to ground facing forward for better heat dissipation. Always install in rows and use heat insulation board to separate between rows. Cooling fans are recommended for drivers to achieve optimal performance.
- ✓ **Grounding**
  PE terminals must be grounded to prevent electrocution hazard or electromagnetic interference.
- ✓ **Wiring**
  Please ensure there is no liquid around the wiring and connectors as liquid leakage may cause serious damage to the driver(s).

2.2 Servo Motor Installation

2.2.1 Installation conditions

Installation conditions may affect the lifespan of a motor

- ➢ Please keep away from corrosive fluid and combustibles.
- ➢ If dusty working environment is unavoidable, please use motors with oil seal.
- ➢ Please keep away from heat source.
- ➢ If motor is used in enclosed environment without heat dissipation, motor lifespan will be short.
- ➢ Please check and clean the installation spot before installation.

2.2.2 Precautions during installation

Installation method

Install horizontal to ground

Make sure power cable and encoder cable is facing downwards to make sure fluid doesn't leak into the ports.

Install vertical to ground

Please use a motor with oil seal when paired with a reducer to prevent reducer oil from leaking into the motor.

Oil- and waterproofing

- Do not submerge motor/cable under oil/water
- Please use a motor with oil seal when paired with a reducer to prevent reducer oil from leaking into the motor.
- If there is an unavoidable fluid leakage near the motor, please use motor with better IP ratings.
- Make sure power cable and encoder cable is facing downwards to make sure fluid doesn't leak into the ports.
- Avoid the usage of motor in water/oil leaking prone environment.

Cable under stress

- Do not the bend the cable especially at each ends of the connectors.
- Make sure to not let the cables be too tight and under tremendous stress especially thinner cables such as signal cables.

Connectors

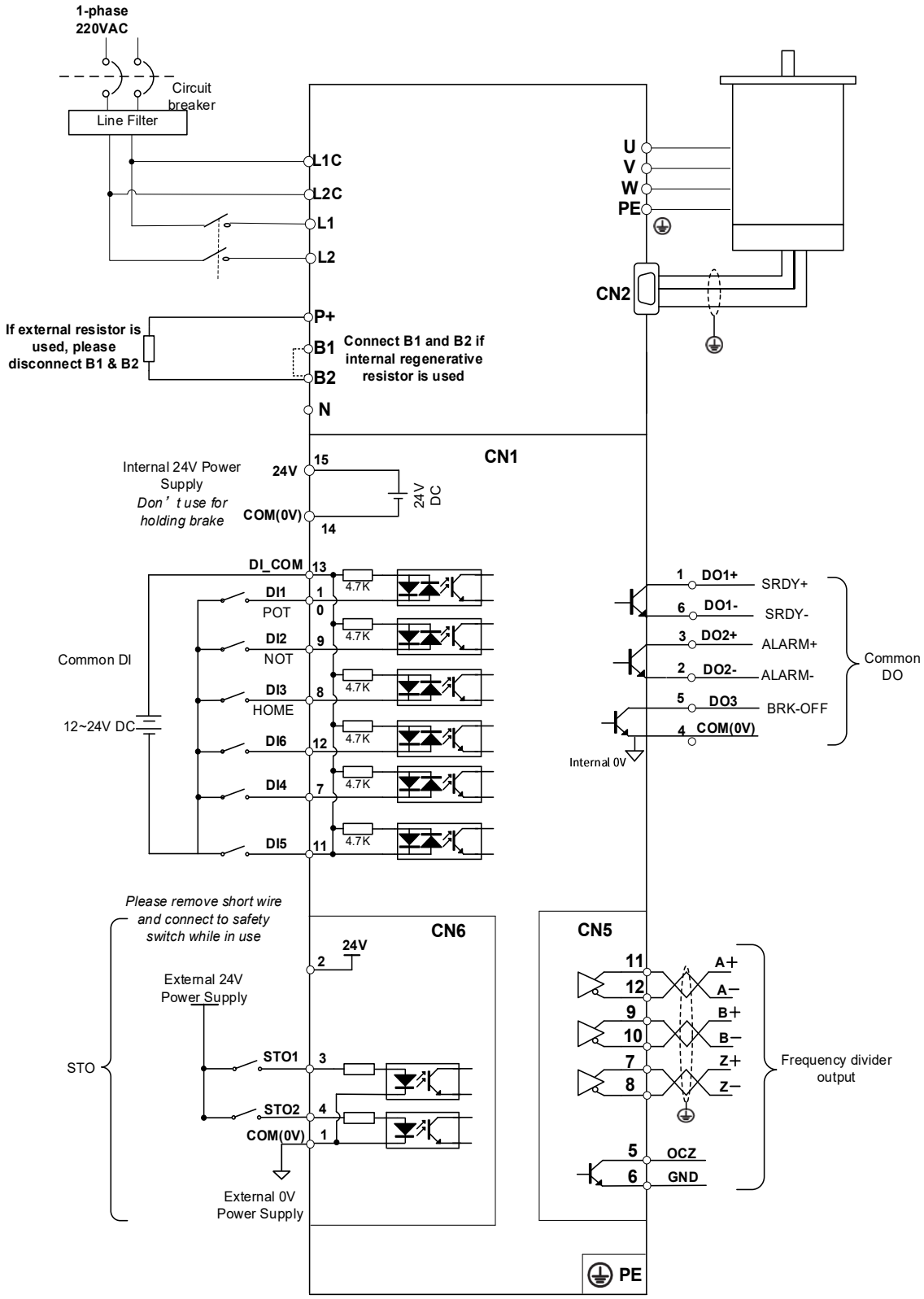
- Please to remove any conductive foreign objects from the connectors before installation
- The connectors are made of resin. May not withstand impact.
- Please hold the driver during transportation, not the cables.
- Leave enough "bend" on the connector cables to ensure less stress upon installation.

Encoder & coupling

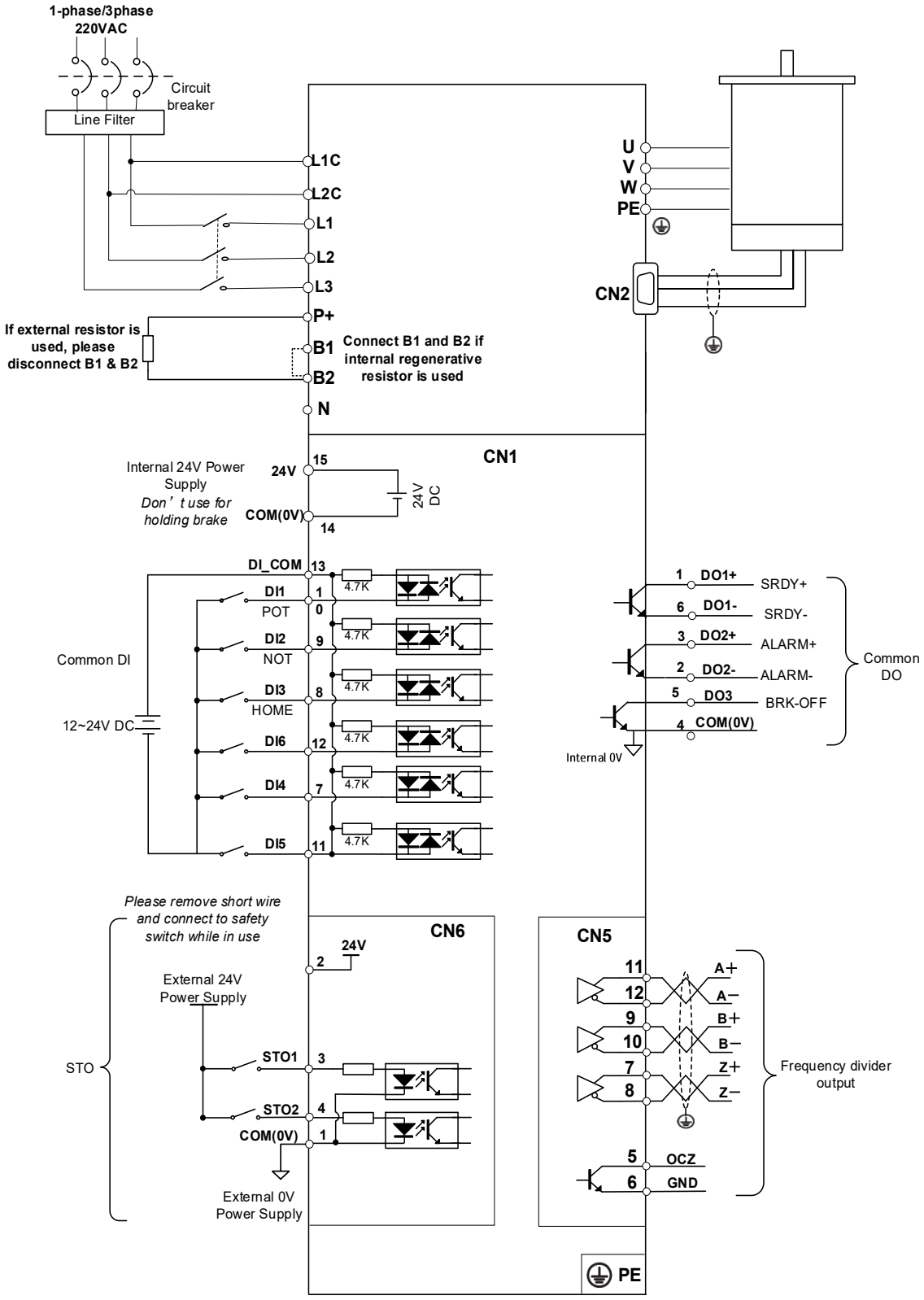
- During installation or removal of coupling, please do not hit the motor shaft with a hammer as it would cause damage to internal encoder.
- Please make sure to centralize the motor shaft and coupling, it might cause damage to motor or encoder due to vibration.
- Please make sure axial and radial load is within the limits specified as it might affect the lifespan of the motor or cause damage to it.

2.3 EL7-PNS Wiring Diagram

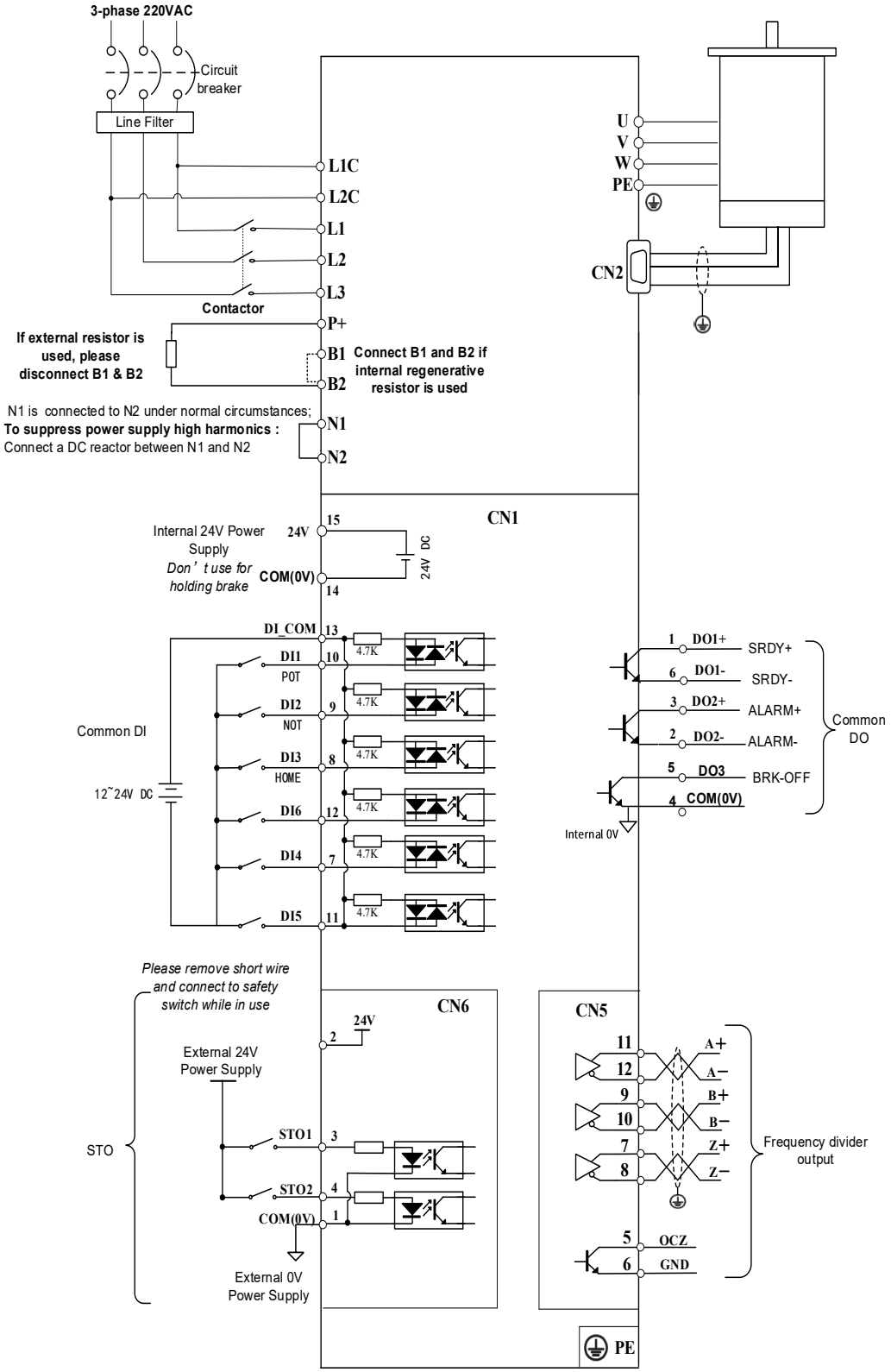
400W/750W/1000W – 220V Models



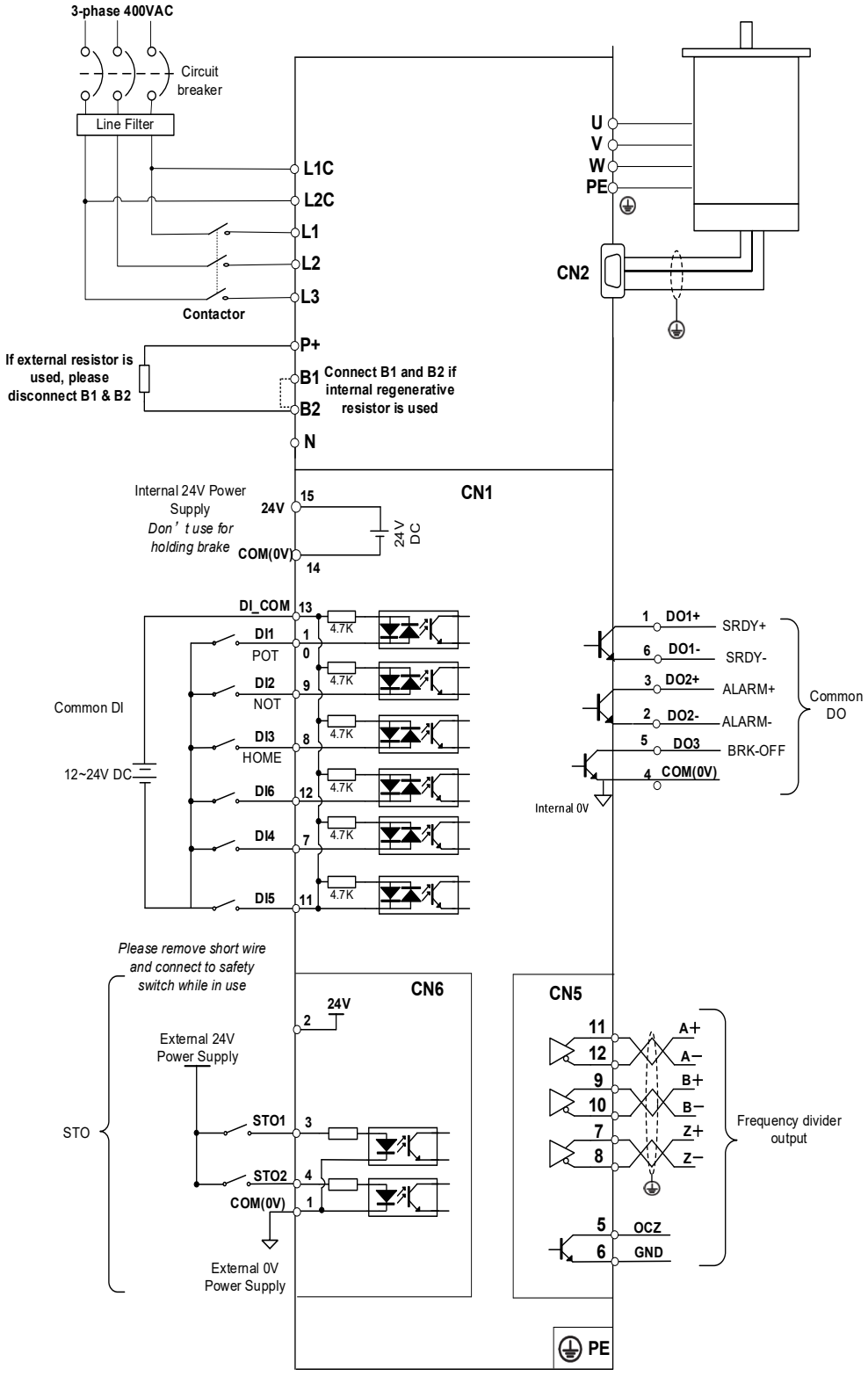
1500W/2000W - 220V Models



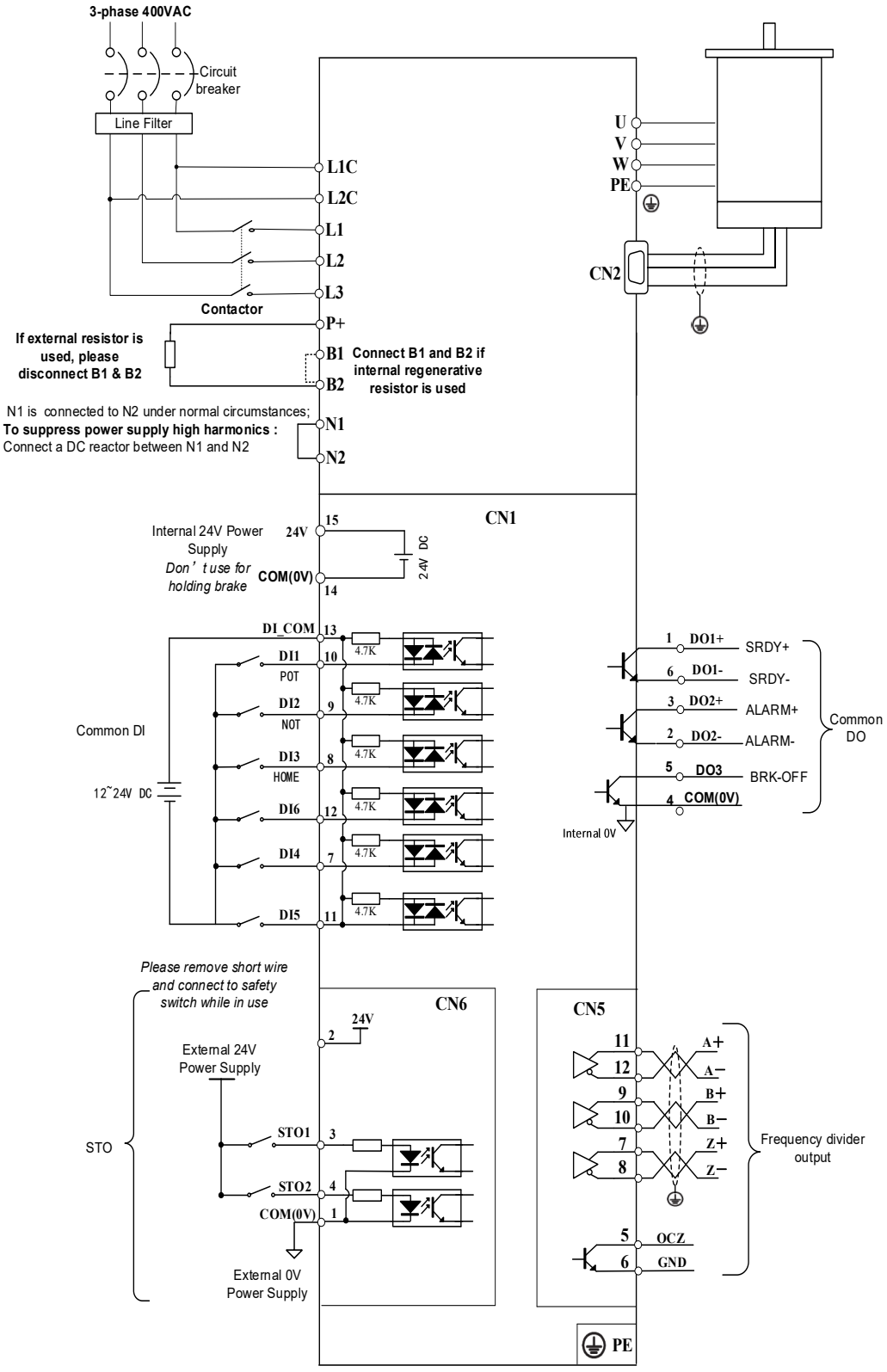
3000W/5000W - 220V Models



1000W/1500W/2000W/3000W – 400V Models

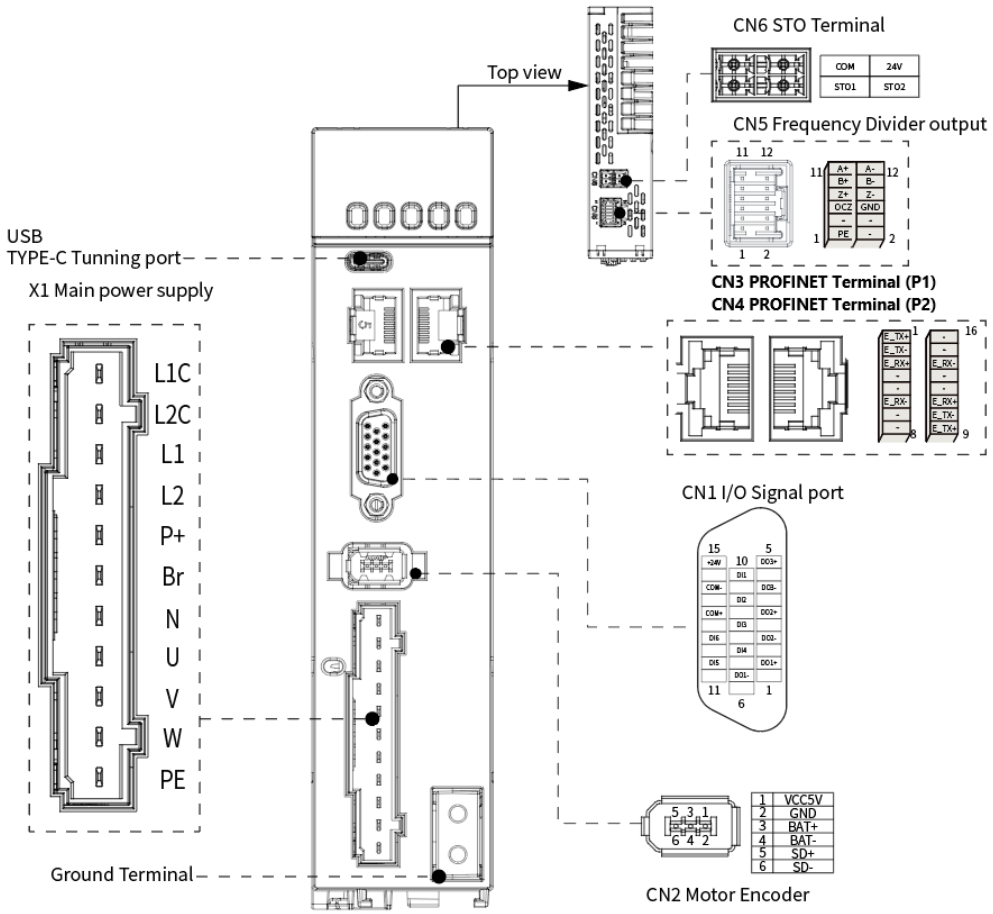


4400W/5500W/7500W – 400V Models



2.4 Servo Drive Ports

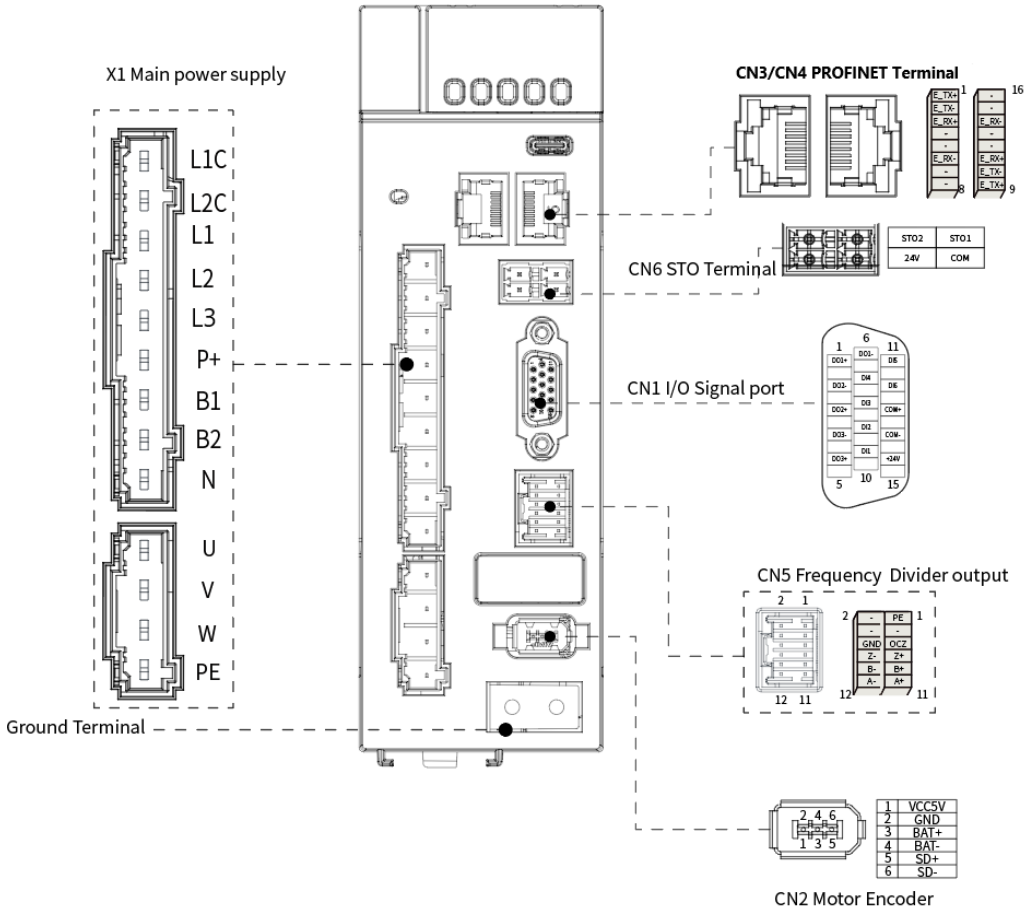
400W/750W/1000W – 220V Models



Functions of driver port

Port	Function
CN1	I/O Control Signal Port
CN2	Motor Encoder feedback input port
USB	PC side USB Type-C Tuning Port
CN3	PROFINET P1 Communication Port
CN4	PROFINET P2 Communication Port
CN5	Frequency divider output port
CN6	Safe Torque Off (STO) Port
X1	Main Power Supply
Ground	Connect to the power supply's ground terminal to ensure proper earthing.

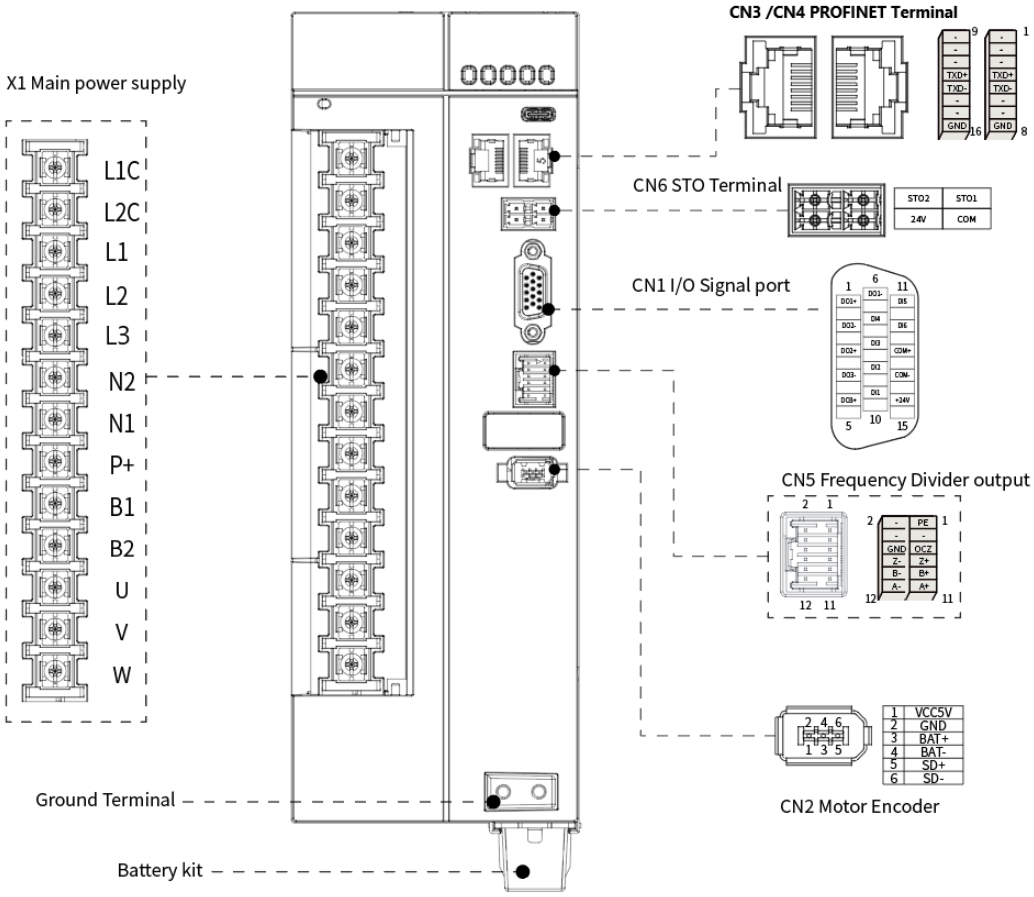
1500W/2000W – 220V Models 、1000W/3000W – 400V Models



Functions of driver port

Port	Function
CN1	I/O Control Signal Port
CN2	Motor Encoder feedback input port
USB	PC side USB Type-C Tuning Port
CN3	PROFINET IN Communication Port
CN4	PROFINET OUT Communication Port
CN5	Frequency divider output port
CN6	Safe Torque Off (STO) Port
X1	Main Power Supply
Ground	Connect to the power supply’s ground terminal to ensure proper earthing.

3000W/5000W-220V Models、 4400W/5500W/7500W– 400V Models

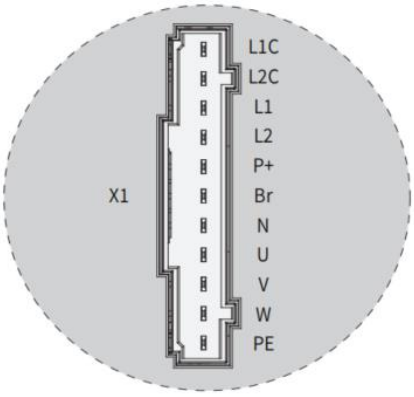


Functions of driver port

Port	Function
CN1	I/O Control Signal Port
CN2	Motor Encoder feedback input port
USB	PC side USB Type-C Tuning Port
CN3	PROFINET P1 Communication Port
CN4	PROFINET P2 Communication Port
CN5	Frequency divider output port
CN6	Safe Torque Off (STO) Port
X1	Main Power Supply
Ground	Connect to the power supply’s ground terminal to ensure proper earthing.

2.4.1 X1

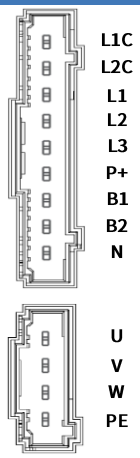
400W~1000W Models



X1 port descriptions

Port	Pin	Functions	Remarks
X1	L1C	Control power L1C port	Single phase 200~240VAC，+10～-15%，50/60Hz
	L2C	Control power L2C port	
	L1	Main power L1 port	Single phase 200~240VAC，+10～-15%，50/60Hz
	L2	Main power L2 port	
	P+	● Internal DC bus positive terminal ● External regenerative resistor P terminal	If an external regeneration resistor is required, connect the regeneration resistor between P+ and Br.
	Br	External regenerative resistor terminal	
	N	Internal DC bus negative terminal	Please do not connect
	U	Motor U terminal	Please ensure proper wire connection on motor.
	V	Motor V terminal	
	W	Motor W terminal	
	PE	Motor Protective Earth	Please ground PE of driver and motor together

1500S ~ 2000S / 1000ST ~ 3000ST Models

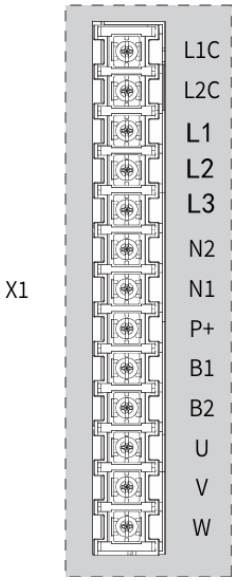


A

Pin	Functions	Remarks
L1C	1500S ~ 2000S Control power supply Single phase 220VAC，+10～-15%，50/60Hz 1000ST ~ 3000ST Control power supply Single phase 400VAC，+10～-15%，50/60Hz	● Optional isolation transformer ● In case of serious interference, it is recommended to connect a line filter to main power supply; ● Don't connect 1500S ~ 2000S to 400VAC power supply, this will result in serious damage to the drive; It is recommended to install a fuseless circuit breaker to cut off power supply in time when the driver fails.
L2C		
L1	1500S ~ 2000S Main Power Supply:Single /Three phase 220VAC，+10～-15%，50/60Hz (When using a single-phase 220V input, either L1, L2 or L3 may be selected for use)) 1000ST ~ 3000ST Main Power Supply:Three phase 400VAC，+10～-15%，50/60Hz	
L2		
L3		
P + B1/B 2	External regenerative resistor terminal	If an external regenerative resistor is required, please disconnect B1 and B2. Connect the external regenerative resistor to terminal P+ and B2.
P+	Internal DC bus terminal	Please do not connect
N		
U	Motor U terminal	Please ensure proper wire connection on motor.
V	Motor V terminal	
W	Motor W terminal	
PE	Motor Protective Earth	Please ground PE of driver and motor together

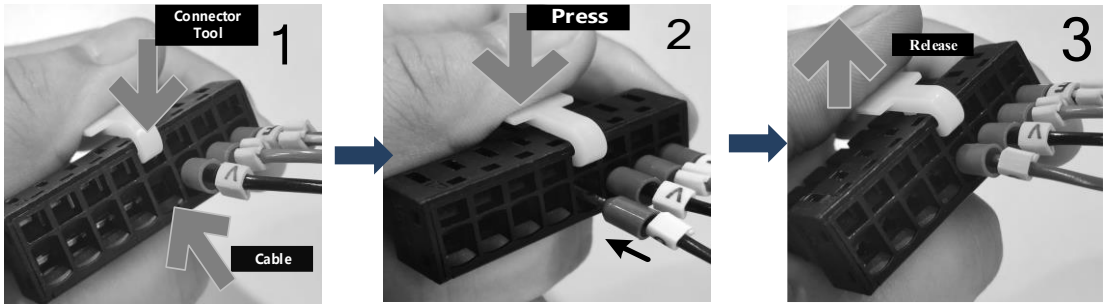
Driver	Resistance(Ω)	Power (w)
1500S/2000S	50	≧100
1000ST~1500ST	100	≧100
2000ST~3000S	50	≧100

3000S~5000S、4400ST ~ 7500ST Models

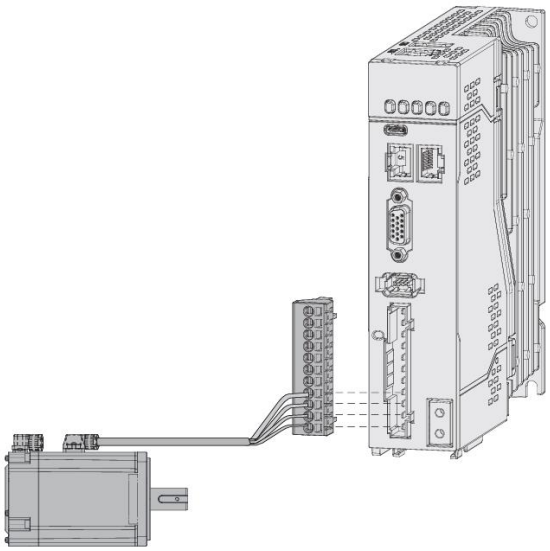


Pin	Functions	Remarks
L1C L2C	3000S ~5000S Control power supply Single phase 220VAC，+10～-15%，50/60Hz 4400ST ~ 7500ST Control power supply Single phase 400VAC，+10～-15%，50/60Hz	● Optional isolation transformer ● In case of serious interference, it is recommended to connect a line filter to main power supply; It is recommended to install a fuseless circuit breaker to cut off power supply in time when the driver fails.
L1 L2 L3	3000S ~ 5000S Main Power Supply:Single /Three phase 220VAC，+10～-15%，50/60Hz (When using a single-phase 220V input, either L1, L2 or L3 may be selected for use)) 4400ST ~ 7500ST Main Power Supply:Three phase 400VAC，+10～-15%，50/60Hz	
N2 N1	External reactor terminals	By default, a short is connected between N1 and N2. To suppress high-order harmonics in the power supply, remove the jumper and connect an external DC reactor between N1 and N2.
P + B1/B 2	Braking resistor terminals	If an external regenerative resistor is required, please disconnect B1 and B2. Connect the external regenerative resistor to terminal P+ and B2.
U	Motor U terminal	Please ensure proper wire connection on motor.
V	Motor V terminal	
W	Motor W terminal	

To fix wire cables into connector



When the servo drive is matched with an AMP flying lead motor



When connecting the motor power cables to the servo drive, the ends of the four cables are labelled U, V, W and PE respectively. These must be matched up one-to-one and connected correctly to the corresponding slots on the drive's main circuit terminal block.

2.4.2 Regenerative resistor selection and connections

The use of regenerative resistor

When the motor opposes the direction of rotation as in deceleration or vertical axis escalation, part of the regenerative energy will be delivered back to the driver. This energy will first be stored in internal capacitors of the driver. When the energy stored in the capacitors reach the maximum capacity, a regenerative resistor is required the excessive energy to prevent over-voltage.

Selection of regenerative resistor

Recommended selection of regenerative resistor

Calculation of regenerative resistance under normal operation

EL7-PNS series. (Power range)	Internal resistance (Ω)	Internal resistor power rating (W)	Minimum resistance (Ω)	Minimum power rating (W)
400S	-	-	50	50
750S	50	75	30	50
1000S	50	75	30	75
1500S	50	100	30	100
2000S	50	100	30	100
3000S	35	100	15	100
5000S	35	100	15	100
1000ST	100	100	80	100
1500ST	100	100	60	100
2000ST	50	100	40	100
3000ST	50	100	40	100
4400ST	35	100	35	100
5500ST	35	100	25	100
7500ST	35	100	25	100

Steps:

1. Determine if driver comes with a regenerative resistor. If not, please prepare a regenerative resistor with resistance value higher than might be required.
2. Monitor the load rate of the regenerative resistor using front panel (d14). Set the driver on high velocity back and forth motions with high acceleration/deceleration.
3. Please make sure to obtain the value under following conditions: Driver temperature < 60℃, d14<80(Won't trigger alarm), Regenerative resistor is not fuming, No overvoltage alarm(Err120).

Pb(Regenerative power rating) = Resistor power rating x Regenerative load rate (%)

Please choose a regenerative resistor with power rating Pr about **2-4 times the value of Pb** in considered of harsh working conditions and some 'headroom'.

If the calculated Pr value is less than internal resistor power rating, external resistor is not required.

$$R(\text{Max. required regenerative resistance}) = (380^2 - 370^2)/Pr$$

Problem diagnostics related to regenerative resistor:

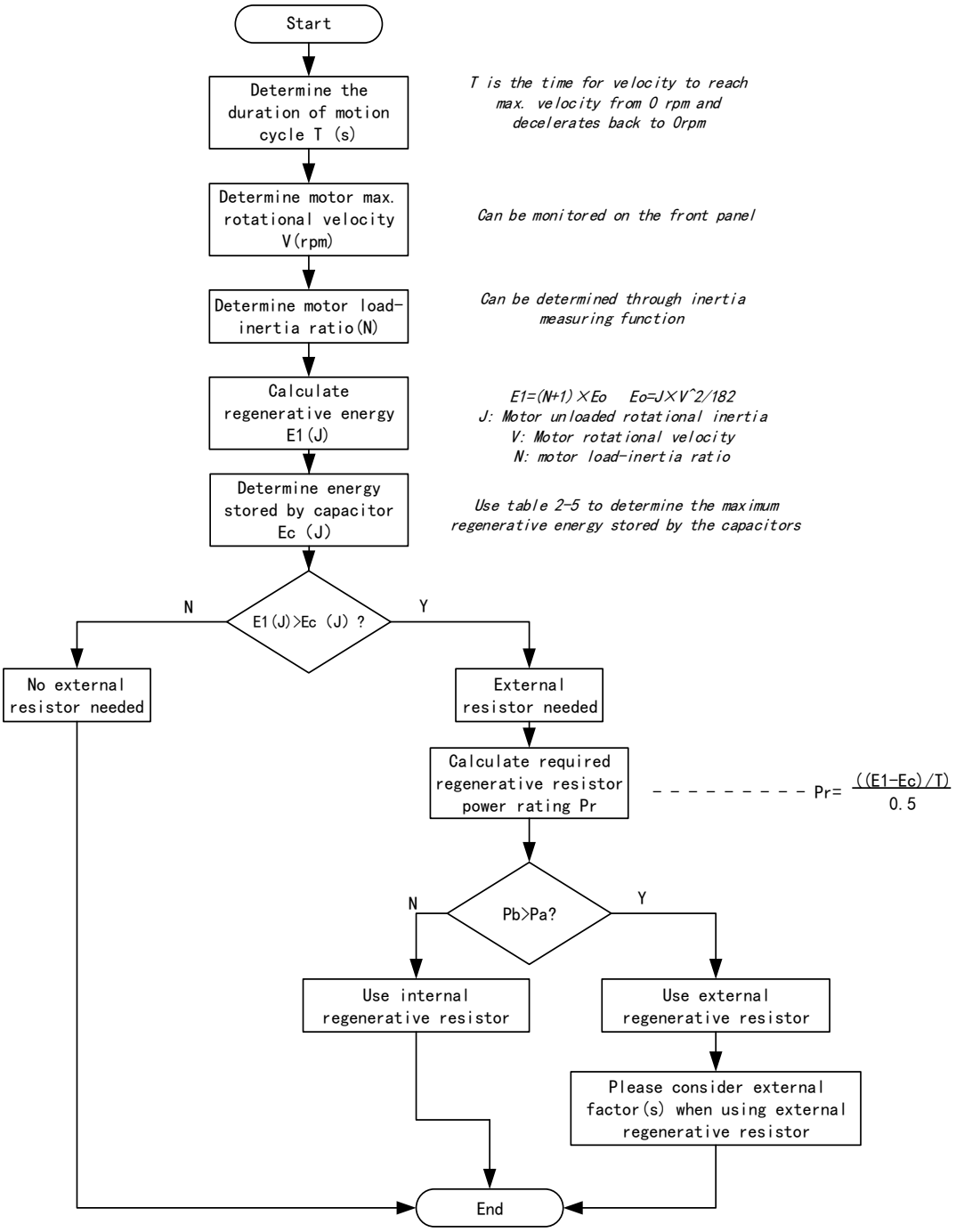
- If driver temperature is high, reduce regenerative energy power rating or use an external regenerative resistor.
- If regenerative resistor is fuming, reduce regenerative energy power rating or use an external regenerative resistor with higher power rating.
- If d14 is overly large or increasing too fast, reduce regenerative energy power rating or use an external regenerative resistor with higher power rating.
- If driver overvoltage alarm (Er120) occurs, please use an external regenerative resistor with lower resistance or connect another resistor in parallel.

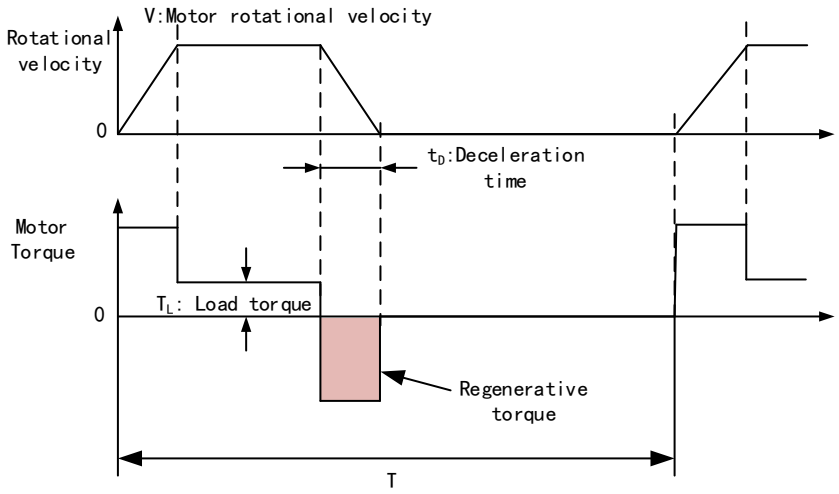
Please take following precautions before installing an external regenerative resistor.

1. Please set the correct resistance value in P00.16 and resistor power rating P00.17 for the external regenerative resistor.
2. Please ensure the resistance value is higher or equals to the recommended values in table 2-3. Regenerative resistors are generally connected in series but they can also be connected in parallel to lower the total resistance.
3. Please provided enough cooling for the regenerative resistor as it can reach above 100℃ under continuous working conditions.
4. The min. resistance of the regenerative resistor is dependent on the IGBT of the holding brake. Please refer to table

Theoretical selection of regenerative resistor

Without external loading torque, the need for an external regenerative resistor can be determined as the flow chart below


Start
Determine the duration of motion cycle T (s)
T is the time for velocity to reach max. velocity from 0 rpm and decelerates back to 0rpm
Determine motor max. rotational velocity V(rpm)
Can be monitored on the front panel
Determine motor load-inertia ratio(N)
Can be determined through inertia measuring function
Calculate regenerative energy E1(J)
E1=(N+1)×Eo Eo=J×V^2/182
J: Motor unloaded rotational inertia
V: Motor rotational velocity
N: motor load-inertia ratio
Determine energy stored by capacitor Ec (J)
Use table 2-5 to determine the maximum regenerative energy stored by the capacitors
E1(J)>Ec (J) ?
N
Y
No external resistor needed
External resistor needed
Calculate required regenerative resistor power rating Pr
Pr= ((E1-Ec)/T) / 0.5
Pb>Pa?
N
Y
Use internal regenerative resistor
Use external regenerative resistor
Please consider external factor(s) when using external regenerative resistor
End



Steps to calculate capacity of regenerative resistor

Steps	Calculation	Symbol	Formula
1	Servo system regenerative energy	E1	$E1=(N+1)\times J\times V^2/182$
2	Depleted energy from loss of load system during acceleration	E_L	$E_L = (\pi/60)\ V\times T_L\times tD$ *If loss is not determined, please assume $E_L = 0$.*
3	Depleted energy due to motor coil resistance.	E_M	$E_M=(U^2/R)\times tD$ R= coil resistance, U = operating voltage *If R is not determined, please assume $E_M = 0$.*
4	Energy stored by internal DC capacitors	Ec	Please refer to table 2-5
5	Depleted energy due to regenerative resistance	E_K	E_K=E1-(EL+EM+EC), If loss is ignored, EK=E1-EC
6	Required power rating of regenerative resistor	Pr	$Pr=E_K/(0.5\times T)$

Internal capacitor capacity and rotor inertia

EL7-PNS series. (Power range)	Servo motor	Rotor Inertia （× 10^{-4}kg.m^2）	Max. regenerative energy stored in capacitor Ec(J)
400S	ELM2H-0100LA40	0.048	13.46
	ELM2H-0400LA60	0.58	13.47
750S	ELM2H-0750LA80	1.66	22.85
1000S	ELM2H-1000LA80	2.03	27.74
1500S	ELM2M-1300LA130	18.7	33.46
2000S	ELM2M-1800LA130	23.8	40.8
1000ST	ELM2M-0850LA130T	12.5	26.3
1500ST	ELM2M-1300LA130T	18.7	32
2000ST	ELM2M-1800LA130T	23.8	38
3000ST	ELM2M-2900LA180T	56.8	47
4400ST	ELM2M-4400LA180T	78.2	77
5500ST	ELM2M-5500LA180T	109	93.4
7500ST	ELM2M-7500LA180T	130	126.3

There are motors with low, medium and high inertia. Different motor models have different rotor inertia. Please refer to servo product catalogue for more information on rotor inertia.

Calculation examples:

Servo drive: EL7-PNS-750S, Servo Motor: ELM2H-0750LA80. When T = 2s, rotational velocity = 3000rpm, load inertia is 5 times of motor inertia.

EL7-PNS series. (Power range)	Servo motor	Rotor Inertia（× 10^{-4}kg.m^2）	Max. regenerative energy stored in capacitor Ec(J)
750W	ELM2H-0750LA80	1.66	22.85

Regenerative energy produced:

$$\mathrm{E1} = \frac{(\mathrm{N}+1)\times \mathrm{J}\times \mathrm{V}^2}{182} = \frac{(5+1)\times 1.66\times 3000^2}{182} = 49.3\mathrm{J}$$

If E1 > Ec, internal capacitors can't take in excessive regenerative energy, regenerative resistor is required.

Required regenerative resistor power rating Pr:

$$\mathrm{Pr} = \frac{(\mathrm{E1}-\mathrm{Ec})}{0.5\mathrm{T}} = \frac{49.3-22.85}{0.5\times 2} = 26.45\mathrm{W}$$

Hence, with the internal regenerative resistor Pa = 75W, Pr<Pa, no external regenerative resistor is required.

Let's assume if the load inertia is 15 times of motor inertia, Pr = 108.6W, Pr>Pa, external regenerative resistor is required. And to consider for harsh working environment,

Pr(external)=108.6/(1-40%)=181 W

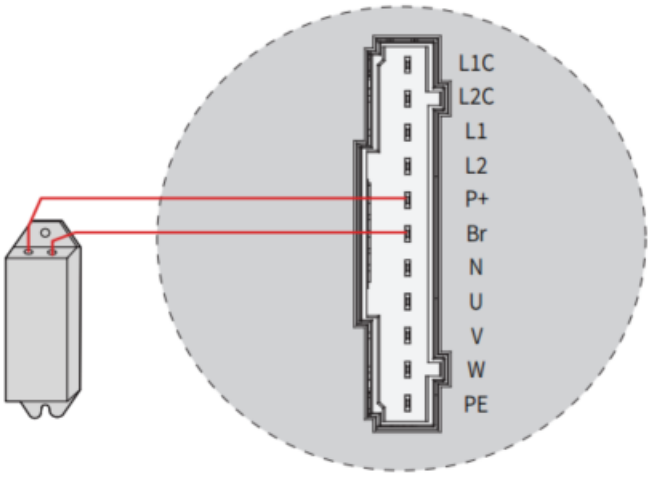
When selecting the resistance of the regenerative resistor, please be higher than the minimum value recommended in table 2-3 but lower than Rmax

$$Rmax = (380^2 - 370^2)/Pr = 7500/108.6 = 69\Omega$$

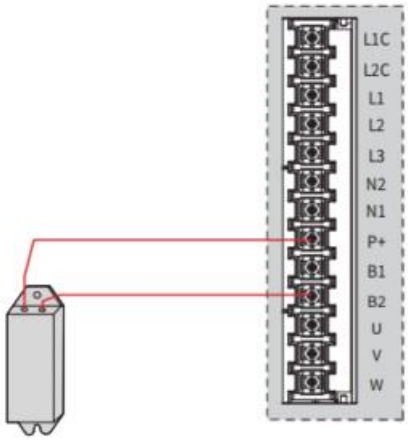
In conclusion, a regenerative resistor with resistance 40Ω - 70Ω and power rating 110W to 180W can be chosen.

Please take note that theoretical calculations of the regenerative resistance is not as accurate as calculations done under normal operation.

Connection of a regenerative resistor



Connection diagram of external braking resistor (SizeA)



Connection diagram of external braking resistor (Take Size E as an example)

External Resistor Note:

1. If you do not connect an external regenerative resistor, short B1 and B2, and the built-in regenerative resistor is used at this time;
2. If external regenerative resistor is required, it is necessary to remove the shorting wire between B1 and B2, and connect it between P+ and B2(Br), otherwise it will lead to overcurrent of the brake pipe, and it is necessary to set the function code P11.31 to select to turn on the braking resistor drain.
3. Do not connect the external brake resistor directly to the positive and negative terminals of the busbar, otherwise it will cause the machine to blow up and cause a fire!
4. please refer to ‘Table 2-3 Regenerative Braking Resistor Specification Table’.
5. Make sure that the regenerative braking resistor parameters P00.16 and P00.17 are set correctly before using the servo.
6. Mount the external braking resistor on a non-flammable object such as metal.
7. Do not make any connection to N!

Wire Gauge for Main Power Supply

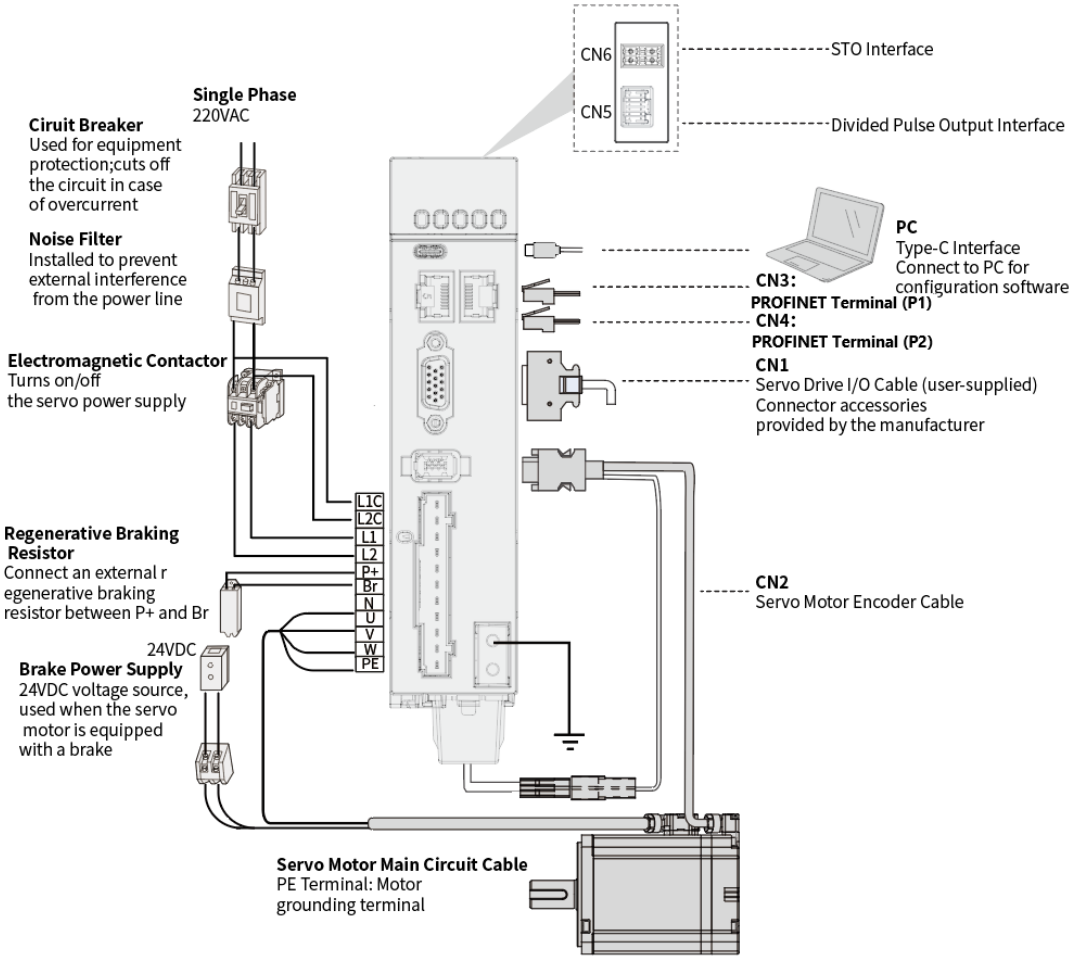
Main power supply wire gauge

EL7-PNS series. (Power range)	Wire diameter (mm^2/AWG)				
	Rate input current(Arms)	**L1 L2/L1 L2 L3**	**P+ BR**	**U V W**	**PE**
Single-phase 220V					
400S	4.0	0.52/AWG20	0.52/AWG20	0.52/AWG20	0.52/AWG20
750S	7.9	0.52/AWG20	0.52/AWG20	0.52/AWG20	0.52/AWG20
1000S	8.8	0.52/AWG20	0.52/AWG20	0.52/AWG20	0.52/AWG20
1500S	10.1	1.31/AWG16	1.31/AWG16	1.31/AWG16	1.31/AWG16
2000S	12.8	1.31/AWG16	1.31/AWG16	1.31/AWG16	1.31/AWG16
Three-phase 220V					
1500S	6.4	1.31/AWG16	1.31/AWG16	1.31/AWG16	1.31/AWG16
2000S	8.0	1.31/AWG16	1.31/AWG16	1.31/AWG16	1.31/AWG16
3000S	14.8	2.08/AWG14	2.08/AWG14	2.08/AWG14	2.08/AWG14
5000S	18.4	3.33/AWG12	3.33/AWG12	3.33/AWG12	3.33/AWG12
Three-phase 380V					
1000ST	2.4	0.52/AWG20	0.52/AWG20	0.52/AWG20	0.52/AWG20
1500ST	3.6	0.52/AWG20	0.52/AWG20	0.52/AWG20	0.52/AWG20
2000ST	5.6	0.52/AWG20	0.52/AWG20	0.52/AWG20	0.52/AWG20
3000ST	7.9	1.31/AWG16	1.31/AWG16	1.31/AWG16	1.31/AWG16
4400ST	11.6	2.08/AWG14	2.08/AWG14	2.08/AWG14	2.08/AWG14
5500ST	15.8	2.08/AWG14	2.08/AWG14	2.08/AWG14	2.08/AWG14
7500ST	20.8	3.33/AWG12	3.33/AWG12	3.33/AWG12	3.33/AWG12

- Grounding: Grounding wire should be thicker. Ground PE terminal of servo drive and servo motor together with resistance <100 Ω.
- A 3-phase isolation transformer is recommended to lessen the risk of electrocution
- Connect a line filter to power supply to reduce electromagnetic interference.
- Please install a fuseless circuit breaker to cut off power supply in time when the driver fails.

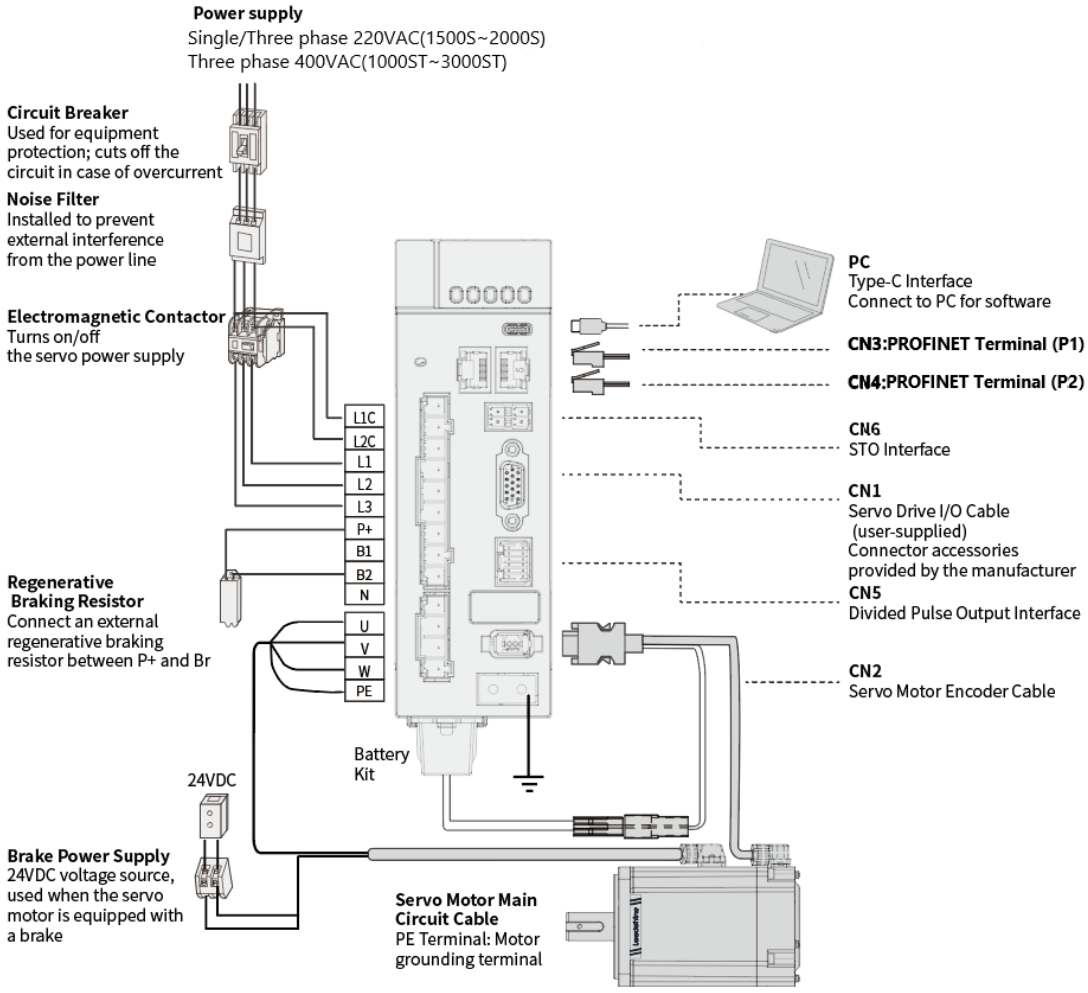
2.4.3 Wiring connections for EL7-PNS series servo drives

400S/750S/1000S Series



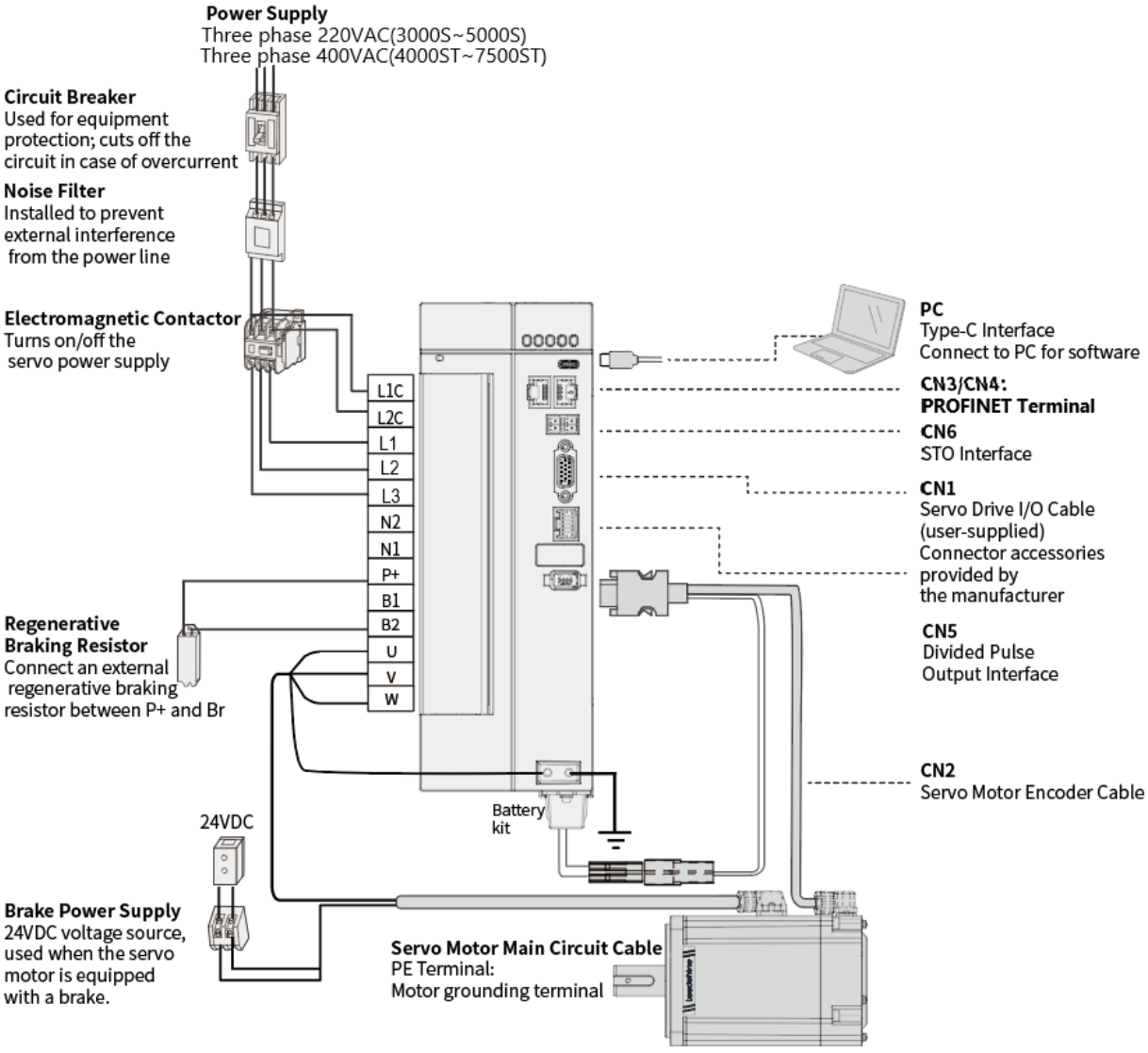
- EL7-PNS series models from 400S to 1000S only support single-phase 220V power supply.
- The servo drive is directly connected to the industrial power supply without isolation via a transformer or similar device. To prevent cross-electric shock accidents in the servo system, use fuses or wiring breakers on the input power supply. For a safer system, use an earth leakage circuit breaker that provides both overload and short-circuit protection, or a dedicated earth leakage circuit breaker with ground fault protection.
- Do not use an electromagnetic contactor to start or stop the motor. As the motor is a large inductive component, the instantaneous high voltage generated may damage the contactor.
- When connecting an external control power supply or 24VDC power supply, pay attention to the power supply capacity. Insufficient capacity, especially when supplying multiple drives or multiple brakes simultaneously, may cause insufficient supply current, resulting in drive or brake failure. The brake power supply must be a 24VDC source, with power rating based on the motor model and meeting the brake power requirements.

1500S ~ 2000S / 1000ST ~ 3000ST Series



- EL7-PNS series models from 1500S to 2000S support single-phase or three-phase 220V power supply.
- EL7-PNS series models from 1000ST to 3000ST only support three-phase 400V power supply.
- The servo drive is directly connected to the industrial power supply without isolation via a transformer or similar device. To prevent cross-electric shock accidents in the servo system, use fuses or wiring breakers on the input power supply. For a safer system, use an earth leakage circuit breaker that provides both overload and short-circuit protection, or a dedicated earth leakage circuit breaker with ground fault protection.
- Do not use an electromagnetic contactor to start or stop the motor. As the motor is a large inductive component, the instantaneous high voltage generated may damage the contactor.
- When connecting an external control power supply or 24VDC power supply, pay attention to the power supply capacity. Insufficient capacity, especially when supplying multiple drives or multiple brakes simultaneously, may cause insufficient supply current, resulting in drive or brake failure. The brake power supply must be a 24VDC source, with power rating based on the motor model and meeting the brake power requirements.

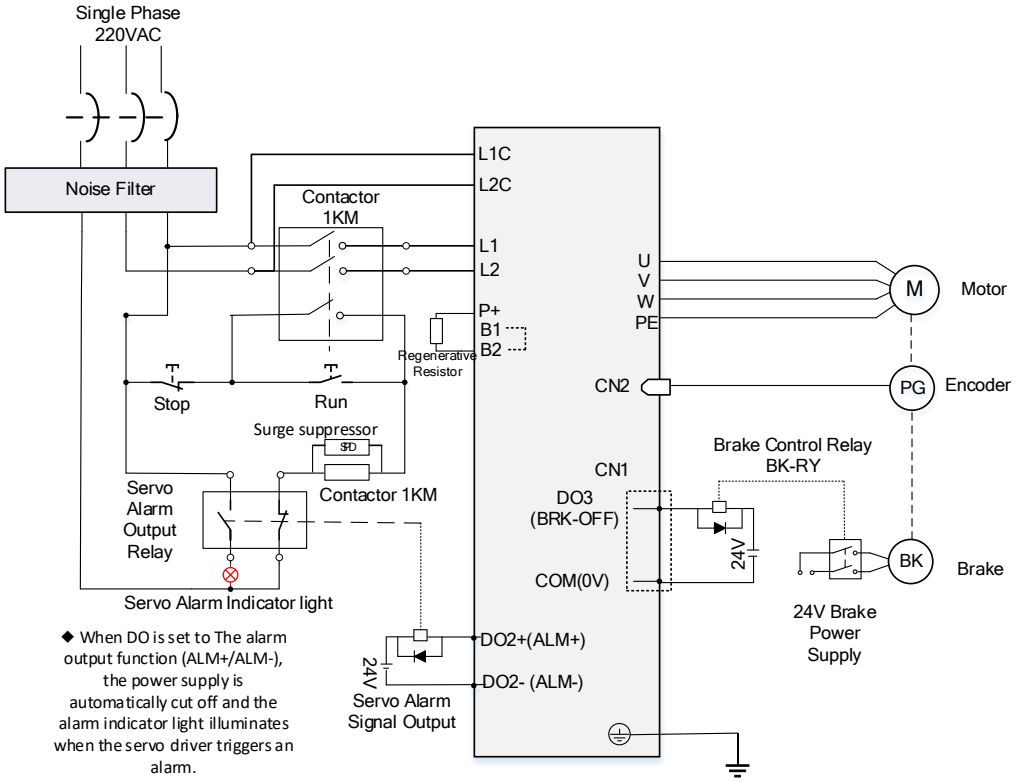
3000S ~ 5000S /4400ST ~ 7500ST Series



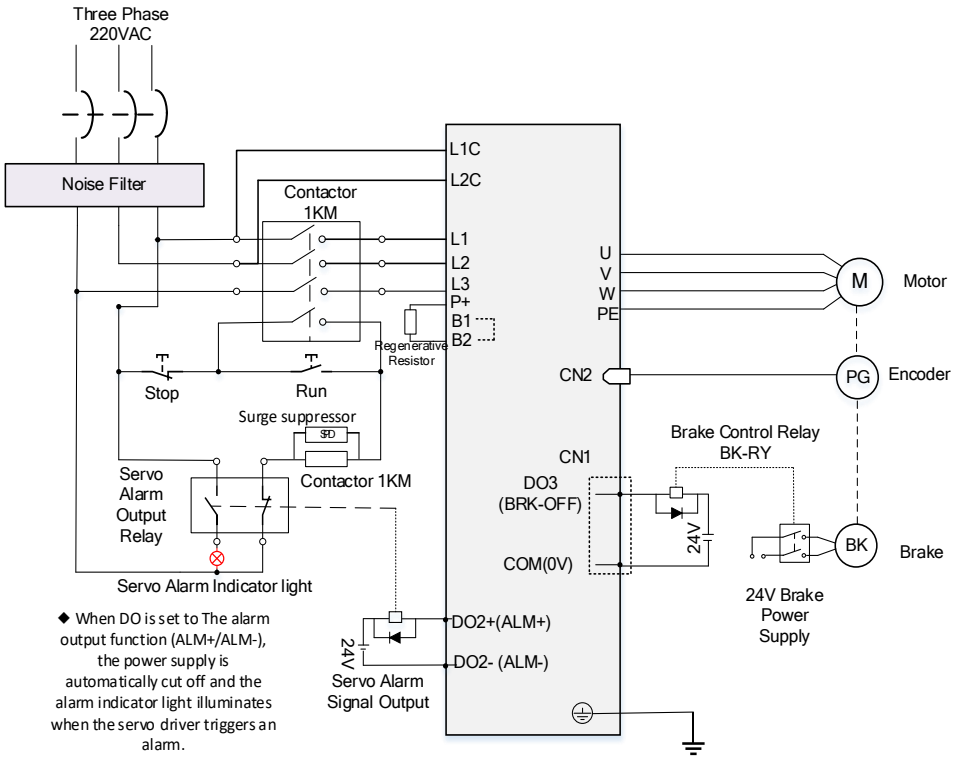
- EL7-PNS series models from 3000S to 5000S only support three-phase 220V power supply.
- EL7-PNS series models from 4400ST to 7500ST only support three-phase 400V power supply.
- The servo drive is directly connected to the industrial power supply without isolation via a transformer or similar device. To prevent cross-electric shock accidents in the servo system, use fuses or wiring breakers on the input power supply. For a safer system, use an earth leakage circuit breaker that provides both overload and short-circuit protection, or a dedicated earth leakage circuit breaker with ground fault protection.
- Do not use an electromagnetic contactor to start or stop the motor. As the motor is a large inductive component, the instantaneous high voltage generated may damage the contactor.
- When connecting an external control power supply or 24VDC power supply, pay attention to the power supply capacity. Insufficient capacity, especially when supplying multiple drives or multiple brakes simultaneously, may cause insufficient supply current, resulting in drive or brake failure. The brake power supply must be a 24VDC source, with power rating based on the motor model and meeting the brake power requirements.

2.4.4 Example of main circuit power supply wiring

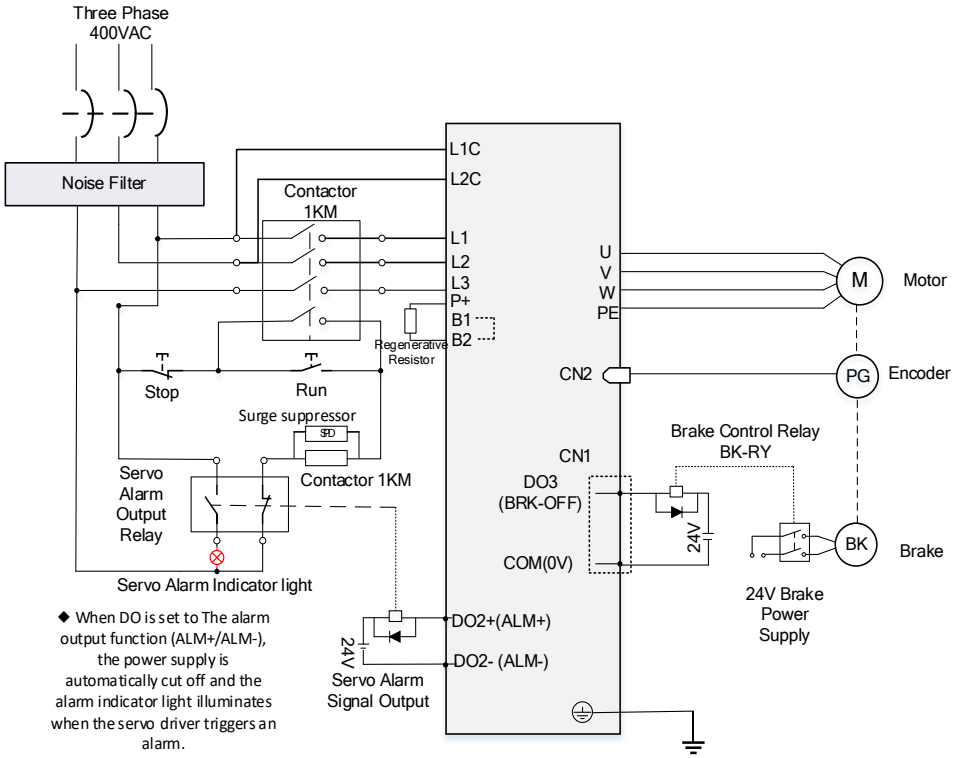
Single-phase 220V supply: 400S ~ 1000S



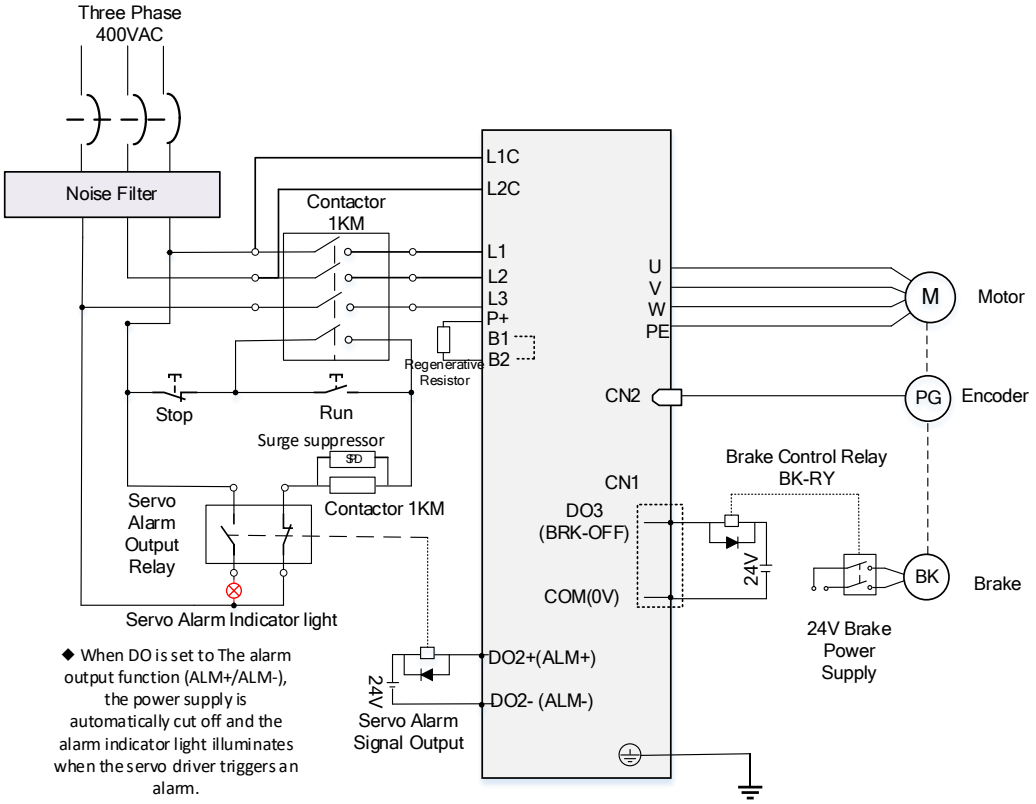
Three-phase 220V supply: 1500S ~ 2000S



Three-phase 400V supply: 3000S ~ 5000S



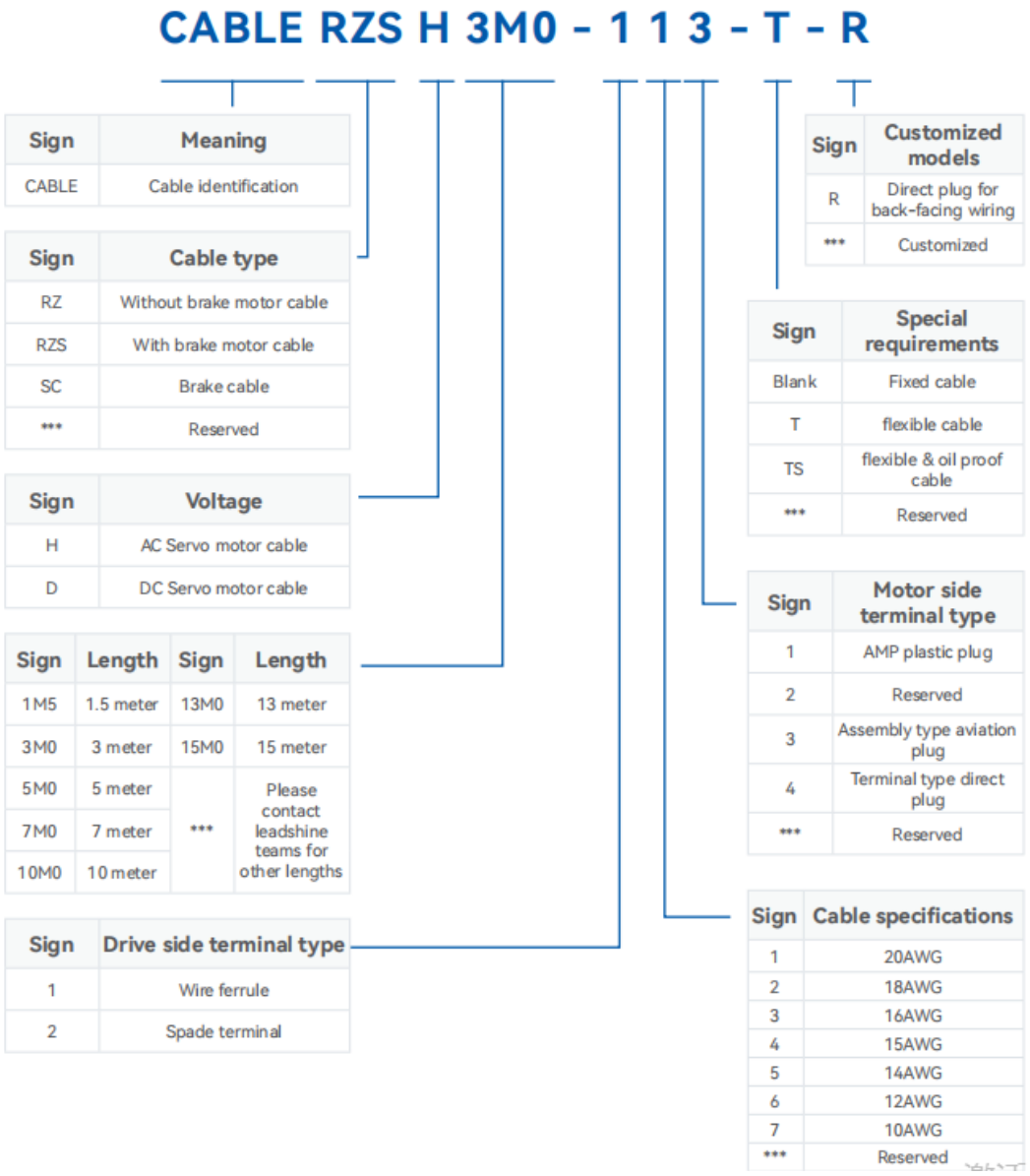
Three-phase 400V supply: 1000ST ~ 7500ST



2.5 Cable Selection

Motor winding power cable

- Wire length available: 1.5m, 3m and 5m….
- Connectors type available: Aviation connectors, direct connectors (recommended)
- Please contact Leadshine sales team or any Leadshine certified local retailers for any customized needs.



Sign	Meaning
CABLE	Cable identification

Sign	Cable type
RZ	Without brake motor cable
RZS	With brake motor cable
SC	Brake cable
***	Reserved

Sign	Voltage
H	AC Servo motor cable
D	DC Servo motor cable

Sign	Length	Sign	Length
1M5	1.5 meter	13M0	13 meter
3M0	3 meter	15M0	15 meter
5M0	5 meter	***	Please contact leadshine teams for other lengths
7M0	7 meter		
10M0	10 meter		

Sign	Drive side terminal type
1	Wire ferrule
2	Spade terminal

Sign	Customized models
R	Direct plug for back-facing wiring
***	Customized

Sign	Special requirements
Blank	Fixed cable
T	flexible cable
TS	flexible & oil proof cable
***	Reserved

Sign	Motor side terminal type
1	AMP plastic plug
2	Reserved
3	Assembly type aviation plug
4	Terminal type direct plug
***	Reserved

Sign	Cable specifications
1	20AWG
2	18AWG
3	16AWG
4	15AWG
5	14AWG
6	12AWG
7	10AWG
***	Reserved

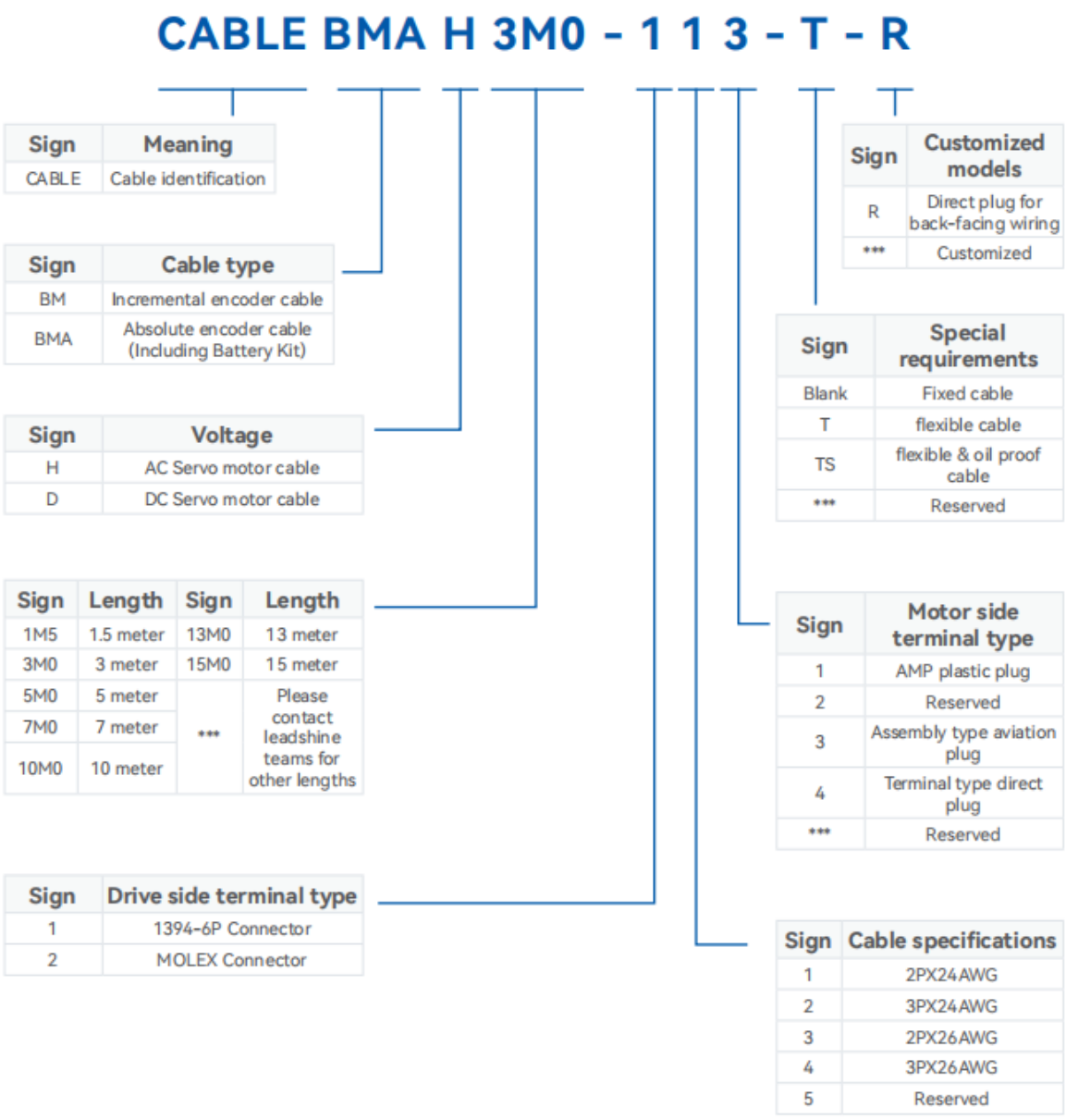
**M*: Length of the cable*

a) Please ground cable shield foil to drive to prevent servo error alarm

b) Please use a double winded shielded cable and make sure to be as short as possible.

c) Please separate CN1 cable from power cables with a minimum gap of 30cm.

Encoder cable:



Sign	Meaning
CABLE	Cable identification

Sign	Cable type
BM	Incremental encoder cable
BMA	Absolute encoder cable (Including Battery Kit)

Sign	Voltage
H	AC Servo motor cable
D	DC Servo motor cable

Sign	Length	Sign	Length
1M5	1.5 meter	13M0	13 meter
3M0	3 meter	15M0	15 meter
5M0	5 meter	***	Please contact leadshine teams for other lengths
7M0	7 meter		
10M0	10 meter		

Sign	Drive side terminal type
1	1394-6P Connector
2	MOLEX Connector

Sign	Customized models
R	Direct plug for back-facing wiring
***	Customized

Sign	Special requirements
Blank	Fixed cable
T	flexible cable
TS	flexible & oil proof cable
***	Reserved

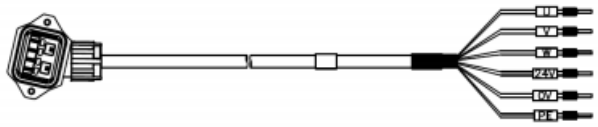
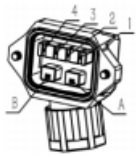
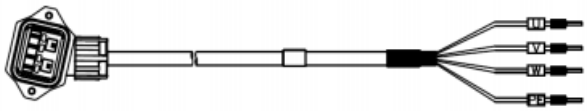
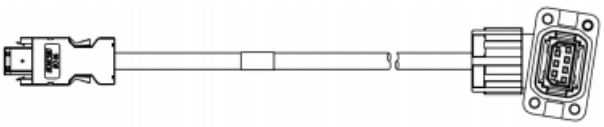
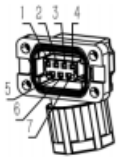
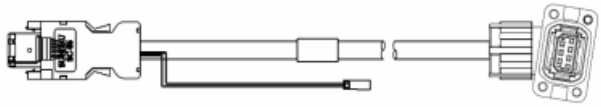
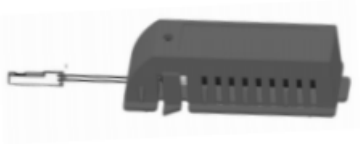
Sign	Motor side terminal type
1	AMP plastic plug
2	Reserved
3	Assembly type aviation plug
4	Terminal type direct plug
***	Reserved

Sign	Cable specifications
1	2PX24AWG
2	3PX24AWG
3	2PX26AWG
4	3PX26AWG
5	Reserved

ELM1/ELM2 Series:

Frame size:40mm/60mm/80mm

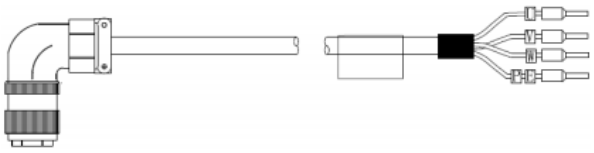
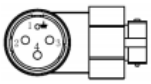
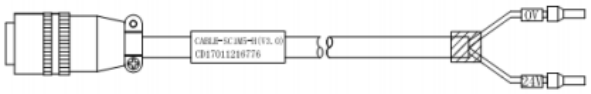
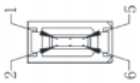
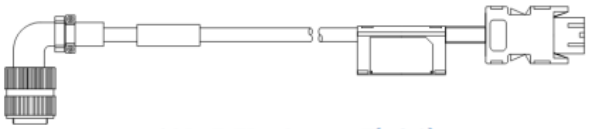
Power rating:50W-1000W

<table>
<tr><th colspan="2">Cable Type</th><th>Diagram</th><th>Pin</th></tr>
<tr><td rowspan="3">Motor power</td><td>With brake</td><td>
CABLE-RZSH*M*-114-TS</td><td></td></tr>
<tr><td>Without brake</td><td>
CABLE-RZH*M*-114-TS</td><td><table><tr><td>1</td><td>Blue</td><td>U</td></tr><tr><td>2</td><td>Black</td><td>V</td></tr><tr><td>3</td><td>Red</td><td>W</td></tr><tr><td>4</td><td>Yellow Green</td><td>PE</td></tr><tr><td>A*</td><td>Black</td><td>0V</td></tr><tr><td>B*</td><td>Red</td><td>24V</td></tr></table>*A&B terminal for motor with brake</td></tr>
<tr><td rowspan="3">Motor encoder</td><td>Incremental</td><td>
CABLE-BMH*M*-114-TS</td><td></td></tr>
<tr><td>Absolute</td><td>
CABLE-BMH*M*-124-TS</td><td></td></tr>
<tr><td>Battery kit</td><td>
ER14505 BOX-G DCH ROHS</td><td><table><tr><td>A</td><td>Terminal</td><td>B</td></tr><tr><td>1</td><td>PE</td><td>-</td></tr><tr><td>2</td><td>5V</td><td>1</td></tr><tr><td>3</td><td>0V</td><td>2</td></tr><tr><td>4</td><td>SD+</td><td>5</td></tr><tr><td>5</td><td>SD-</td><td>6</td></tr><tr><td>6*</td><td>BAT+</td><td>-</td></tr><tr><td>7*</td><td>BAT-</td><td>-</td></tr></table>*Terminal 6 & 7 is to be connected to battery kit for absolute encoder</td></tr>
</table>

ELM2 Series

Frame size:100mm/130mm

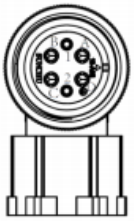
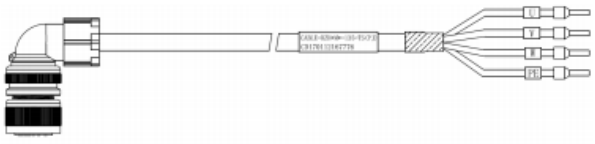
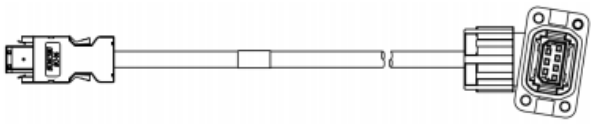
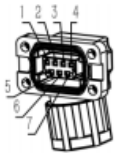
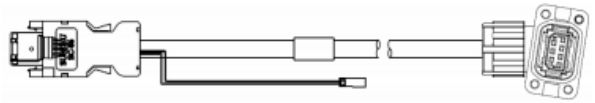
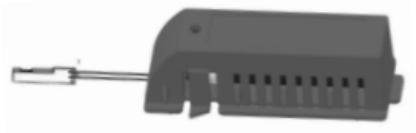
Power rating:1000W/1500W/2000W/2500W/3800W

<table>
<tr><th colspan="2">Cable Type</th><th>Diagram</th><th colspan="3">Pin</th></tr>
<tr><td colspan="2">Motor power</td><td>
CABLE-RZ*M*-H(V2.0)</td><td colspan="3">
1 Yellow PE
2 Red U
3 Green V
4 Black W</td></tr>
<tr><td colspan="2">Motor brake</td><td>
CABLE-SC*M*-H(V3.0)</td><td colspan="3">
1 Black 0V
2 Red 24V</td></tr>
<tr><td rowspan="2">Motor encoder</td><td>Incremental</td><td>
CABLE-7BM*M*-HZ(V3.0)</td><td colspan="3">
</td></tr>
<tr><td>Absolute</td><td>
CABLE-7BMA*M*-HZ(V3.0)</td><td colspan="3">A Terminal B
1 PE -
2 5V 1
3 0V 2
4 SD+ 5
5 SD- 6
6* BAT+ -
7* BAT- -
*Terminal 6 & 7 is to be connected to battery kit for absolute encoder</td></tr>
</table>

ELM1 Series

Frame size: 130mm

Power rating: 850W/1300W/1500W/1800W

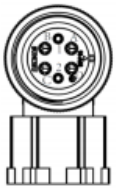
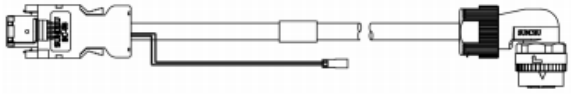
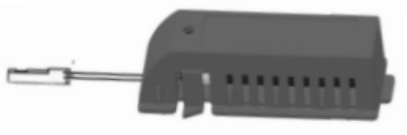
<table>
<tr><th colspan="2">Cable Type</th><th>Diagram</th><th>Pin</th></tr>
<tr><td rowspan="5">Motor power</td><td>With brake</td><td rowspan="2">
CABLE-RZSH*M*-135-TS</td><td rowspan="2">
<table><tr><td>A</td><td>Blue</td><td>U</td></tr><tr><td>B</td><td>Black</td><td>V</td></tr><tr><td>C</td><td>Red</td><td>W</td></tr><tr><td>D</td><td>Yellow Green</td><td>PE</td></tr><tr><td>1*</td><td>Black</td><td>0V</td></tr><tr><td>2*</td><td>Red</td><td>24V</td></tr></table>*1&2 terminal for motor with brake</td></tr>
<tr><td>Without brake</td><td>
CABLE-RZH*M*-135-TS</td></tr>
<tr><td rowspan="3">Motor encoder</td><td>Incremental</td><td>
CABLE-BMH*M*-114-TS</td><td></td></tr>
<tr><td>Absolute</td><td>
CABLE-BMH*M*-124-TS</td><td></td></tr>
<tr><td>Battery kit</td><td>
ER14505 BOX-G DCH ROHS</td><td><table><tr><td>A</td><td>Terminal</td><td>B</td></tr><tr><td>1</td><td>PE</td><td>-</td></tr><tr><td>2</td><td>5V</td><td>1</td></tr><tr><td>3</td><td>0V</td><td>2</td></tr><tr><td>4</td><td>SD+</td><td>5</td></tr><tr><td>5</td><td>SD-</td><td>6</td></tr><tr><td>6*</td><td>BAT+</td><td>-</td></tr><tr><td>7*</td><td>BAT-</td><td>-</td></tr></table>*Terminal 6 & 7 is to be connected to battery kit for absolute encoder</td></tr>
</table>

ELM2 Series

Frame size: 130mm

Power rating:

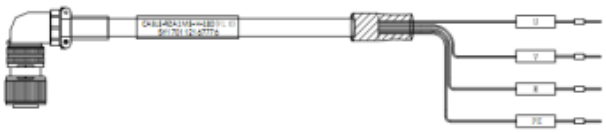
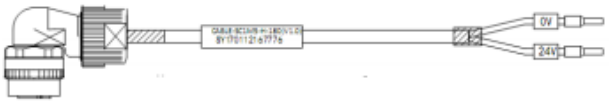
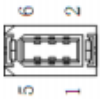
850W/1300W/1800W/3000W/4000W/5000W

<table>
<tr><th colspan="2">Cable Type</th><th>Diagram</th><th>Pin</th></tr>
<tr><td rowspan="2">Motor power</td><td>With brake</td><td>
CABLE-RZSH*M*-135-TS</td><td></td></tr>
<tr><td>Without brake</td><td>
CABLE-RZH*M*-135-TS</td><td>A Blue U
B Black V
C Red W
D Yellow Green PE
1* Black 0V
2* Red 24V
*1&2 terminal for motor with brake</td></tr>
<tr><td rowspan="3">Motor encoder</td><td>Incremental</td><td>
CABLE-BMH*M*-115-TS</td><td></td></tr>
<tr><td>Absolute</td><td>
CABLE-BMH*M*-125-TS</td><td></td></tr>
<tr><td>Battery kit</td><td>
ER14505 BOX-G DCH ROHS</td><td>A Terminal B
10 PE -
2 5V 1
3 0V 2
4 SD+ 5
5 SD- 6
6* BAT+ -
7* BAT- -
*Terminal 6 & 7 is to be connected to battery kit for absolute encoder</td></tr>
</table>

ELM2M Series

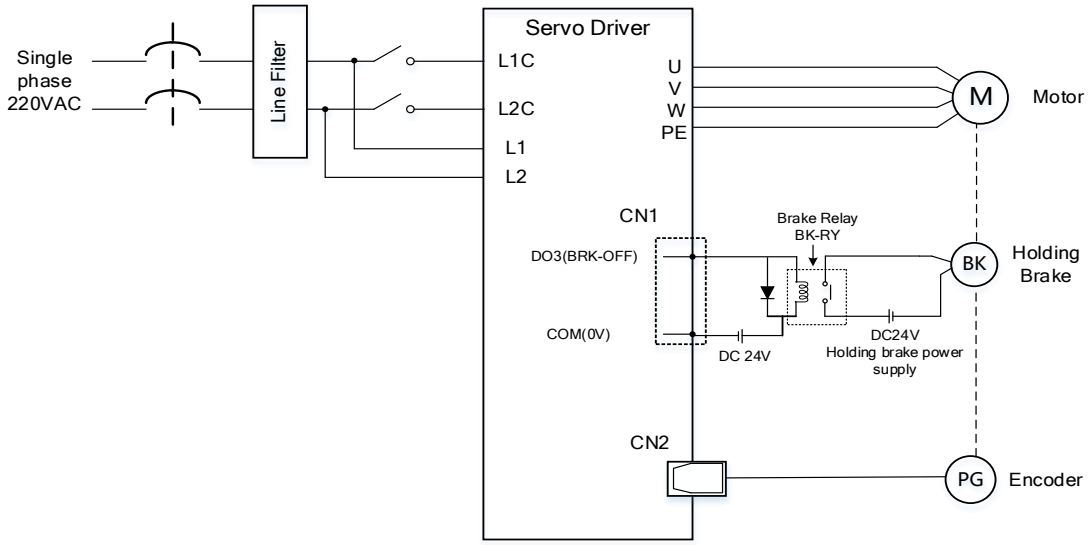
Frame size:180mm

Power rating:2900W-7500W

<table>
<tr><th colspan="2">Cable Type</th><th>Diagram</th><th colspan="3">Pin</th></tr>
<tr><td rowspan="6">Motor power</td><td rowspan="3">2900W</td><td rowspan="3">
CABLE-RZA*M*-H-180(V1.0)</td><td colspan="3"></td></tr>
<tr><td>A</td><td>Blue</td><td>U</td></tr>
<tr><td>B</td><td>Black</td><td>V</td></tr>
<tr><td>C</td><td>Red</td><td>W</td></tr>
<tr><td>D</td><td>Yellow Green</td><td>PE</td></tr>
<tr><td rowspan="3">4400W-7500W</td><td rowspan="3">
CABLE-RZB*M*-H-180(V1.0)</td><td colspan="3"></td></tr>
<tr><td>A</td><td>White</td><td>U</td></tr>
<tr><td>B</td><td>Black</td><td>V</td></tr>
<tr><td>C</td><td>Red</td><td>W</td></tr>
<tr><td>D</td><td>Yellow Green</td><td>PE</td></tr>
<tr><td colspan="2">Motor brake</td><td>
CABLE-SC-H-180(V1.0)</td><td colspan="3"></td></tr>
<tr><td>1</td><td>Black</td><td>0V</td></tr>
<tr><td>2</td><td>Red</td><td>24V</td></tr>
<tr><td rowspan="13">Motor encoder</td><td rowspan="2">Incremental</td><td rowspan="2">
CABLE-7BM-HZ-180(V1.0)</td><td colspan="3">
</td></tr>
<tr><td>A</td><td>Terminal</td><td>B</td></tr>
<tr><td rowspan="11">Absolute</td><td rowspan="11">
CABLE-7BMA-HZ-180(V1.0)</td><td>10</td><td>PE</td><td>-</td></tr>
<tr><td>2</td><td>5V</td><td>1</td></tr>
<tr><td>3</td><td>0V</td><td>2</td></tr>
<tr><td>4</td><td>SD+</td><td>5</td></tr>
<tr><td>5</td><td>SD-</td><td>6</td></tr>
<tr><td>6*</td><td>BAT+</td><td>-</td></tr>
<tr><td>7*</td><td>BAT-</td><td>-</td></tr>
<tr><td colspan="3">*Terminal 6 & 7 is to be connected to battery kit for absolute encoder</td></tr>
</table>

2.6Holding brake connection

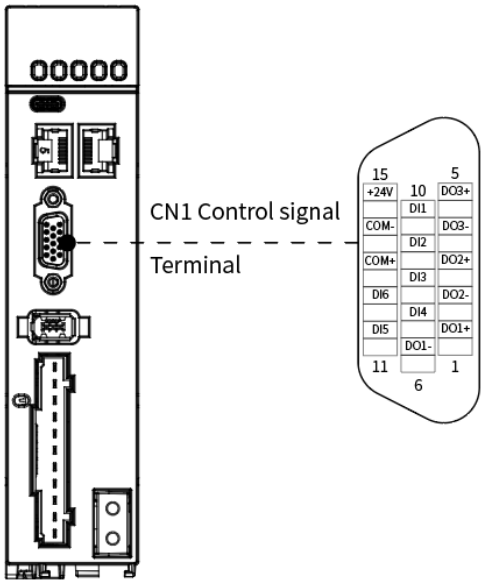
Holding brake is activated when servo drive is not powered on to prevent axis from moving due to gravitational pull or other external forces by locking the motor in place. Usually used on axis mounted vertically to the ground so that the load would not drop under gravitational force when the driver is powered off or when alarm occurs.



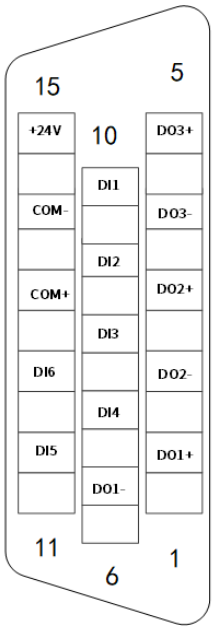
Holding brake wiring diagram

- When a motor with a built-in brake runs, the brake may produce a clicking sound, which does not affect functionality.
- When the brake coil is energized (brake released), magnetic flux leakage may occur at the shaft end. Use caution with magnetic sensors near the motor.
- Account for voltage drop from brake cable resistance; maintain ~24V input to ensure proper brake operation.
- Do not share the brake power supply with other loads, as this may cause voltage/current drops and unintended brake operation.

2.7CN1 I/O Signal Port



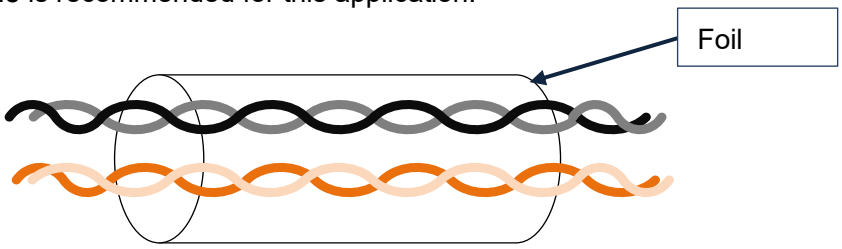
Recommend using cable with a gauge of 24–26 AWG for the connection to CN1; the CN1 connector is a 15-pin DB connector.

Port	Pin	Signal	Description	Remarks
	1	DO1+	SRDY+	Servo Ready Output Signal
	6	DO1-	SRDY-	
	3	DO2+	ALM+	Alarm Output Signal
	2	DO2-	ALM-	
	5	DO3	BRK-OFF	Break Off Output Signal
	4	COM(0V)	-	
	10	DI1	POT	Positive limit switch
	9	DI2	NOT	Negative limit switch
	8	DI3	HOME	Homing switch
	7	DI4	-	Up to user configuration
	11	DI5	-	Up to user configuration
	12	DI6	-	Up to user configuration
	13	DI_COM	Common DI	Common digital input terminal
	14	COM(0V)	Internal 24V Power Supply	Output voltage: 20~28VDC, max current output: 100mA（Don't used it on motor brake power supply）
	15	24V		

2.7.1 Selection of I/O signal cable

I/O signal cable

To ensure I/O signal to not be affected by electromagnetic interference, a **shielded twisted pair cable** is recommended for this application.

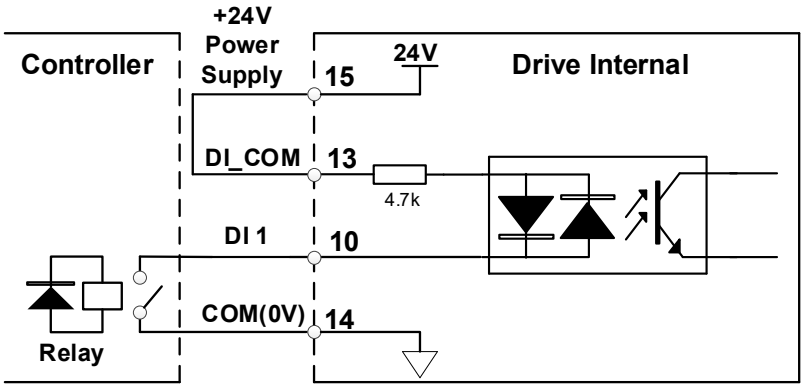


2.7.2 Common input circuit

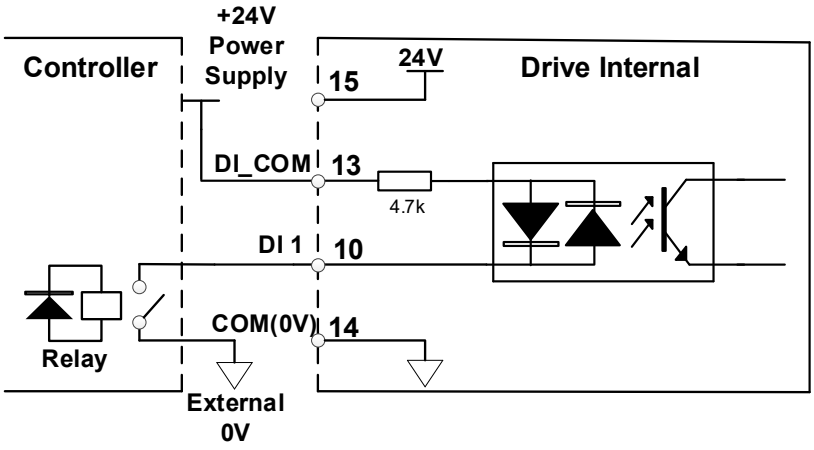
The internal circuit of common input is a bidirectional optocoupler which supports common anode and common cathode configurations. There are 2 types of outputs from master device: Relay output and Open Collector output as shown below.

Output from master device: Relay

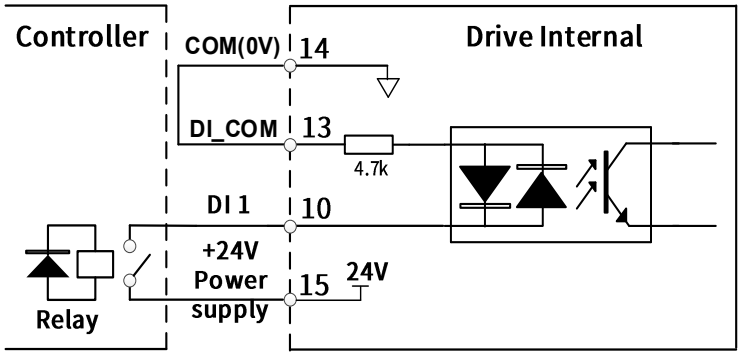
Common Anode(Internal 24V):



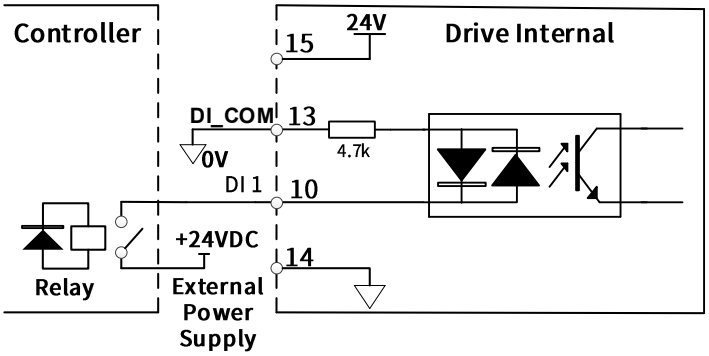
Common Anode(External 24V):



Common Cathode(Internal 24V):

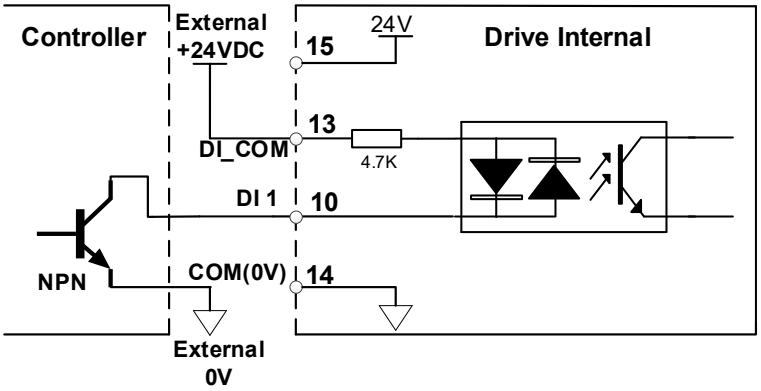


Common Cathode(External 24V):

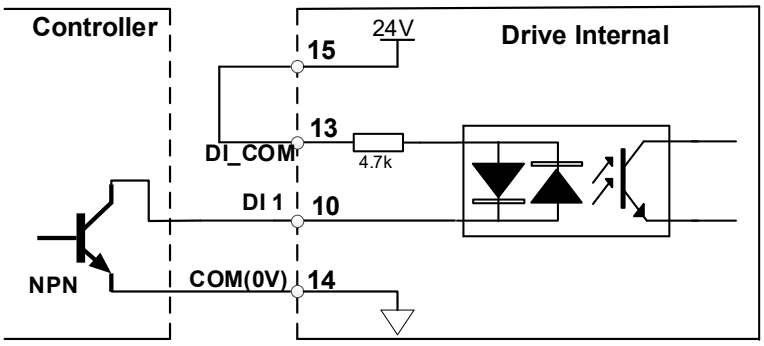


Output from master device: Open Collector

Common Anode(Internal 24V):

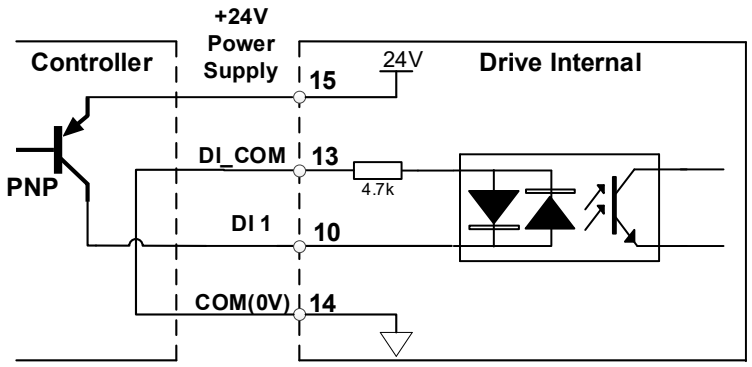


Common Anode(External 24V):

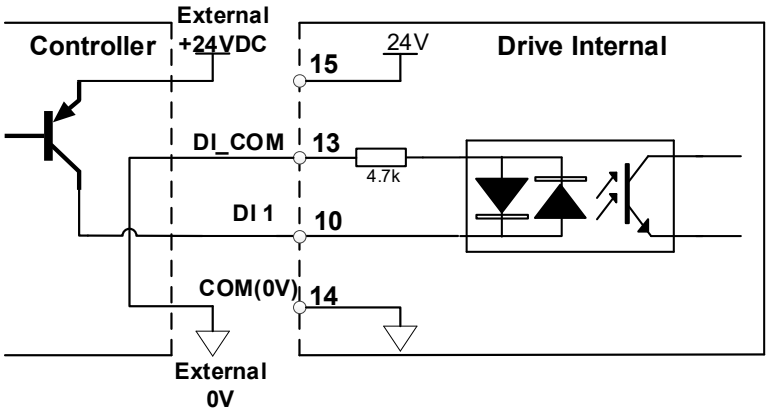


Please prepare switching power supply with output of 12-24VDC, current≥ 100mA;

Common Cathode(Internal 24V):



Common Cathode(External 24V):



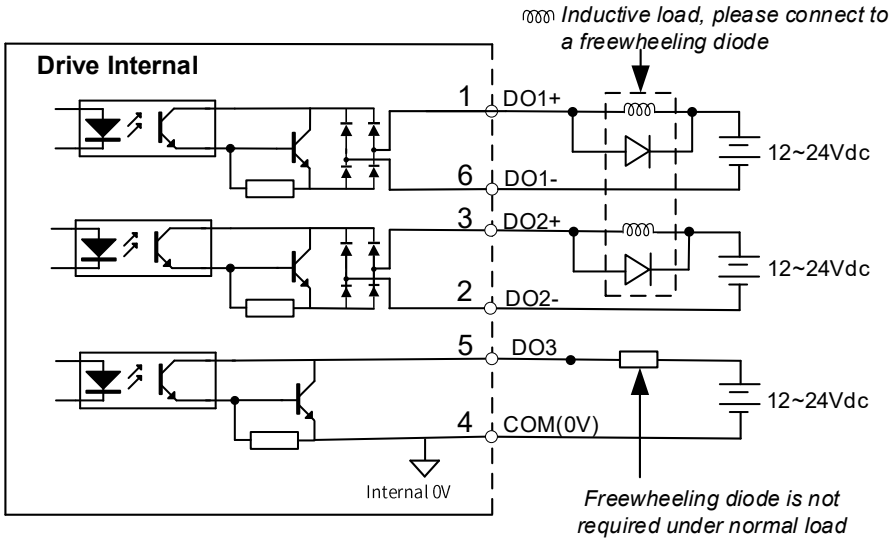
Digital input DI (1~6) default functions

Signal		Default function	PIN No.	Description
Command Digital output	DI 1	POT	10	Positive drive inhibit input
	DI 2	NOT	9	Negative drive inhibit input
	DI 3	HomeSwitch	8	Home switch input
	DI 4	-	7	Unassigned function (configurable by user)
	DI 5	-	11	Unassigned function (configurable by user)
	DI 6	-	12	Unassigned function (configurable by user)
24V			15	Internal 24V power supply, voltage range +20~28V, maximum output current 100mA.
COM(0V)			14	
DI_COM			13	Common terminal for DI input pins.

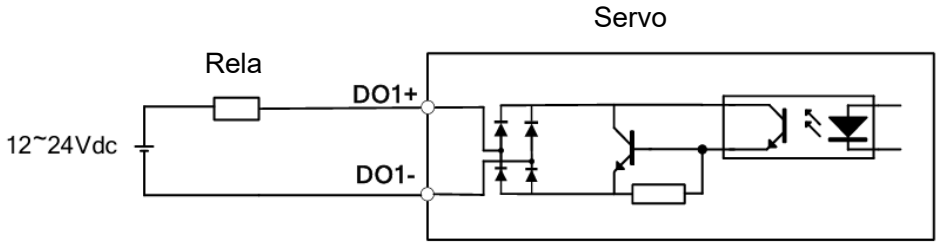
2.7.3 Common output circuit

There are 3 common outputs: DO1/DO2 are double-ended, DO3 is single-ended,having an isolated 24v power supply.

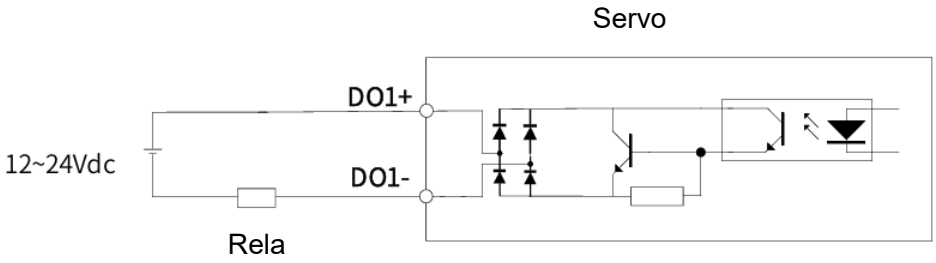
Double-ended Digital Outputs



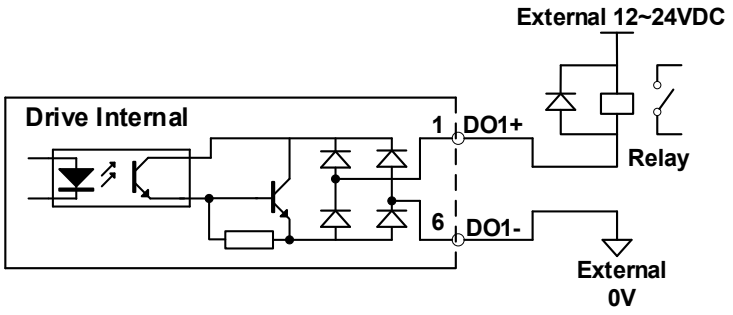
NPN wiring：



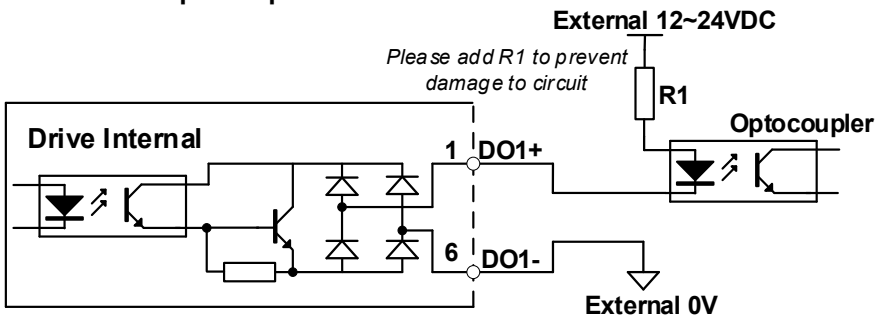
PNP wiring：



When connected to a relay:



When connected to optocoupler:



- Power supply is provided by user. Please be aware that reversed power supply polarity might cause damage to the driver.
- When it is an open collector output, max current: 50mA, max supplying voltage: 25V. Please ensure the switching power supply fulfills the conditions.
- If the load is an inductive load such as a relay, please connect a flyback diode in parallel in reverse. A wrong installation of the flyback diode might cause damage to the driver.

Digital input D0 (1~3) default functions

Signal		Default function	PIN No.	Description
Command Digital output	DO1+	SRDY+	1	Servo ready
	DO1-	SRDY-	6	
	DO2+	ALM+	3	ALARM
	DO2-	ALM-	2	
	DO3	BRK-OFF+	5	Brake output
	COM(0V)	COM(0V)	4	
	24V	-	15	Internal 24V power supply, voltage range +20~28V, maximum output current 100mA.
	DI_COM	-	14	
	COM(0V)	-	13	Common terminal for DI input pins.

2.7.5 DI signal function configuration

Default DI signal functions

CN1 Pin	Signal	Parameter	Default function	Factory default Status
13	DI COM	-	Common Digital Input	-
10	DI1	P01.00	Positive limit switch (POT)	Normally open 0FF
9	DI2	P01.01	Negative limit switch (NOT)	Normally open 0FF
8	DI3	P01.02	Home switch (HOME)	Normally open 0FF
7	DI4	P01.03	User configurable	Normally open 0FF
11	DI5	P01.04	User configurable	Normally open 0FF
12	DI6	P01.05	User configurable	Normally open 0FF

***NO: Normally Open*

- When limit switch or emergency stop is used, POT, NOT and E-STOP signal will be normally close (NC) by default. Please make sure there is no safety concern if these signals need to be set to normally open (NO).

Relevant parameters

P01.00	**Label**	Input selection DI1					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10100
P01.01	**Label**	Input selection DI2					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10101
P01.02	**Label**	Input selection DI3					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10102
P01.03	**Label**	Input selection DI4					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10103
P01.04	**Label**	Input selection DI5					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10104
P01.05	**Label**	Input selection DI6					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10105

Digital input DI allocation using hexadecimal system

Input	Symbol	Set value	
		Normally open	Normally close
Invalid Input	—	00h	--
Positive limit switch	POT	01h	81h
Negative limit switch	NOT	02h	82h
Clear alarm	A-CLR	04h	-
Forced alarm	E-STOP	14h	94h
Home switch	HOME-SWITCH	16h	96h

- Please don't set anything other than listed in table above.
- Normally open: Valid when input = ON Normally close: Valid when input = OFF
- Er210 might occur if same function is allocated to different channels at the same time
- Channel that has no value doesn't affect driver motion.
- Front panel is of hexadecimal system.

P01.00~P01.05 corresponds to DI1~DI6, which can be connected to external sensor signals,

2.7.6 DO signal function configuration

DO signal functions by default

CN1 Pin	Signal	Parameter	Default function
1	DO1+	P01.16	Servo Ready (S-RDY)
6	DO1+		
3	DO2+	P01.17	Alarm (ALM)
2	DO2+		
5	DO3	P01.18	DO3 is a low-voltage-drop DO output circuit, with a conduction voltage drop of approximately 0.5 V (when the DO output current is 20 mA); the default function is brake-holding output.
4	COM(0V)		Connected to pin14 internally

*** NO: Normally Open*

Relevant parameters

P01.16	**Label**	Output selection DO1					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10116
P01.17	**Label**	Output selection DO2					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10117
P01.18	**Label**	Output selection DO3					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10118

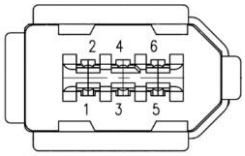
Digital output DO allocation using hexadecimal system.

Output	Symbol	Set value	
		Normally open	Normally close
Master device control	—	00h	-
Alarm	ALM	01h	81h
Servo-Ready	S-RDY	02h	82h
External brake released	BRK-OFF	03h	83h
Positioning completed	INP	04h	84h
At-speed	AT-SPEED	05h	85h
Torque limit signal	TLC	06h	86h
Zero speed clamp detection	ZSP	07h	87h
Velocity coincidence	V-COIN	08h	88h
Position command ON/OFF	P-CMD	0Bh	8Bh
Velocity limit signal	V-LIMIT	0Dh	8Dh
Velocity command ON/OFF	V-CMD	0Fh	8Fh
Servo status	SRV-ST	12h	92h
Homing done	HOME-OK	22h	A2h
DB brake output	-	2Dh	AD
Z phase output	-	2Eh	AEh

Please don't set any other than the outputs listed in the table above.

- Normally open：Active low
- Normally close：Active high
- Front panel is of hexadecimal system.

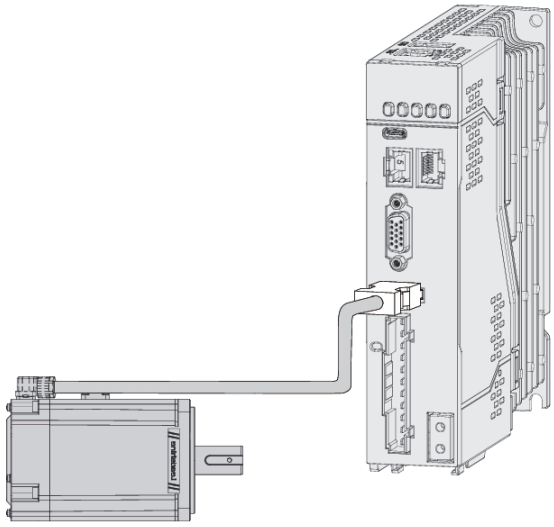
2.8 CN2 Encoder



Connector	Pin	Signal	Description
CN2	1	VCC5V	Power supply 5V
	2	GND	Power supply ground
	3	BAT+	Battery positive terminal
	4	BAT-	Battery negative terminal
	5	SD+	SSI Data+
	6	SD-	SSI Data-
	Frame	PE	Shield grounding

- Please ground both driver and motor PE terminals to avoid any servo alarms.
- It is recommended to use a shielded twisted pair cable not longer than 20m.
- Please leave a space of min. 30cm between motor power cable and encoder to avoid interference.

Connecting motor encoder cable to servo drive



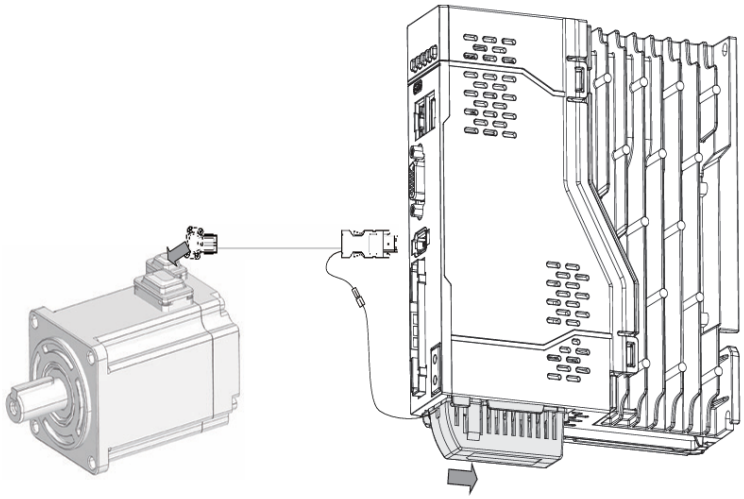
- Please ensure the shield of both the drive side and motor side is properly grounded. Otherwise, the drive may trigger false alarms!
- It is recommended to use twisted-pair shielded cables for encoder wiring, and keep the wiring length as short as possible!
- Encoder cables and power cables must be routed separately to avoid interference! Maintain a minimum separation of at least 30cm!

Absolute Battery kit installation

Absolute battery kit installation is shown in the figure below:

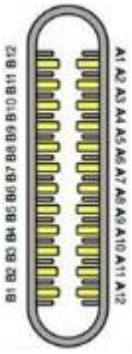
Only when purchasing our direct-plug motor with a cable that has no built-in battery kit but

leads out battery wires, you may connect by clipping the battery kit onto the driver.



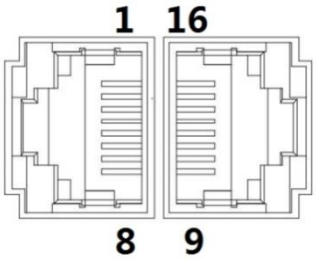
2.9 USB Type-C Tuning Port

EL7-PNS series servo drive can be connected to PC for performance tuning, data monitoring and parameters modifying using a **USB Type-C data cable**. Can be done without the servo drive connecting to main power supply.

Port	Figure	Pin	Signal	Description
USB Type-C		A4, B4,A9, B9	VCC 5V	Power supply positive terminal 5V
		A12,B12,A1,B1	GND	Power supply negative terminal
		A6,B6	D+	USB data positive terminal
		A7,B7	D-	USB data negative terminal
		Frame	USB_GND	Ground through capacitor

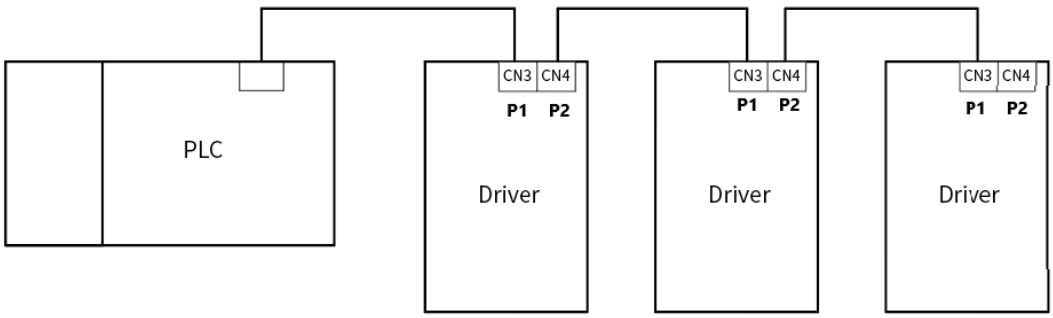
2.10 CN3/CN4 PROFINET Communication Port

CN3 and CN4 aed to re communication ports for PROFINET protocol. LAN cable from master device will be connectCN3 (P1) and CN4 (P2) will be connected to the next slave device.

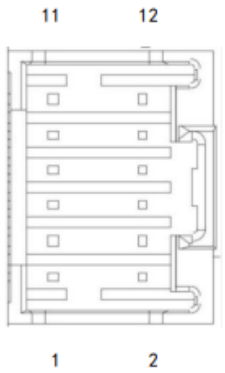
Port	Pin	Signal	Description
	1, 9	TX+	PROFINET Data sending positive terminal
	2, 10	TX-	PROFINET Data sending negative terminal
	3, 11	RX+	PROFINET Data receiving positive terminal
	4, 12	--	--
	5, 13	--	--
	6, 14	RX-	PROFINET Data receiving negative terminal
	7, 15	--	--
	8, 16	--	--
	Frame	PE	Shielded ground

- The EL7-PNS model supports PROFINET communication with the following connection methods:

1) Communication between multiple drives and the host is available.
2) Communication between a single drive and the host is also available.



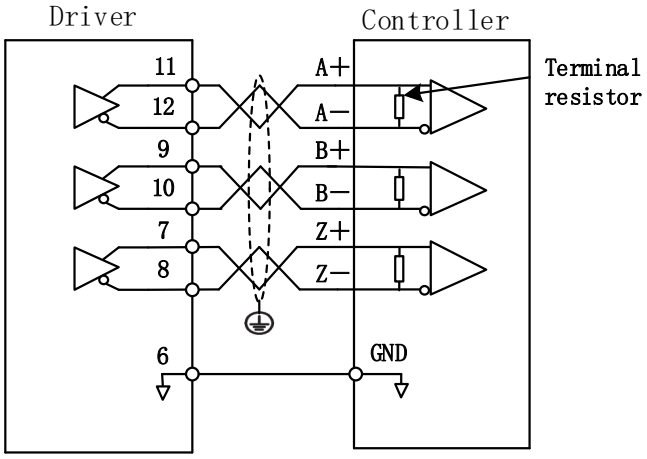
2.11 CN5 Frequency divider pulse output port

Port	Diagram	Pin	Signal	Label
CN5		11	A+	Motor encoder phase A frequency divider output
		12	A-	
		9	B+	Motor encoder phase B frequency divider output
		10	B-	
		7	Z+	Motor encoder phase Z frequency divider output
		8	Z-	
		5	OCZ	Motor encoder Z-signal OC output
		6	GND	Motor encoder Z-signal OF output reference ground
		3	/	/
		4	/	/
		1	PE	Shield grounding
		2	/	/

**Please use stranded shielded cable ≥ 0.14mm^2 with shield foil grounded to PE terminal.*
***Keep it shorter than 3 meters and away from any power cables.*

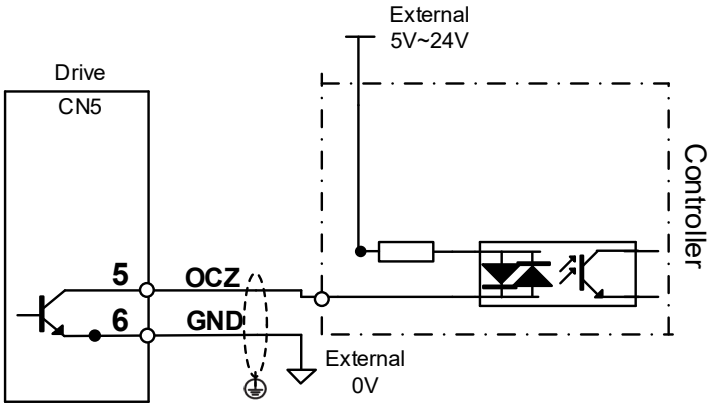
The encoder signal, following frequency division processing, is output as a differential signal via a differential driver. This typically provides a feedback signal when a position control system is configured with a host device.

Differential Connection:

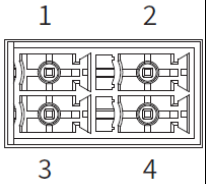


If controller input circuit is not an optocoupler input circuit but a differential receiving circuit, please connect CN5 pin 6 (OC reference ground) to GND of controller differential receiving circuit.

Encoder Z-phase frequency divider output:



2.12 CN6 Safe Torque Off (STO) Port

Terminal No.	Diagram (Driver Side)	Pin No.	Signal	Name	Description
CN6		1	COM(0V)	STO Reference Ground (0V)	The power supply is output port, and only used to bypass the STO1/STO2 inputs to prevent alarms when the STO safety function is not in use; it cannot be used to trigger the normal STO safety function; it cannot be used to power other devices.
		2	24V	24V Power Supply	
		3	STO1	STO Control Signal Input 1	STO activates if STO1=OFF, STO2=OFF, or both OFF.
		4	STO2	STO Control Signal Input 2	

Note:

1. To avoid cable faults, the two channels must use two separate lines; otherwise, the cable must be protected with a double shielding method.
2. The total length of the input signal cable should be less than 30 meters.

2.13 Measures against electromagnetic interference

To reduce interference, please take the following measures:

- I/O signal cable > 3m; Encoder cable > 20m
- Use cable with larger diameter for grounding
  ①Grounding resistance > 100Ω
  ②When there are multiple drivers connected in parallel, PE terminal of the main power supply and ground terminal of servo drives must be connected to copper ground bar in the electrical cabinet and the copper ground bar needs to be connected to the metal frame of the cabinet.
- Please install a line filter on main power supply cable to prevent interference from radio frequency.
- In order to prevent malfunctions caused by electromagnetic interference, please take following measures:

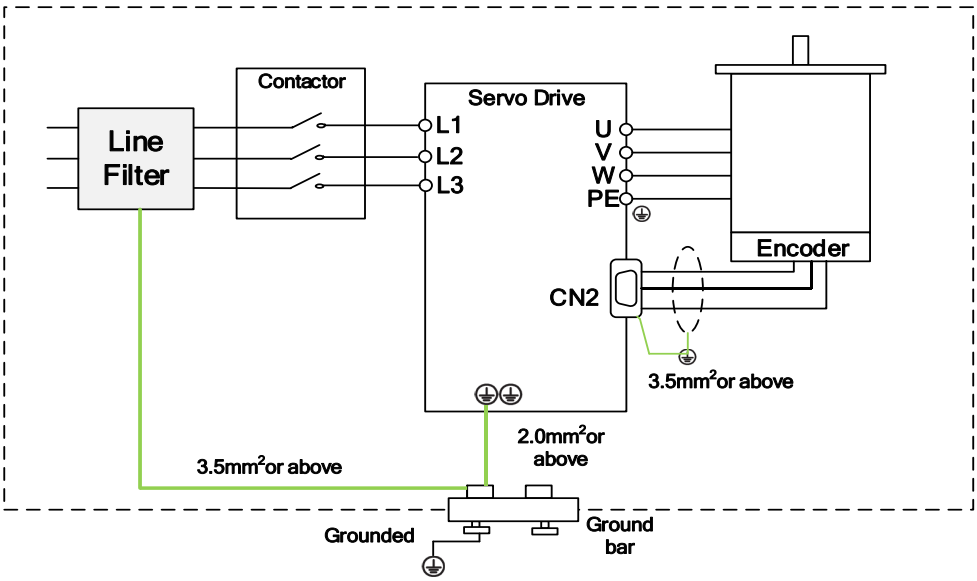
  ① Install master device and line filter close to the servo drive

  ② Install surge suppressor for relay and contactor

  ③ Please separate signal/encoder cable from power cable with a space of at least 30cm

  ④ Install a line filter for the main power supply if a device with high frequency generation such as a welding machine exists nearby

2.13.1 Grounding connection and other anti-interference wiring connections

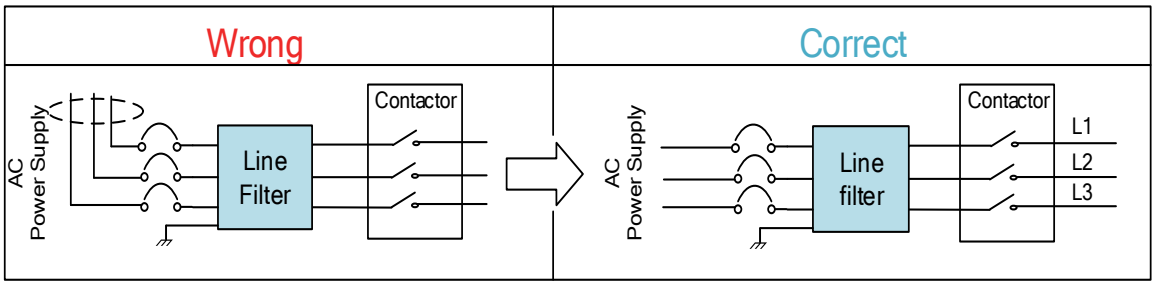


- Servo motor frame should be grounded. Please connect the PE terminal of servo motor and servo drive and ground them together to reduce interference.
- Ground both ends of the foil shield of encoder cable.

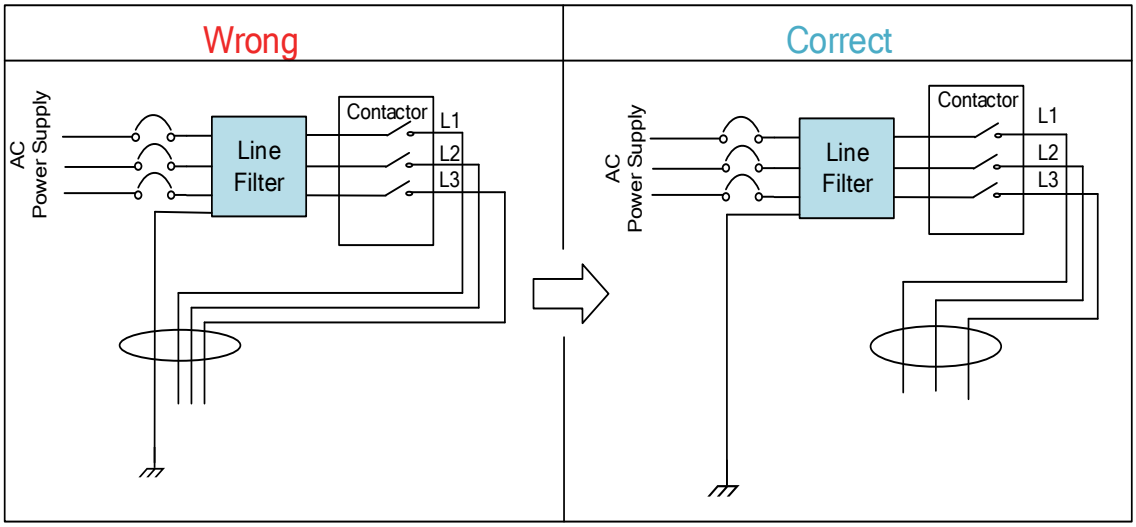
2.13.2 Using line filter

To reduce interference from main power supply cable and to prevent from affecting other sensitive components around the servo drive, please choose a line filter based on actual supply current. Please do be aware of the following mistake when installing a line filter.

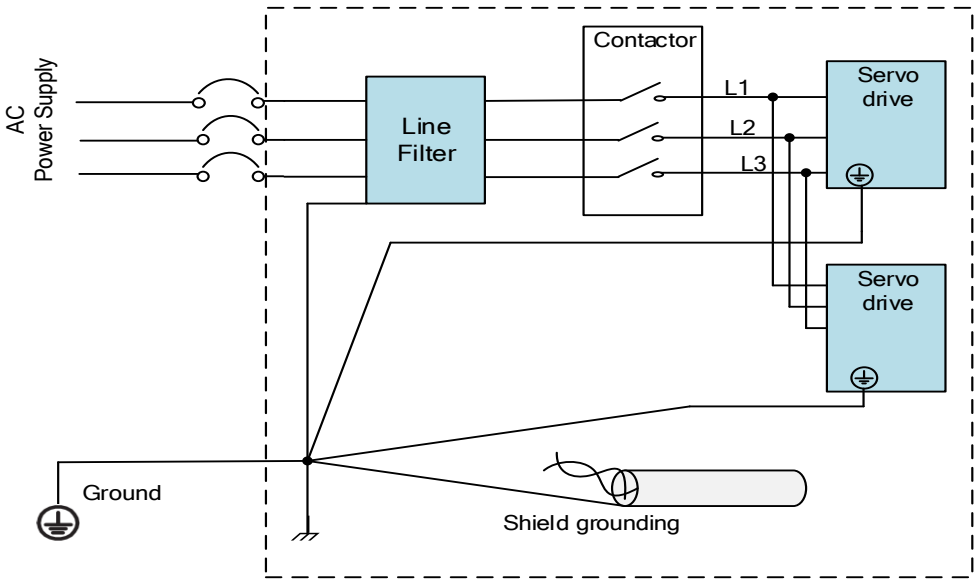
Do not band the main power supply cable together.



Separate the ground wire from the line filter and the main power supply cable.



Ground wires inside an electrical cabinet



Chapter 3 Parameter

3.1 Parameter List

- Panel Display as follows:



3.1.1 Servo Driver Parameter

Category	No.	Name	PNU	Unit	Activation
P00	01	Control Mode	10001	-	Take effect after re-enable
	06	Command Polarity Setting	10006	-	Take effect after power off
	11	Pulse Count Per Revolution for Frequency Division Output	10011	P/rev	Take effect after power off
	12	Logic Inversion of Frequency Division Output	10012	-	Take effect after power off
	13	Z Signal Polarity of Frequency Division Output	10013	-	Take effect after power off
	14	Z Signal Width of Frequency Division Output	10014	us	Take effect after power off
	15	Source Selection of Frequency Division Output	10015	-	Take effect after power off
	16	Delay Compensation of Frequency Division Output	10016	us	Take effect immediately
	21	Regenerative Discharge Resistance Value	10021	Ω	Take effect immediately
	22	Regenerative Discharge Resistance Power	10022	W	Take effect immediately
	25	Motor Power-off Delay	10025	ms	Take effect

		Time			immediately
	26	Brake Release Waiting Time	10026	ms	Take effect immediately
	27	Brake Release Speed Setting	10027	r/min	Take effect immediately
	28	Maximum Stop Time When Servo Disabled	10028	ms	Take effect immediately
	30	Stop Mode When Servo Enable is Off	10030	-	Take effect immediately
	31	Class 1 Fault Stop Mode	10031	-	Take effect immediately
	32	Class 2 Fault Stop Mode	10032	-	Take effect immediately
	33	Forced Stop Mode	10033	-	Take effect immediately
	34	Positive & Negative Limit Stop Mode	10034	-	Take effect immediately
	35	Deceleration Time for Positive & Negative Limit	10035	ms/(1000r/min)	Take effect immediately
	36	Emergency Stop Deceleration Time	10036	ms/(1000r/min)	Take effect immediately
	37	Fault Deceleration Time	10037	ms/(1000r/min)	Take effect immediately
	38	Maximum Deceleration Time	10038	ms/(1000r/min)	Take effect immediately
	39	Torque Limit During Immediate Stop	10039	-	Take effect immediately
	40	E-STOP Function Selection	10040	-	Take effect immediately
	41	Position Feedback Polarity Setting	10041	-	Take effect immediately
	43	LED Initial State	10043	-	Take effect after power off
	48	Z Signal Holding Time	10048	ms	Take effect immediately
	51	Position Setting Unit Selection	10051	-	Take effect after re-enable
	55	Soft Limit Function Setting	10055	-	Take effect immediately
	56	Positive Software Limit	10056	unit	Take effect immediately
	57	Negative Software Limit	10057	unit	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
P01	00	DI-1 Input Selection	10100	-	Take effect immediately
	01	DI-2 Input Selection	10101	-	Take effect immediately
	02	DI-3 Input Selection	10102	-	Take effect immediately
	03	DI-4 Input Selection	10103	-	Take effect immediately
	04	DI-5 Input Selection	10104	-	Take effect immediately
	05	DI-6 Input Selection	10105	-	Take effect immediately
	16	DO-1 Output Selection	10116	-	Take effect immediately
	17	DO-2 Output Selection	10117	-	Take effect immediately
	18	DO-3 Output Selection	10118	-	Take effect immediately
	25	Forced DIDO Enable Switch	10125	-	Take effect immediately
	26	Forced DI Set Value	10126	-	Take effect immediately
	27	Forced DO Set Value	10127	-	Take effect immediately
	28	DI Status	10128	-	Take effect immediately
	29	DO Status	10129	-	Take effect immediately
	30	DI Filter Setting	10130	ms	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
P02	00	Virtual DIDO Enable	10200	-	Take effect immediately
	01	VDI-01 Input Selection	10201	-	Take effect immediately
	02	VDI-02 Input Selection	10202	-	Take effect immediately
	03	VDI-03 Input Selection	10203	-	Take effect immediately
	04	VDI-04 Input Selection	10204	-	Take effect immediately
	05	VDI-05 Input Selection	10205	-	Take effect immediately
	06	VDI-06 Input Selection	10206	-	Take effect immediately
	07	VDI-07 Input Selection	10207	-	Take effect immediately
	08	VDI-08 Input Selection	10208	-	Take effect immediately
	09	VDI-09 Input Selection	10209	-	Take effect immediately
	10	VDI-10 Input Selection	10210	-	Take effect immediately
	11	VDI-11 Input Selection	10211	-	Take effect immediately
	12	VDI-12 Input Selection	10212	-	Take effect immediately
	13	VDI-13 Input Selection	10213	-	Take effect immediately
	14	VDI-14 Input Selection	10214	-	Take effect immediately
	15	VDI-15 Input Selection	10215	-	Take effect immediately
	16	VDI-16 Input Selection	10216	-	Take effect immediately
	17	VDO-01 Output Selection	10217	-	Take effect immediately
	18	VDO-02 Output Selection	10218	-	Take effect immediately
	19	VDO-04 Output Selection	10219	-	Take effect immediately
	20	VDO-03 Output Selection	10220	-	Take effect immediately

	21	VDO-05 Output Selection	10221	-	Take effect immediately
	22	VDO-06 Output Selection	10222	-	Take effect immediately
	23	VDO-07 Output Selection	10223	-	Take effect immediately
	24	VDO-08 Output Selection	10224	-	Take effect immediately
	25	VDO-09 Output Selection	10225	-	Take effect immediately
	26	VDO-10 Output Selection	10226	-	Take effect immediately
	27	VDO-11 Output Selection	10227	-	Take effect immediately
	28	VDO-12 Output Selection	10228	-	Take effect immediately
	29	VDO-13 Output Selection	10229	-	Take effect immediately
	30	VDO-14 Output Selection	10230	-	Take effect immediately
	31	VDO-15 Output Selection	10231	-	Take effect immediately
	32	VDO-16 Output Selection	10232	-	Take effect immediately
	45	VDI Status	10245	-	Take effect immediately
	46	VDO Status	10246	-	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
P04	02	Position Deviation Excessive Setting	10402	unit	Take effect immediately
	03	Fault Clear Mode	10403	-	Take effect immediately
	05	Current Fault Code	10405	-	Take effect immediately
	06	Current Warning Code	10406	-	Take effect immediately
	07	Overspeed Level Setting	10407	-	Take effect immediately
	17	E2 Storage Overfast Threshold	10417	min	Take effect immediately

	19	Discharge Overload Level	10419	-	Take effect immediately
	20	Overload Level Setting	10420	-	Take effect immediately
	23	Motor Stall Alarm Torque Threshold	10423	%	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P05	00	Position Command (User Unit)	10500	unit	Take effect immediately
	01	Position Feedback (User Unit)	10501	unit	Take effect immediately
	02	Position Command (Encoder Unit)	10502	pulse	Take effect immediately
	03	Position Feedback (Encoder Unit)	10503	pulse	Take effect immediately
	04	Relative Position Error (Encoder Unit)	10504	pulse	Take effect immediately
	05	Absolute Position Error	10505	pulse	Take effect immediately
	06	Relative Position Error (User Unit)	10506	unit	Take effect immediately
	07	Encoder Single-turn Position	10507	pulse	Take effect immediately
	08	Encoder Multi-turn Position	10508	r	Take effect immediately
	09	Position Command Speed	10509	r/min	Take effect immediately
	10	Speed Command	10510	r/min	Take effect immediately
	11	Motor Speed	10511	r/min	Take effect immediately
	12	Speed Error	10512	r/min	Take effect immediately
	13	Torque Current Command	10513	%	Take effect immediately
	14	Torque Current Feedback	10514	%	Take effect immediately
	15	Field-weakening Current Command	10515	%	Take effect immediately
	16	Field-weakening Current Feedback	10516	%	Take effect immediately
	17	Vector Current	10517	%	Take effect immediately

	18	U-phase Current	10518	A	Take effect immediately
	19	V-phase Current	10519	A	Take effect immediately
	20	W-phase Current	10520	A	Take effect immediately
	21	Bus Voltage	10521	V	Take effect immediately
	22	Drive Temperature	10522	°C	Take effect immediately
	23	Monitor Channel 1 Selection	10523	-	Take effect immediately
	24	Monitor Channel 2 Selection	10524	-	Take effect immediately
	25	Monitor Channel 3 Selection	10525	-	Take effect immediately
	26	Monitor Channel 4 Selection	10526	-	Take effect immediately
	27	Monitor Channel 1	10527	-	Take effect immediately
	28	Monitor Channel 2	10528	-	Take effect immediately
	29	Monitor Channel 3	10529	-	Take effect immediately
	30	Monitor Channel 4	10530	-	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P10	03	Command Pulse Per Revolution	11603	pulse	Take effect after re-enable
	04	1st Command Scaling Numerator	11604	-	Take effect after re-enable
	05	1st Command Scaling Denominator	11605	-	Take effect after re-enable
	09	Absolute Encoder Reset Enable	11609	-	Take effect after re-enable
	10	Absolute Encoder Setting	11610	-	Take effect after power off
	11	Absolute Value Rotation Mode Minimum Value	11611	pulse	Take effect after power off
	12	Absolute Value Rotation Mode Range Value	11612	pulse	Take effect after power off
	14	Position Command Low-pass Filter	11614	ms	Take effect after stop

	15	Position Command FIR Filter	11615	ms	Take effect after stop
	19	Positioning Completion Range	11619	Pulse	Take effect immediately
	20	Positioning Output Setting	11620	-	Take effect immediately
	21	INP Delay In-position Output Time	11621	ms	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P11	07	S-type Acceleration/Deceleration Setting	11707	ms	Take effect after re-enable
	08	Zero Speed Clamp Function Selection	11708	-	Take effect immediately
	09	Zero Speed Clamp Level	11709	r/min	Take effect immediately
	10	Zero Speed Clamp Standstill Delay Time	11710	ms	Take effect immediately
	11	Motor Maximum Speed Limit	11711	r/min	Take effect immediately
	13	Zero Speed Setting	11713	r/min	Take effect immediately
	14	Speed Consistency Band Setting	11714	r/min	Take effect immediately
	15	Speed Attainment Setting	11715	r/min	Take effect immediately
	16	Speed Attainment Hysteresis Band Width	11716	r/min	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P12	00	Torque Mode Selection	11800	-	Take effect immediately
	01	1st Torque Limit	11801	%	Take effect immediately
	02	2nd Torque Limit	11802	%	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P20	00	1st Position Loop Gain	13200	Hz	Take effect immediately
	01	1st Speed Loop Gain	13201	Hz	Take effect immediately
	02	1st Speed Loop Integral Time Constant	13202	ms	Take effect immediately
	04	1st torque filter time	13204	ms	Take effect

		constant Time Constant			immediately
	05	2nd Position Loop Gain	13205	Hz	Take effect immediately
	06	2nd Speed Loop Gain	13206	Hz	Take effect immediately
	07	2nd Speed Loop Integral Time Constant	13207	ms	Take effect immediately
	09	2nd Torque Filter Time Constant	13209	ms	Take effect immediately
	10	Speed Feedforward Gain	13210	1	Take effect immediately
	11	Speed Feedforward Filter Time Constant	13211	ms	Take effect immediately
	12	Torque Feedforward Gain	13212	1	Take effect immediately
	13	Torque Feedforward Filter Time Constant	13213	ms	Take effect immediately
	15	Position Control Parameter Switching Mode	13215	-	Take effect immediately
	16	Position Control Parameter Switching Delay	13216	ms	Take effect immediately
	17	Position Control Parameter Switching Level	13217	-	Take effect immediately
	18	Position Control Parameter Switching Hysteresis	13218	-	Take effect immediately
	19	Position Control Parameter Switching Time	13219	ms	Take effect immediately
	21	Speed Regulator -kr	13221	%	Take effect immediately
	22	Speed Feedback Filter Level	13222	-	Take effect immediately
	23	Position 3rd Gain Valid Time	13223	ms	Take effect immediately
	24	Position 3rd Gain Multiplier	13224	%	Take effect immediately
	28	Speed Observer Gain	13228	%	Take effect immediately
	29	Speed Observer Bandwidth	13229	ms	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
P21	00	Model Following Bandwidth (MFC)	13300	Hz	Take effect immediately
	01	Real-time auto adjustment mode	13301	-	Take effect immediately
	02	Real time Auto stiffness adjusting	13302	-	Take effect immediately
	03	Inertia Ratio	13303	%	Take effect immediately
	04	MFC Curve Damping Correction Coefficient	13304	%	Take effect immediately
	05	Forward & Reverse Torque Compensation Gain Difference Percentage	13305	%	Take effect immediately
	06	MFC Type	13306	-	Take effect immediately
	07	Speed Feedforward Compensation Coefficient	13307	-	Take effect immediately
	08	Torque Feedforward Compensation Coefficient	13308	-	Take effect immediately
	09	Dynamic Friction Compensation Coefficient	13309	-	Take effect immediately
	10	Overshoot Time Constant	13310	-	Take effect immediately
	11	Overshoot Suppression Gain	13311	-	Take effect immediately
	12	One-click Tuning Mode	13312	-	Take effect immediately
	14	One-click Tuning Progress	13314	-	Take effect immediately
	15	One-click Tuning Error Code	13315	-	Take effect immediately
	16	One-click Tuning Speed Limit	13316	r/min	Take effect immediately
	19	Auxiliary Adjustment Mode	13319	-	Take effect immediately
	20	Ltune Off Time	13320	s	Take effect immediately
	21	Ltune Progress	13321	%	Take effect immediately

	22	Friction Compensation Function Setting	13322	-	Take effect immediately
	23	Forward Torque Compensation Value	13323	%	Take effect immediately
	24	Reverse Torque Compensation Value	13324	%	Take effect immediately
	25	Torque Command Addition Value	13325	%	Take effect immediately
	27	Vibration Detection Threshold	13327	%	Take effect immediately
	30	Inertia Identification Value	13330	-	Take effect immediately
	32	Tuning In-position Count	13332	counts	Take effect immediately
	33	Tuning In-position Time	13333	s	Take effect immediately
	34	Tuning Overshoot	13334	%	Take effect immediately
	35	Tuning Jitter Count	13335	counts	Take effect immediately
	36	Tuning Maximum Current	13336	%	Take effect immediately
	37	Tuning Maximum Speed	13337	r/min	Take effect immediately
	41	Vibration Monitoring Value	13341	%	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
P22	00	Adaptive Notch Filter Mode Setting	13400	-	Take effect immediately
	01	1st Notch Frequency	13401	Hz	Take effect immediately
	02	1st Notch Width	13402	-	Take effect immediately
	03	1st Notch Depth	13403	-	Take effect immediately
	04	2nd Notch Frequency	13404	Hz	Take effect immediately
	05	2nd Notch Width	13405	-	Take effect immediately
	06	2nd Notch Depth	13406	-	Take effect immediately
	07	3rd Notch Frequency	13407	Hz	Take effect

					immediately
	08	3rd Notch Width	13408	-	Take effect immediately
	09	3rd Notch Depth	13409	-	Take effect immediately
	10	4th Notch Frequency	13410	Hz	Take effect immediately
	11	4th Notch Width	13411	-	Take effect immediately
	12	4th Notch Depth	13412	-	Take effect immediately
	13	1st Vibration Suppression Frequency	13413	Hz	Take effect immediately
	14	1st Vibration Suppression Filter	13414	-	Take effect immediately
	15	2nd Vibration Suppression Frequency	13415	Hz	Take effect immediately
	16	2nd Vibration Suppression Filter	13416	-	Take effect immediately
	17	MFC Vibration Suppression Frequency 1	13417	Hz	Take effect immediately
	18	MFC Vibration Suppression Damping 1	13418	-	Take effect immediately
	19	MFC Resonance Frequency 1	13419	Hz	Take effect immediately
	20	MFC Vibration Suppression Damping 2	13420	-	Take effect immediately
	47	d-axis Current Filter Time Constant	13447	-	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
P30	00	Homing Mode	14800	-	Take effect immediately
	01	Homing High Speed	14801	unit/s	Take effect immediately
	02	Homing Low Speed	14802	unit/s	Take effect immediately
	03	Homing Acceleration/Deceleration	14803	unit/s^2	Take effect immediately
	04	Set Current Position as Origin	14804	-	Take effect immediately
	08	Homing Position Offset	14808	unit	Take effect immediately
	09	Torque Homing Torque Limit Value	14809	%	Take effect immediately
	10	Torque Homing Time	14810	ms	Take effect immediately
	11	Homing Over Travel	14811	r	Take effect immediately
	12	Homing Timeout	14812	ms	Take effect immediately
	14	Homing In-position Threshold	14814	0.00001rev	Take effect immediately
	15	Homing Auxiliary Function	14815	-	Take effect immediately
	18	Homing In-position Delay Time	14818	ms	Take effect immediately
	22	Homing Maximum Speed Limit Value	14822	rpm	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
P41	00	Position Comparison Enable	16500	-	Take effect immediately
	01	Position Comparison Mode Selection	16501	-	Take effect after re-enable
	02	Position Comparison Pulse Output Width	16502	ms	Take effect immediately
	03	Position Comparison Output Delay Compensation	16503	us	Take effect immediately
	04	Position Comparison Start Point Value	16504	-	Take effect immediately

	05	Position Comparison End Point Value	16505	-	Take effect immediately
	06	Fixed Count Mode Cycle Count	16506	counts	Take effect immediately
	07	Set Current Position as Position Comparison Zero Point	16507	-	Take effect immediately
	08	Position Comparison Zero Point Offset	16508	unit	Take effect immediately
	10	Position Comparison Real-time Position	16510	unit	Take effect immediately
	11	Position Comparison Current Comparison Point	16511	-	Take effect immediately
	12	Position Comparison Output Count	16512	counts	Take effect immediately
	13	Position Comparison Cycle Count	16513	counts	Take effect immediately
	15	Position Comparison Value Resolution	16515	pulse	Take effect after power off
	16	Position Comparison filter	16516	-	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P42	00	Position Comparison 1 Target Value	16600	unit	Take effect immediately
	01	Position Comparison 1 Attribute Value	16601	-	Take effect immediately
	02	Position Comparison 2 Target Value	16602	unit	Take effect immediately
	03	Position Comparison 2 Attribute Value	16603	-	Take effect immediately
	04	Position Comparison 3 Target Value	16604	unit	Take effect immediately
	05	Position Comparison 3 Attribute Value	16605	-	Take effect immediately
	06	Position Comparison 4 Target Value	16606	unit	Take effect immediately
	07	Position Comparison 4 Attribute Value	16607	-	Take effect immediately
	08	Position Comparison 5 Target Value	16608	unit	Take effect immediately
	09	Position Comparison 5 Attribute Value	16609	-	Take effect immediately
	10	Position Comparison 6	16610	unit	Take effect

		Target Value			immediately
	11	Position Comparison 6 Attribute Value	16611	-	Take effect immediately
	12	Position Comparison 7 Target Value	16612	unit	Take effect immediately
	13	Position Comparison 7 Attribute Value	16613	-	Take effect immediately
	14	Position Comparison 8 Target Value	16614	unit	Take effect immediately
	15	Position Comparison 8 Attribute Value	16615	-	Take effect immediately
	16	Position Comparison 9 Target Value	16616	unit	Take effect immediately
	17	Position Comparison 9 Attribute Value	16617	-	Take effect immediately
	18	Position Comparison 10 Target Value	16618	unit	Take effect immediately
	19	Position Comparison 10 Attribute Value	16619	-	Take effect immediately
	20	Position Comparison 11 Target Value	16620	unit	Take effect immediately
	21	Position Comparison 11 Attribute Value	16621	-	Take effect immediately
	22	Position Comparison 12 Target Value	16622	unit	Take effect immediately
	23	Position Comparison 12 Attribute Value	16623	-	Take effect immediately
	24	Position Comparison 13 Target Value	16624	unit	Take effect immediately
	25	Position Comparison 13 Attribute Value	16625	-	Take effect immediately
	26	Position Comparison 14 Target Value	16626	unit	Take effect immediately
	27	Position Comparison 14 Attribute Value	16627	-	Take effect immediately
	28	Position Comparison 15 Target Value	16628	unit	Take effect immediately
	29	Position Comparison 15 Attribute Value	16629	-	Take effect immediately
	30	Position Comparison 16 Target Value	16630	unit	Take effect immediately
	31	Position Comparison 16 Attribute Value	16631	-	Take effect immediately

	32	Position Comparison 17 Target Value	16632	unit	Take effect immediately
	33	Position Comparison 17 Attribute Value	16633	-	Take effect immediately
	34	Position Comparison 18 Target Value	16634	unit	Take effect immediately
	35	Position Comparison 18 Attribute Value	16635	-	Take effect immediately
	36	Position Comparison 19 Target Value	16636	unit	Take effect immediately
	37	Position Comparison 19 Attribute Value	16637	-	Take effect immediately
	38	Position Comparison 20 Target Value	16638	unit	Take effect immediately
	39	Position Comparison 20 Attribute Value	16639	-	Take effect immediately
	40	Position Comparison 21 Target Value	16640	unit	Take effect immediately
	41	Position Comparison 21 Attribute Value	16641	-	Take effect immediately
	42	Position Comparison 22 Target Value	16642	unit	Take effect immediately
	43	Position Comparison 22 Attribute Value	16643	-	Take effect immediately
	44	Position Comparison 23 Target Value	16644	unit	Take effect immediately
	45	Position Comparison 23 Attribute Value	16645	-	Take effect immediately
	46	Position Comparison 24 Target Value	16646	unit	Take effect immediately
	47	Position Comparison 24 Attribute Value	16647	-	Take effect immediately
	48	Position Comparison 25 Target Value	16648	unit	Take effect immediately
	49	Position Comparison 25 Attribute Value	16649	-	Take effect immediately
	50	Position Comparison 26 Target Value	16650	unit	Take effect immediately
	51	Position Comparison 26 Attribute Value	16651	-	Take effect immediately
	52	Position Comparison 27 Target Value	16652	unit	Take effect immediately
	53	Position Comparison 27 Attribute Value	16653	-	Take effect immediately

	54	Position Comparison 28 Target Value	16654	unit	Take effect immediately
	55	Position Comparison 28 Attribute Value	16655	-	Take effect immediately
	56	Position Comparison 29 Target Value	16656	unit	Take effect immediately
	57	Position Comparison 29 Attribute Value	16657	-	Take effect immediately
	58	Position Comparison 30 Target Value	16658	unit	Take effect immediately
	59	Position Comparison 30 Attribute Value	16659	-	Take effect immediately
	60	Position Comparison 31 Target Value	16660	unit	Take effect immediately
	61	Position Comparison 31 Attribute Value	16661	-	Take effect immediately
	62	Position Comparison 32 Target Value	16662	unit	Take effect immediately
	63	Position Comparison 32 Attribute Value	16663	-	Take effect immediately
	64	Position Comparison 33 Target Value	16664	unit	Take effect immediately
	65	Position Comparison 33 Attribute Value	16665	-	Take effect immediately
	66	Position Comparison 34 Target Value	16666	unit	Take effect immediately
	67	Position Comparison 34 Attribute Value	16667	-	Take effect immediately
	68	Position Comparison 35 Target Value	16668	unit	Take effect immediately
	69	Position Comparison 35 Attribute Value	16669	-	Take effect immediately
	70	Position Comparison 36 Target Value	16670	unit	Take effect immediately
	71	Position Comparison 36 Attribute Value	16671	-	Take effect immediately
	72	Position Comparison 37 Target Value	16672	unit	Take effect immediately
	73	Position Comparison 37 Attribute Value	16673	-	Take effect immediately
	74	Position Comparison 38 Target Value	16674	unit	Take effect immediately
	75	Position Comparison 38 Attribute Value	16675	-	Take effect immediately

	76	Position Comparison 39 Target Value	16676	unit	Take effect immediately
	77	Position Comparison 39 Attribute Value	16677	-	Take effect immediately
	78	Position Comparison 40 Target Value	16678	unit	Take effect immediately
	79	Position Comparison 40 Attribute Value	16679	-	Take effect immediately
	80	Position Comparison 41 Target Value	16680	unit	Take effect immediately
	81	Position Comparison 41 Attribute Value	16681	-	Take effect immediately
	82	Position Comparison 42 arget Value	16682	unit	Take effect immediately
	83	Position Comparison 42 ttribute Value	16683	-	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P47	00	Collision Detection Mode	17100	-	Take effect after re-enable
	01	Collision Detection current observe source selection	17101		Take effect immediately
	02	Collision Detection Forward Current Threshold	17102	%	Take effect immediately
	03	Collision Detection Reverse Current Threshold	17103	%	Take effect immediately
	04	Collision Detection Speed Threshold	17104	r/min	Take effect immediately
	05	Holding Current After Positive-Direction Collision	17105	%	Take effect immediately
	06	Holding Current After Negative-Direction Collision	17106	%	Take effect immediately
	07	Positive-Direction Collision Detection Start Position	17107	Unit	Take effect after re-enable
	08	Negative-Direction Collision Detection Start Position	17108	unit	Take effect after re-enable
	09	Collision Detection time	17109	10us	Take effect immediately

	10	Collision BLF Center Frequency	17110	Hz	Take effect immediately
	11	Collision BLF Q Value	17111	1	Take effect immediately
	12	Collision Rebound Distance	17112	Unit	Take effect immediately
	13	Collision Rebound Speed	17113	Rpm	Take effect immediately
	16	Mechanical Analysis Injection Mode	17116	-	Take effect immediately
	17	Emergency Stop	17117	-	Take effect immediately
	18	Software Reset	17118	-	Take effect immediately
	19	Current Fault Clear	17119	-	Take effect immediately
	20	Historical Fault Clear	17120	-	Take effect immediately
	21	Encoder Initial Angle Identification	17121	-	Take effect immediately
	22	Status Function Setting Source	17122	-	Take effect immediately
	24	JOG Run Torque Command	17124	%	Take effect immediately
	25	JOG Run Speed Command	17125	r/min	Take effect immediately
	26	JOG Distance	17126	r	Take effect immediately
	27	Trail run Waiting Interval	17127	ms	Take effect immediately
	28	Trail run Cycle Count	17128	counts	Take effect immediately
	29	Trail run Acceleration/Deceleration Time	17129	Ms/krpm	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P50	00	STO Fault Flag	18000	-	Take effect immediately
	01	STO Buffer Diagnosis and Filter Time	18001	ms	Take effect immediately
	02	STO Power Supply and Optocoupler Diagnosis and Filter Time	18002	ms	Take effect immediately

	04	STO Version	18003	-	Take effect immediately
	05	STO Real-time Running Timestamp	18004	-	Take effect immediately
Category	**No.**	**Name**	**PNU**	**Unit**	**Activation**
P61	00	Heartbeat Alarm Threshold	19700	-	Take effect immediately
	12	Custom Receive Word Setting	19712	-	Take effect immediately
	13	Custom Send Word Setting	19713	-	Take effect immediately
	14	Communication Timeout Setting	19714	-	Take effect immediately
	15	Synchronization Cycle	19715	ns	Take effect immediately
	16	IP Address	19716	-	Take effect immediately
	17	Subnet Mask	19717	-	Take effect immediately
	18	Default Gateway	19718	-	Take effect immediately
	19	MAC Address (Low)	19719	-	Take effect immediately
	20	MAC Address (Middle)	19720	-	Take effect immediately
	21	MAC Address (High)	19721	-	Take effect immediately
	22	Enable User Data of Auxiliary Telegram 901	19722	-	Take effect immediately
	23	PNU of Parameter to Be Modified	19723	-	Take effect immediately
	24	Save After Parameter Modification	19724	-	Take effect immediately
	29	PN Uplink Packet Loss Count	19729	-	Take effect immediately
	30	PN Downlink Packet Loss Count	19730	-	Take effect immediately
	31	Main Telegram	19731	-	Take effect immediately
	32	Auxiliary Telegram	19732	-	Take effect immediately
P62	00~31	Telegram Transmission and Reception	19800~19831	-	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
PA0	11	Motor Model Input	26011	-	Take effect after re-enable
PA1	00	Encoder Selection	26100	-	Take effect after power off
	17	Encoder Feedback Pulse Digital Filter	26117	-	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
PA2	00	MCU1 Version Number	26200	-	Take effect immediately
	01	MCU2 Version Number	26201	-	Take effect immediately
	02	FPGA Version Number	26202	-	Take effect immediately
	06	Drive Voltage Class	26206	V	Take effect immediately
	07	Drive Rated Power	26207	W	Take effect immediately
	08	Drive Rated Current	26208	A	Take effect immediately
	09	Drive Maximum Current	26209	A	Take effect immediately
	12	Dead Time Compensation Coefficient 1	26212	-	Take effect immediately
	13	Dead Time Compensation Coefficient 2	26213	-	Take effect immediately
	19	Current Loop Gain	26219	Hz	Take effect immediately
	20	Current Loop Integral Time	26220	ms	Take effect immediately
	21	Current Differential Coefficient	26221	-	Take effect immediately
	40	Control Supply Undervoltage Value	26240	V	Take effect immediately
	42	Main Power Loss Detection Delay	26242	ms	Take effect immediately
	43	DC Bus Undervoltage (LV) Detection Delay	26243	ms	Take effect immediately
	45	Main circuit power typr set	26245	-	Take effect after power off

	52	Bus Voltage Discharge Control Mode	26252	-	Take effect immediately
	94	Hardware Version	26294	-	Take effect immediately

Category	No.	Name	PNU	Unit	Activation
PF3	00	Acceleration Time Setting (RFG)	34300	ms/krpm	Take effect immediately
	01	Deceleration Time Setting (RFG)	34301	ms/krpm	Take effect immediately
	02	Sensor Header	979[0]	-	Take effect immediately
	03	Sensor Type	979[1]	-	Take effect immediately
	04	Sensor Resolution	979[2]	-	Take effect immediately
	05	Sensor Slip Factor 1	979[3]	-	Take effect immediately
	06	Sensor Slip Factor 2	979[4]	-	Take effect immediately
	07	Sensor Multi-turn Revolution Count	979[5]	-	Take effect immediately
	19	EPOS Maximum Speed	34319	1000 LU/min	Take effect immediately
	20	EPOS Maximum Acceleration	34320	1000 LU/s²	Take effect immediately
	21	EPOS Maximum Deceleration	34321	1000 LU/s²	Take effect immediately
	27	EPOS Positioning Completion Window Time	34327	ms	Take effect immediately
	28	EPOS JOG1 Set Speed	34328	1000 LU/min	Take effect immediately
	29	EPOS JOG2 Set Speed	34329	1000 LU/min	Take effect immediately
	30	EPOS JOG1 Travel Distance	34330	LU	Take effect immediately
	31	EPOS JOG2 Travel Distance	34331	LU	Take effect immediately
	46	Positive Speed Limit in Torque Mode	34346	rpm	Take effect immediately
	47	Negative Speed Limit in Torque Mode	34347	rpm	Take effect immediately

	48	DSC Position Loop Gain Mode	34348	-	Take effect immediately
	49	DSC Speed Feedforward Mode	34349	-	Take effect immediately
	50	DSC Position Loop Gain Factor	34350	-	Take effect immediately

3.2 General Parameters

- Panel Display as follows:



3.2.1【Class P00】Basic Settings

P00.01	**Label**	Control Mode Settings				
	Range	10~10	**Default**	10	**Unit**	-
	Activation	After re-enable	**Attribute**	RW	**PNU**	10
	Set value to use following control modes： 10: PROFINET mode					

P00.06	**Label**	Command polarity inversion				
	Range	0 ~ 1	**Default**	0	**Unit**	—
	Activation	After restart	**Attribute**	RW	**PNU**	10006

Used to change the rotational direction of the motor.

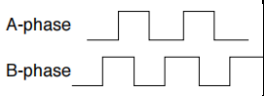
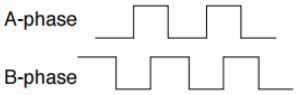
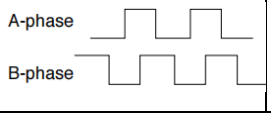
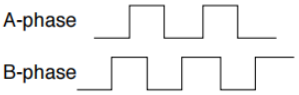
Set value	Details
0	Polarity of the command is not inversed. The direction of rotation is consistent with the polarity of command.
1	Polarity of command is inversed. The direction of rotation is opposite to the polarity of command.

Note: Rotational direction of the motor is recommended to be set through object dictionary 607E. However, P00.06 has higher priority than object dictionary 607E. 607E only takes effect when P00.06 = 0.

P00.11	**Label**	Frequency-divided pulse output per revolution				
	Range	1~4194304	**Default**	2500	**Unit**	P/r
	Activation	After restart	**Attribute**	RW	**PNU**	2500
	Set the number of output pulses from phase A and phase B of the frequency division output terminals for one revolution of the motor, which is used as position feedback in the host device. The pulse resolution output from the frequency division terminals for one revolution of the motor = P00.11×4. When setting this parameter, the following condition must be satisfied: motor speed × P00.11 (number of pulses output by the encoder per revolution) × 4 ≤ 1MHz. If this value exceeds 1MHz, alarm Er280 will be triggered.					
P00.12	**Label**	Frequency-divided output logic inversion				
	Range	0~1	**Default**	0	**Unit**	-
	Activation	After restart	**Attribute**	RW	**PNU**	10012

To set phase B logic and output source from encoder pulse output. To inverse B-Phase pulse logic and change the phase relation between Phase A and Phase B

Pulse output logic inversion

P00.12	Phase B logic	CW direction	CCW direction
[0]	Not inverted		
[1]	Inverted		

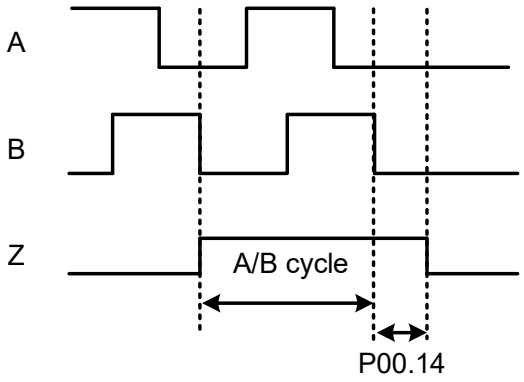
P00.13	**Label**	Frequency divider output - Z signal polarity				
	Range	0~1	**Default**	0	**Unit**	%
	Activation	Immediate	**Attribute**	RW	**PNU**	10013

Set the polarity of the Z signal for frequency division output:
0: Positive polarity; 1: Negative polarity.

P00.14	**Label**	Frequency divider output – Z-signal width				
	Range	0~100000	**Default**	30	**Unit**	Us
	Activation	After restart	**Attribute**	RW	**PNU**	10014

Set value	Description
【0】	Z bandwidth equivalent to 1 cycle of A/B
1~100000	Delay setting on top of A/B cycle width

When P0014 0, width of frequency divider output Z-signal is equivalent to width of 1 cycle of A/B, value set in P00.14 A/B cycle width = delay setting.



P00.15	**Label**	Frequency Output Source				
	Range	0~1	**Default**	1	**Unit**	-
	Activation	Immediate	**Attribute**	RW	**PNU**	10015

Set Value	Description
【0】	Disable frequency division output;
1	Use the feedback position of the motor (first encoder) as the frequency division output source;

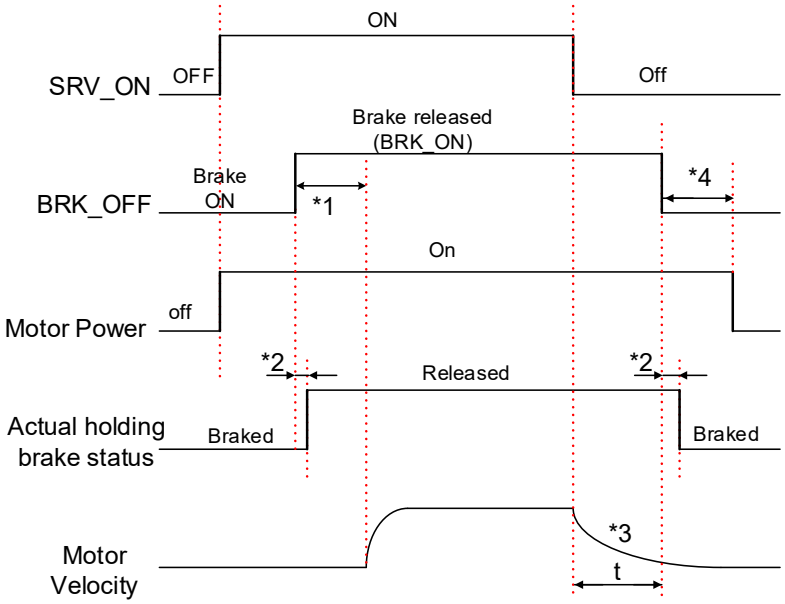
P00.16	**Label**	Frequency Output Delay Compensation				
	Range	-1000.0~1000.0	**Default**	0.0	**Unit**	us

	Activation	Immediate	**Attribute**	RW	**PNU**	10016
	Used to compensate for the fixed delay of frequency division output, allowing the drive to output frequency division pulses in advance or delayed, thereby offsetting the internal processing delay and fully aligning the feedback signal with the actual motor position in time. The larger the value set, the better the compensation effect. The servo drive processes and divides the frequency of the original high-resolution signal from the motor encoder, then outputs standard A/B quadrature pulses to the host computer as feedback. This processing process introduces an extremely small, fixed time delay (usually in the microsecond level). The function of P00.16 (frequency division output delay compensation) is to actively perform software compensation for this fixed delay.					

P00.21	**Label**	Regenerative discharge resistor value				
	Range	25~500	**Default**	100	Unit	Ω
	Activation	Immediate	**Attribute**	RW	PNU	10021
	To set resistance value of regenerative resistor The values of P00.21 and P00.22 determine the threshold of the over-current alarm Er120 for the discharge circuit. When the set value is greater than the actual regenerative resistance value, the Er120 alarm will occur later compared to the scenario where the resistance value is set correctly.					
P00.22	**Label**	Regenerative discharge resistor Power				
	Range	20~5000	**Default**	50	**Unit**	W
	Activation	Immediate	**Attribute**	RW	**PNU**	10022
	P00.21 and P00.22 determines the threshold value of Er 120. Please set accordingly or it might trigger false alarm or damage to servo driver. *Note: If external regenerative resistor is used, please set according to its labeled power rating.*					
P00.25	**Label**	Motor power-off delay time				
	Range	0~3000	**Default**	150	**Unit**	ms
	Activation	Immediate	**Attribute**	RW	**PNU**	10025
To set delay time for holding brake to be activated after motor power off to prevent axis from sliding.						

P00.26	Label	Delay time for holding brake release				
	Range	0~3000	Default	0	Unit	ms
	Activation	Immediate	Attribute	RW	PNU	10026

To set delay time for holding brake to be released after motor power on. Motor will remain at current position and input command is masked to allow holding brake to be fully released before motor is set in motion.



*1: Delay time set in P00.25

*2: Delay time from the moment BRK_OFF signal is given until actual holding brake is released or BRK_ON signal is given until actual holding brake is activated. It is dependent on the holding brake of the motor.

*3: Deceleration time is determined by P00.28 or if motor speed goes below Trigger brake speed, whichever comes first. BRK_OFF given after deceleration time.

*4: P00.25 set time value.

Delay time from the moment SRV_ON is given until BRK_OFF switch to BRK_ON, is less than 500ms.

P00.27	Label	Brake release speed setting				
	Range	10~3000	Default	30	Unit	r/min
	Activation	Immediate	Attribute	RW	PNU	10027

Set the motor speed threshold when the speed signal BRK is set to OFF (start holding brake) during disable.

When the servo enable is turned off (SRV-OFF), the motor starts to decelerate. When the motor speed is lower than the set value of this parameter and the time of P00.28 has not elapsed, the holding brake signal (BRK-OFF) is output. The actual timing for BRK to be set to OFF is whichever comes first: the time of P00.28 or the time taken for the motor speed to drop to the speed set by P00.27.

Application examples:

Case 1: After disable, if the motor deceleration time has reached the set time of P00.28, even if the motor speed is still higher than the speed set by P00.27, the drive's holding brake signal

	BRK is set to OFF (start holding brake).Case 2: After disable, if the motor deceleration time has not reached the set time of P00.28, but the motor speed is already lower than the speed set by P00.27, the drive's holding brake signal BRK is set to OFF (start holding brake).

P00.28	**Label**	Max. time to stop after disabling				
	Range	0~3000	**Default**	500	**Unit**	ms
	Activation	Immediate	**Attribute**	RW	**PNU**	10028
	To set the max. time allowed for the axis to stop on emergency stop or normal axis disabling. After disabling axis, if motor speed is still higher than P04.39 but the time set in P00.28 is reached, BRK_ON given and holding brake activated. BRK_ON given time is determined by P00.28 or when motor speed goes below P04.39, whichever comes first. Applications: 1. After disabling axis, if motor speed is still higher than Trigger brake speed but the time set in P00.28 is reached, BRK_ON given and holding brake activated. 2. After disabling axis, if motor speed is already lower than P04.39 but the time set in P00.28 is not yet reached, BRK_ON given and holding brake activated.					

P00.30	Label	Stop Mode when Servo Enable Off				
	Range	0~10	Default	9	Unit	-
	Activation	Immediate	Attribute	RW	PNU	10030

Value	Description	Deceleration for Servo Braking Stop
0	Servo braking stop, the servo state is dynamic braking after stop;	Determined by P00.37 (Fault deceleration time).
1	Servo braking stop, the servo state is dynamic braking after stop;	In homing mode, deceleration is 609Ah (Homing acceleration/deceleration);in non-homing mode, deceleration is 6084h (Protocol deceleration).
2	Servo braking stop, the servo state is dynamic braking after stop;	Determined by 6085h (Emergency stop deceleration).
3	Servo braking stop, the servo state is free after stop;	When enable is off, the deceleration for servo braking stop is determined by P00.37 (Fault deceleration time).
4	Servo braking stop, the servo state is free after stop;	In homing mode, deceleration is 609Ah (Homing acceleration/deceleration);in non-homing mode, deceleration is 6084h (Protocol deceleration).
5	Servo braking stop, the servo state is free after stop;	Determined by 6085h (Emergency stop deceleration).
6	DB braking stop, the servo state is dynamic braking after stop;	-
7	DB braking stop, the servo state is free after stop;	
8	Free stop, the servo state is free after stop;	
9	PN master station stop; the servo state is dynamic braking after stop.	OFF1: P00.37 OFF2: Free stop OFF3: P00.36
10	PN master station stop; the servo state is free after stop.	

P00.31	Label	Class 1 Fault Stop Mode				
	Range	0~2	Default	0	Unit	-
	Activation	Immediate	Attribute	RW	PNU	100331

Set the stop method and stop state for Class 1 faults.

0: Stop via dynamic braking, and the state after stop is dynamic braking state;

1: Stop via free stop method, and the state after stop is free state;

2: Stop via DB braking method, and the state after stop is free state.

P00.32	Label	Class 2 Fault Stop Mode				
	Range	0~8	Default	0	Unit	-
	Activation	Immediate	Attribute	RW	PNU	10032

Set the stop method and stop state for Class 1 faults. P00.32 is equivalent to PF2.08 (605Eh), and the parameters are interrelated, i.e., changing the value of P00.32 will synchronously update PF2.08, and vice versa.

Refer to the table below for the stop methods of Class 2 alarms (excluding Er260/Er570/Er571):

Value	Description	Deceleration for Servo Braking Stop
0	Servo braking stop, the servo state is dynamic braking after stop;	Deceleration is determined by P00.37 (Fault deceleration time)
1	Servo braking stop, the servo state is dynamic braking after stop;	Deceleration is determined by P00.36 (Fault deceleration time)
2	Servo braking stop, the servo state is dynamic braking after stop;	Deceleration is determined by P00.37 (Fault deceleration time)
3	Servo braking stop, the servo state is free after stop;	Deceleration is determined by P00.37 (Fault deceleration time)
4	Servo braking stop, the servo state is free after stop;	Deceleration is determined by P00.36 (Fault deceleration time)
5	Servo braking stop, the servo state is free after stop;	Deceleration is determined by P00.37 (Fault deceleration time)
6	DB braking stop, the servo state is dynamic braking after stop;	-
7	DB braking stop, the servo state is free after stop;	
8	Free stop, the servo state is free after stop;	

Note：

• The stop method and deceleration of Er260 (Positive/Negative limit input valid) are selected by P00.34 (Positive/Negative limit stop mode).

• The stop method and deceleration of Er570 (Force alarm input) and Er571 (PC force alarm) are selected by P00.3. (Force stop mode).

P00.33	Label	Forced Stop Mode				
	Range	0~6	Default	2	Unit	-
	Activation	Immediate	Attribute	RW	PNU	10033

Set the force stop mode. This parameter is linked with 605Ah, i.e., changing the value of P00.33 will synchronously update 605Ah.

Value	Description	Deceleration for Servo Braking Stop
0	Servo braking stop, the servo state is DB state after stop;	In homing mode, deceleration is 609Ah (Homing acceleration/deceleration); In non-homing mode, deceleration is 6084h (Protocol deceleration).
1		Deceleration is 6085h (Emergency stop deceleration)
2		Deceleration is fixed to the maximum value
3	Servo braking stop, the servo state is free after stop;	In homing mode, deceleration is 609Ah (Homing acceleration/deceleration); In non-homing mode, deceleration is 6084h (Protocol deceleration).
4		Deceleration is 6085h (Emergency stop deceleration)
5		In homing mode, deceleration is 609Ah (Homing acceleration/deceleration); In non-homing mode, deceleration is 6084h (Protocol deceleration).
6		Deceleration is 6085h (Emergency stop deceleration), continuous enabling

P00.34	Label	Positive/Negative Limit Stop Mode				
	Range	0~6	Default	0	Unit	-
	Activation	Immediate	Attribute	RW	PNU	10034

Set the Positive/Negative Limit Stop Mode.

Value	Description
0	Limit Valid Mode: Stop via servo braking, and the deceleration is selected as the larger value between P00.35 (Positive/Negative Limit Deceleration Time) and P00.38 (Maximum Deceleration Time).
1	Limit Invalid Mode.
2	Limit Alarm Trigger Mode: Stop via servo braking, the deceleration is selected as the larger value between P00.35 (Positive/Negative Limit Deceleration Time) and P00.38 (Maximum Deceleration Time), and the servo state is dynamic braking state after stopping.
3	Limit Alarm Trigger Mode: Stop via servo braking, the deceleration is selected as the larger value between P00.35 (Positive/Negative Limit Deceleration Time) and P00.38 (Maximum Deceleration Time), and the servo state is free state after stopping.
4	Limit Alarm Trigger Mode: Stop via DB braking, and the servo state is DB braking state after stopping.
5	Limit Alarm Trigger Mode: Stop via DB braking, and the servo state is free state after stopping.
6	Limit Alarm Trigger Mode: Free stop, and the servo state is free state after stopping.

P00.35	Label	Positive/Negative Limit Deceleration Time				
	Range	0~60000	Default	0	Unit	ms/(1000r/min)
	Activation	Immediate	Attribute	RW	PNU	10035

Limit Deceleration Time Setting.

=0, Deceleration is fixed to the maximum deceleration, which is subject to the maximum deceleration time specified in P00.38;

=1~60000, Deceleration time is the set value.

P00.36	Label	Emergency stop Deceleration Time				
	Range	0~60000	Default	0	Unit	ms/(1000r/min)
	Activation	Immediate	Attribute	RW	PNU	10036

Emergency stop Time Setting.

=0, Deceleration is fixed to the maximum deceleration, which is subject to the maximum deceleration time specified in P00.38;

=1~60000, Deceleration time is the set value.

P00.37	Label	Fault Deceleration Time				
	Range	0~60000	Default	0	Unit	ms/(1000r/min)
	Activation	Immediate	Attribute	RW	PNU	10037

Fault Time Setting.

=0, Deceleration is fixed to the maximum deceleration, which is subject to the maximum deceleration time specified in P00.38;

=1~60000, Deceleration time is the set value.

P00.38	**Label**	Maximum Deceleration Time				
	Range	0~60000	**Default**	20000	**Unit**	ms/(1000r/min)
	Activation	Immediate	**Attribute**	RW	**PNU**	10038

Maximum Time Setting.

=0, Deceleration is fixed to the maximum deceleration, which is subject to the maximum deceleration time specified in P00.38;

=1~60000, Deceleration time is the set value.

P00.39	**Label**	Torque Limit during Immediate Stop				
	Range	0~500	**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RW	**PNU**	10039

Set the torque limit value for the servo brake stop mode.

When the set value is 0, it is determined by P12.01 (First Torque Limit);

When the set value is non-zero, it is determined by P00.39 (Immediate Stop Torque Limit).

P00.40	**Label**	E-Stop Function Selection				
	Range	0~1	**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RW	**PNU**	10040

0：Emergency stop is valid, servo driver will be forced to STOP and alarm occurs.
1：Emergency stop is invalid, servo driver will not be forced to STOP.

P00.41	**Label**	Position Feedback Polarity Setting				
	Range	0~1	**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RW	**PNU**	10041

0 When the Force Alarm Input E-STOP is active, the servo performs a forced emergency stop and displays alarm Er570;
1 When the Force Alarm Input E-STOP is active, the servo performs a forced emergency stop and displays warning Ar00. The driver operates normally after the E-STOP signal is released.

P00.43	**Label**	LED Initial Status				
	Range	0~38	**Default**	34	**Unit**	-
	Activation	After restart	**Attribute**	RW	**PNU**	10043

To set content display on front panel of the servo driver at servo driver power on.

Set value	Content	Set value	Content	Set value	Content
0	Position command deviation	14	Regenerative load rate	27	Voltage across Bus
1	Motor speed	15	Motor overload rate	28	Software version
2	Position command velocity	16	Inertia ratio	30	No. of encoder communication error
3	Velocity control command	17	Driver overload rate	32	MCU temperature
4	Actual feedback torque	18	No. of changes in I/O signals	33	Driver temperature

5	Position feedback	19	Time per power-up	34	Servo status
6	Position command	20	Power on total time	35	Motor temperature
7	Maximum torque during motion	21	Single turn position		
8	Input commend pulse frequency	22	Multiturn position		
9	Control mode	23	Communication axis address		
10	DI/DO signal status	24	Encoder position deviation		
12	Error cause and history record	25	Motor electrical angle		
13	Driver power	26	Motor mechanical angle		

P00.48	Label	Z-Signal Holding Time				
	Range	1~1000	Default	0	Unit	ms
	Activation	Immediate	Attribute	RW	PNU	10048

Z Signal High-Level Hold Time Setting.

Applicable to:

- Z signal in 60FDh
- Z signal during homing;
- Z-phase pulse width for frequency division output, with the unit being 0.1 ms at this time;

Note: When using the above three conditions, the set P00.48 time must be ≥ 0.2 ms.

P00.51	Label	Position unit setting				
	Range	0~2	Default	0	Unit	-
	Activation	After re-enable	Attribute	RW	PNU	10051

Set value	Unit
0	Encoder unit
1	Command unit
2	10000 Pulse / rev

Command unit: Pulse from host (Affected by electronic gear ratio)

Encoder unit: Pulse from encoder (Related to encoder resolution)

P05.20 can only be modified when axis is disabled as it will clear position data.

P00.55	Label	Software Limit Function Setting				
	Range	0~2	Default	2	Unit	-
	Activation	Immediate	Attribute	RW	PNU	10055

Set the enabling timing of the soft limit function.

0: Soft limit function disabled;

1: Soft limit function enabled;

2: Enabled after homing is completed.

P00.56	Label	Positive Software Limit				
	Range	-2147483648~2147483648	Default	0	Unit	Pulse
	Activation	Immediate	Attribute	RW	PNU	10056

						-39h
	Positive Software Limit Position Setting. When the motor position runs to this position, the positive limit is valid. The drive will limit the motor's forward movement to protect the equipment and ensure operational safety. This parameter is equivalent to 607D-02h (maximum soft limit), and the two are linked; that is, changing P00.56 will result in a corresponding change to 607D-02h.					
P00.57	**Label**	Negative Software Limit				
	Range	-2147483648~2147483648	**Default**	0	**Unit**	Pulse
	Activation	Immediate	**Attribute**	RW	**PNU**	10057
	Negative Software Limit Position Setting. When the motor position runs to this position, the positive limit is valid. The drive will limit the motor's forward movement to protect the equipment and ensure operational safety. This parameter is equivalent to 607D-01h (minimum soft limit), and the two are linked; that is, changing P00.56 will result in a corresponding change to 607D-01h.					

3.2.2【Class P01】Digital DIDO

P01.00	**Label**	Input selection DI1				
	Range	0x0~0xFF		**Default**	0x0	**Unit** -
	Activation	Immediate	**Attribute**	RW		**PNU** 10100
P01.01	**Label**	Input selection DI2				
	Range	0x0~0xFF		**Default**	0x0	**Unit** -
	Activation	Immediate	**Attribute**	RW		**PNU** 10101
P01.02	**Label**	Input selection DI3				
	Range	0x0~0xFF		**Default**	0x0	**Unit** -
	Activation	Immediate	**Attribute**	RW		**PNU** 10102
P01.03	**Label**	Input selection DI4				
	Range	0x0~0xFF		**Default**	0x0	**Unit** -
	Activation	Immediate	**Attribute**	RW		**PNU** 10103
P01.04	**Label**	Input selection DI5				
	Range	0x0~0xFF		**Default**	0x0	**Unit** -
	Activation	Immediate	**Attribute**	RW		**PNU** 10104
P01.05	**Label**	Input selection DI6				
	Range	0x0~0xFF		**Default**	0x0	**Unit** -
	Activation	Immediate	**Attribute**	RW		**PNU** 10105

Digital input DI allocation using hexadecimal system

Input	Symbol	Set value	
		Normally open	Normally close
Invalid Input	—	00h	--
Positive limit switch	POT	01h	81h
Negative limit switch	NOT	02h	82h
Clear alarm	A-CLR	04h	-
Forced alarm	E-STOP	14h	94h
Home switch	HOME-SWITCH	16h	96h

- Please don't set anything other than listed in table above.

- Normally open: Valid when input = ON Normally close: Valid when input = OFF
- Er210 might occur if same function is allocated to different channels at the same time
- Channel that has no value doesn't affect driver motion.
- Front panel is of hexadecimal system.

P01.00~P01.05 corresponds to DI1~DI6, which can be connected to external sensor signals,

P01.16	**Label**	Output selection DO1					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10116
P01.17	**Label**	Output selection DO2					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10117
P01.18	**Label**	Output selection DO3					
	Range	0x0~0xFF		**Default**	0x0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10118

Digital output DO allocation using hexadecimal system.

Output	Symbol	Set value	
		Normally open	Normally close
Master device control	—	00h	-
Alarm	ALM	01h	81h
Servo-Ready	S-RDY	02h	82h
External brake released	BRK-OFF	03h	83h
Positioning completed	INP	04h	84h
At-speed	AT-SPEED	05h	85h
Torque limit signal	TLC	06h	86h
Zero speed clamp detection	ZSP	07h	87h
Velocity coincidence	V-COIN	08h	88h
Position command ON/OFF	P-CMD	0Bh	8Bh
Velocity limit signal	V-LIMIT	0Dh	8Dh
Velocity command ON/OFF	V-CMD	0Fh	8Fh
Servo status	SRV-ST	12h	92h
Homing done	HOME-OK	22h	A2h
DB brake output	-	2Dh	AD
Z phase output	-	2Eh	AEh

Please don't set any other than the outputs listed in the table above.

- Normally open：Active low
- Normally close：Active high
- Front panel is of hexadecimal system.

P01.25	Label	Forced DI/DO Enable Switch					
	Range	0~7		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10125

Set the valid source of forced DI/DO. Refer to the table below for the setting method:

Function	Bit Position	Set Value	Description
Forced DI Enable Switch	bit0	0	No forced DI
		1	Set DI force activation based on the value set in P01.26
Forced DO Enable Switch	bit1~2	0	No forced DO
		1	Set DO force activation based on the value set in P01.27
		2	Set DO force activation via 60FEh
		3	Reserved

P01.26	Label	Forced DI Set Value					
	Range	0×0~0×FFFF		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10126

DI Input Signal Force Setting. When P01.25 bit0=1, DI can be forced valid by the rules set in this parameter.

P01.26 bit0~bit5 correspond to the forced outputs of DI1~DI6 respectively, and a bit position set to 1 indicates forced validity.

P01.27	Label	Forced DO Set Value					
	Range	0×0~0×FFFF		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10127

DO Output Signal Force Setting. When P01.25 bit1~2=1, DO can be forced valid by the rules set in this parameter.

P01.27 bit0~bit3 correspond to the forced outputs of DO1~DO4 respectively, and a bit position set to 1 means forced validity.

P01.28	Label	DI Status					
	Range	-2147483648~2147483647		Default	0	Unit	
	Activation	Immediate	Attribute	RO		RW	10128

DI status display.

bit0~bit5 correspond to the statuses of DI1~DI6 respectively.

A bit value of 0 indicates the status OFF;

A bit value of 1 indicates the status ON.

P01.29	Label	DO Status					
	Range	-2147483648~2147483647		Default	0	Unit	
	Activation	Immediate	Attribute	RO		PNU	10129
	DO status display. bit0~bit3 correspond to the statuses of DO1~DO3 respectively. A bit value of 0 indicates the status OFF; A bit value of 1 indicates the status ON.						

P01.30	Label	DI Filter Setting					
	Range	0~25.5		Default	1	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	10130
	Set the reading filter time constant of DI to avoid excessive signal interference that causes level jumps. An excessively large setting value will result in control delay.						

3.2.3【Class P02】Virtual DIDO

P02.00	Label	Virtual DIDO Enable					
	Range	0×0~0×1		Default	0×0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10200
	0: Not enabled; 1: Virtual DI DO enabled.						

P02.01	Label	VDI-01 Input Selection					
	Range	0×0~0×FF		Default	0×0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10201
P02.02	Label	VDI-02 Input Selection					
	Range	0×0~0×FF		Default	0×0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10201
P02.03	Label	VDI-03 Input Selection					
	Range	0×0~0×FF		Default	0×0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10203
P02.04	Label	VDI-04 Input Selection					
	Range	0×0~0×FF		Default	0×0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10204
P02.05	Label	VDI-05 Input Selection					
	Range	0×0~0×FF		Default	0×0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10205
P02.06	Label	VDI-06 Input Selection					
	Range	0×0~0×FF		Default	0×0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10206
P02.07	Label	VDI-07 Input Selection					
	Range	0×0~0×FF		Default	0×0	Unit	
	Activation	Immediate	Attribute	RW		PNU	10207
P02.08	Label	VDI-08 Input Selection					

	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10208
P02.09	**Label**	VDI-09 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10209
P02.10	**Label**	VDI-10 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10210
P02.11	**Label**	VDI-11 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10211
P02.12	**Label**	VDI-12 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10212
P02.13	**Label**	VDI-13 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10213
P02.14	**Label**	VDI-14 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10214
P02.15	**Label**	VDI-15 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10215
P02.16	**Label**	VDI-16 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10216
	Configure virtual DI input function. For example: If you configure the function of VDI-01 as forward drive inhibit input, the parameter value of P02.01 is 0x01.						
P02.17	**Label**	VD0-01 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10217
P02.18	**Label**	VDO-02 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10218
P02.19	**Label**	VD0-04 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10219
P02.20	**Label**	VD0-03 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10220
P02.21	**Label**	VD0-05 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	

	Activation	Immediate	**Attribute**	RW		**PNU**	10221
P02.22	**Label**	VDO-06 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10222
P02.23	**Label**	VD0-07 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10223
P02.24	**Label**	VDO-08 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10224
P02.25	**Label**	VD0-09 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10225
P02.26	**Label**	VDO-10 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10226
P02.27	**Label**	VDO-11 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10227
P02.28	**Label**	VDO-12 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10228
P02.29	**Label**	VDO-13 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10229
P02.30	**Label**	VDO-14 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10230
P02.31	**Label**	VDO-15 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10231
P02.32	**Label**	VDO-16 Input Selection					
	Range	0×0~0×FF		**Default**	0×0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10232
	Configure virtual DO output function. For example: If you configure the function of VDO-01 as positioning complete output, the parameter value of P02.32 is 0x04.						
P02.45	**Label**	VDI Status					
	Range	-2147483648~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	10245
	Configure virtual VDI output function. Bit0~Bit15 correspond to the states of VDI1~VDI16. A bit value of 0 indicates status OFF;A bit value of 1 indicates status ON.						
P02.46	**Label**	VDO Status					

	Range	-2147483648~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	10246
	Configure virtual VDO output function. Bit0~Bit15 correspond to the states of VDO1~VDO16. A bit value of 0 indicates status OFF;A bit value of 1 indicates status ON.						

3.2.3【Class P04】Fault parameters

P04.02	**Label**	Excessive Position Deviation Settings					
	Range	0~2147483647		**Default**	2147483647	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	10402
	Please set threshold value for position deviation accordingly. Default factory setting = 30, Er180 will be triggered if positive deviation is in excess of 3 revolutions.						

P04.03	**Label**	Fault Clearing Mode					
	Range	0~1		**Default**	1	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10403

Set the clearing conditions for the alarm clear input signal.

Set Value	Description
0	Always clear (level clear)
1	Clear only once (rising edge clear)

P04.05	**Label**	Current Fault Code					
	Range	-2147483648~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	10405
	Current Fault Code						
P04.06	**Label**	Current Warning Code					
	Range	-2147483648~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	10406
	Current Warning Code						
P04.07	**Label**	Overspeed Level Setting					
	Range	0~10000		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10407
	If the motor speed exceeds this set value, Er1A0 "Over-speed" will occur.When the speed level set value is set to 0, the speed level is equivalent to 1.2 times the maximum motor speed.						
P04.17	**Label**	E2 Storage Speed Threshold					
	Range	0~10		**Default**	4	**Unit**	min
	Activation	Immediate	**Attribute**	RW		**PNU**	10417
	This parameter is used to set the judgment threshold for the "too fast storage" threshold of the servo EEPROM storage module. When the actual storage speed exceeds the set threshold, the system will trigger the corresponding protection mechanism to avoid data or hardware failures caused by abnormal storage speed. The EEPROM storage module is mainly used to store key data such as system parameters,						

fault records, and operation logs. Its storage operations must comply with specific speed specifications. If the data write/update speed exceeds the safe range, it may cause data loss, writing exceptions, or even damage the EEPROM storage module, affecting the normal operation of the driver.

P04.19	**Label**	Regeneration Overload Level					
	Range	0~115		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10419

Set value	Description
【0】	Default level: 80%
1~115	Set vent overload level accordingly

P04.20	**Label**	Overload Level Setting					
	Range	0~115		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10420

Set the overload level. When the set value is 0, the overload level is set to 100%.
Note: Please set it to 0 during normal use. Reducing the overload level will shorten the motor's overload time. A normal motor overload triggers alarm Er100, indicating excessive load, meaning the driver's output current is greater than the motor's rated current.

P04.23	**Label**	Motor Stall Alarm Torque Threshold					
	Range	0~300		**Default**	300	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	10423

Set the torque threshold for the motor stall alarm. When the speed is less than 20r/min and the torque output is greater than this threshold, the motor stall alarm (Er102) will be triggered.
0: Mask motor stall (Er102) alarm;
Non-0: Set the torque threshold for motor stall alarm according to the set value.

3.2.4【Class P05】Monitor parameters

P05.00	**Label**	Position Setpoint (User Units)					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	unit
	Activation	Immediate	**Attribute**	RO		**PNU**	10500
	Display position setting, unit is user unit. The received command pulse count is converted and displayed in user units. For example, if the user unit is 10000LU/rev and the encoder unit is 8388608P/rev, when the driver receives 8388608 pulses, this parameter will display 10000.						

P05.01	**Label**	Position feedback (User Units)					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	unit
	Activation	Immediate	**Attribute**	RO		**PNU**	10501
	Display position feedback, unit is user unit. The position feedback pulse count of the motor encoder is converted and displayed in user units. For example, if the user unit is 10000LU/rev and the encoder unit is 8388608P/rev, when the driver receives 8388608 feedback pulses from the encoder, this parameter will display 10000.						
P05.02	**Label**	Position Setting (Encoder Units)					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	Pulse
	Activation	Immediate	**Attribute**	RO		**PNU**	10502
	Display position setpoint in encoder units. The received command pulse count is converted and displayed in motor encoder units.						
P05.03	**Label**	Position Feedback (Encoder Units)					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	pulse
	Activation	Immediate	**Attribute**	RO		**PNU**	10503
	Displays position feedback in encoder units. The received command pulse count is converted and displayed based on the motor encoder feedback of the driver.						
P05.04	**Label**	Positioning Error (Encoder Units)					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	pulse
	Activation	Immediate	**Attribute**	RO		**PNU**	10504
	Displays the positioning error in encoder units. The driver displays the received positioning error pulses from the motor encoder.						
P05.05	**Label**	Absolute Position Error (Encoder Units)					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	pulse
	Activation	Immediate	**Attribute**	RO		**PNU**	10505
	Displays the absolute position error in encoder units, which is the difference between the position setpoint and the position feedback.						

P05.06	**Label**	Relative Position Error (User Unit)					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	unit
	Activation	Immediate	**Attribute**	RO		**PNU**	10506
	Displays the relative position error in user units.						

P05.07	**Label**	Encoder Single-turn Position					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	pulse
	Activation	Immediate	**Attribute**	RO		**PNU**	10507
	Displays the current single-turn position value of the encoder.						
P05.08	**Label**	Encoder Multi-turn Position					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	R
	Activation	Immediate	**Attribute**	RO		**PNU**	10508
	Displays the Encoder Multi-turn Position.						
P05.09	**Label**	Position Command Speed					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	rpm
	Activation	Immediate	**Attribute**	RO		**PNU**	10509
	Displays the Position Command Speed						
P05.10	**Label**	Speed Setpoint					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	rpm
	Activation	Immediate	**Attribute**	RO		**PNU**	10510
	Displays the Speed Setpoint						
P05.11	**Label**	Motor Speed					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	rpm
	Activation	Immediate	**Attribute**	RO		**PNU**	10511
	Displays the Motor Speed						
P05.12	**Label**	Speed Error					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	rpm
	Activation	Immediate	**Attribute**	RO		**PNU**	10512
	Displays the speed error , which is the error between speed setpoint and motor speed.						
P05.13	**Label**	Torque Current Setpoint					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	%
	Activation	Immediate	**Attribute**	RO		**PNU**	10513
	Displays the current torque current setpoint. The unit is the percentage of the motor's rated current.						
P05.14	**Label**	Torque Current Feedback					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	%
	Activation	Immediate	**Attribute**	RO		**PNU**	10514
	Displays the current torque current feedback. The unit is the percentage of the motor's rated current						
P05.15	**Label**	Flux-weakening Current Setpoint					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	%
	Activation	Immediate	**Attribute**	RO		**PNU**	10515

	Displays the Flux-weakening current setpoint. The unit is the percentage of the motor's rated current.					
P05.16	**Label**	Flux-weakening Current Feedback				
	Range	-2147483647~2147483647	**Default**	0	**Unit**	%
	Activation	Immediate	**Attribute**	RO	**PNU**	10516
	Displays the Flux-weakening current feedback. The unit is the percentage of the motor's rated current.					
P05.17	**Label**	Vector Current				
	Range	-2147483647~2147483647	**Default**	0	**Unit**	%
	Activation	Immediate	**Attribute**	RO	**PNU**	10517
	Displays the vector current values output by the driver to the U, V, and W windings of the motor.					
P05.18	**Label**	Phase U Current				
	Range	-2147483647~2147483647	**Default**	0	**Unit**	A
	Activation	Immediate	**Attribute**	RO	**PNU**	10518
	Displays the real-time current value of the U-phase winding output by the driver.					
P05.19	**Label**	Phase V Current				
	Range	-2147483647~2147483647	**Default**	0	**Unit**	A
	Activation	Immediate	**Attribute**	RO	**PNU**	10519
	Displays the real-time current value of the V-phase winding output by the driver.					
P05.20	**Label**	Phase W Current				
	Range	-2147483647~2147483647	**Default**	0	**Unit**	A
	Activation	Immediate	**Attribute**	RO	**PNU**	10520
	Displays the real-time current value of the W-phase winding output by the driver.					
P05.21	**Label**	Bus Voltage				
	Range	-2147483647~2147483647	**Default**	0	**Unit**	V
	Activation	Immediate	**Attribute**	RO	**PNU**	10521
	Displays the real-time bus voltage.					
P05.22	**Label**	Driver Temperature				
	Range	-2147483647~2147483647	**Default**	0	**Unit**	° C
	Activation	Immediate	**Attribute**	RO	**PNU**	10522
	Displays the real-time driver temperature.					
P05.23	**Label**	Monitor Channel 1 Selection				
	Range	0~300	**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RW	**PNU**	10523

value	Content	value	Content	value	Content

00	Current Fault Code	19	Cumulative Power-on Time (s)	35	Internal Position Feedback (Encoder Unit)	
01	Motor Overload Rate (%)	22	Discharge Overload Rate (%)	39	Motor Temperature (℃)	
02	DI Status	23	Average Load Rate (0.1%)	40	U-phase Current (0.1%)	
03	DO Status	24	Peak Current (within 2s, 0.1%)	41	V-phase Current (0.1%)	
04	Drive Overload (%)	25	Inertia Identification Value (%)	42	W-phase Current (0.1%)	
05	Control Voltage (0.1V)	27	IO Change Count	56	Virtual DI	
06	MCU Temperature (℃)	28	Single Power-on Time (s)	57	Virtual DO	
13	Mechanical Angle (0.1°)	32	Position Command 32bit (Encoder Unit)	58	Encoder identification value	
14	Electrical Angle (0.1°)	33	Position Feedback 32bit (Encoder Unit)			
15	Encoder Communication Error Count	34	Internal Position Command (Encoder Unit)			

P05.24	**Label**	Monitor Channel 2 Selection					
	Range	0~300		**Default**	1	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10524
P05.25	**Label**	Monitor Channel 3 Selection					
	Range	0~300		**Default**	2	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10525
P05.26	**Label**	Monitor Channel 4 Selection					
	Range	0~300		**Default**	3	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	10526
	Same as 05.23						

P05.27	**Label**	Monitor Channel 1 Value					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RO		**PNU**	10527
P05.28	**Label**	Monitor Channel 2 Value					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RO		**PNU**	10528
P05.29	**Label**	Monitor Channel 3 Value					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RO		**PNU**	10529

P05.30	**Label**	Monitor Channel 4 Value					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RO		**PNU**	10530
	Monitor Channel Value						

3.3 Basic Control

3.3.1【Class P10】Position Control

P10.03	**Label**	Command Pulses Per Revolution					
	Range	0~67108864		**Default**	0	**Unit**	Pulse
	Activation	After reset	**Attribute**	RW		**PNU**	11603
This parameter is used to set the number of command pulses per revolution of the motor.							

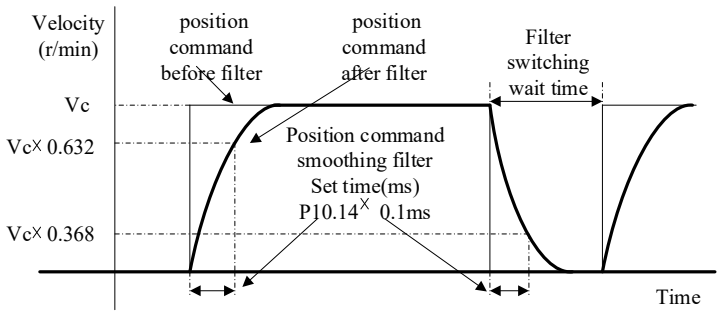
P10.04	**Label**	1st Command Frequency Division Numerator					
	Range	1~2147483647		**Default**	1	**Unit**	
	Activation	After reset	**Attribute**	RW		**PNU**	11604
Sets the numerator for frequency division and frequency multiplication processing of the command pulse input. This value is valid when P10.03 (Command Pulses Per Revolution) = 0. For details, refer to the parameter description of P10.05.							
P10.05	**Label**	1st Command Frequency Division Denominator					
	Range	1~2147483647		**Default**	1	**Unit**	
	Activation	After reset	**Attribute**	RW		**PNU**	11605
Sets the denominator for frequency division and frequency multiplication processing of the command pulse input, which is used as follows: • Settings 1) The number of command pulses input to the driver is X 2) The number of encoder pulses after frequency division and frequency multiplication is Y 3) The number of pulses per revolution of the motor is Z 4) The number of running revolutions of the motor is W • Calculations 1) Calculation of X and Y Y=X*P10.04/P10.05 Note: The value range of P00.09 and P00.10 must be less than 2^24 (i.e. 16777216). Exceeding the above range may result in incorrect frequency division and frequency multiplication results. 2) Description of Z For 17-bit motor: Z=2^17=131072 ;For 23-bit motor: Z=2^23=8388608 3) Calculation of Y, Z and W W=Y/Z Note: Although the values of the denominator and numerator can be set to any value within the range, normal operation cannot be guaranteed when an extreme frequency division ratio or frequency multiplication ratio is set. If the converted pulse command per magnetic pole pitch of the motor is less than 500, the Er1b1 alarm will be triggered.							
P10.09	**Label**	Absolute Encoder Reset Enable					
	Range	0~2		**Default**	0	**Unit**	
	Activation	After reset	**Attribute**	RW		**PNU**	11609
Sets functions related to the absolute encoder.							

	0: Function disabled; 1: Clear encoder alarm; 2: Clear encoder alarm and multi-turn position.						
P10.10	**Label**	Absolute Encoder Setting					
	Range	0~3		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	11610
	Sets the type and usage mode of the absolute encoder. The specific usage can be set as follows: 0: Incremental mode. The encoder is used as a bus incremental encoder, with no power-off position memory function. There is no restriction on the load travel range of the equipment. 1: Multi-turn linear mode. Enables the multi-turn absolute value function, with power-off position memory function. It is applicable to scenarios where the load travel range of the equipment is fixed and the encoder's multi-turn data will not overflow. 2: Multi-turn rotary mode. Enables the multi-turn absolute value function, with power-off position memory function. The actually fed back multi-turn data cycles back and forth between 0 and (P10.12+1); it is applicable to scenarios where the load travel range of the equipment is unrestricted. 3: Single-turn absolute value mode. This mode is mainly used in scenarios where the equipment load only needs to record the position within one revolution of the motor. The initial position fed back at each power-on is used to calculate the current position feedback based on the coordinate system after the last homing operation, with no need for re-homing.						
P10.11	**Label**	Absolute Multi-turn Mode Minimum Value					
	Range	0~2147483647		**Default**	0	**Unit**	pulse
	Activation	Immediate	**Attribute**	RW		**PNU**	11611
	Sets the minimum value of multi-turn data when the absolute encoder is in rotary mode. When P10.10=2 (multi-turn rotary mode), the number of pulses per single revolution is: P10.12 (range value of absolute value rotary mode) - P10.11 (minimum value of absolute value rotary mode).						

P10.12	**Label**	Absolute Multi-turn Mode Range Value					
	Range	0~2147483647		**Default**	0	**Unit**	Pulse
	Activation	Immediate				**PNU**	11612
	Sets the value range of multi-turn data when the absolute encoder is in rotary mode. When P10.10=2 (multi-turn rotary mode), the number of pulses per single revolution is: P10.12 (range value of absolute value rotary mode) - P10.11 (minimum value of absolute value rotary mode).						

P10.14	**Label**	Position Command Low-pass Filter					
	Range	0~300		**Default**	0	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	11614
	Sets the time constant of the first-order low-pass filter for the position command, i.e., performs smoothing processing on the command.						

For the square command of the target speed Vc, as shown in the figure below, set the time constant of the 1st-order delay filter.

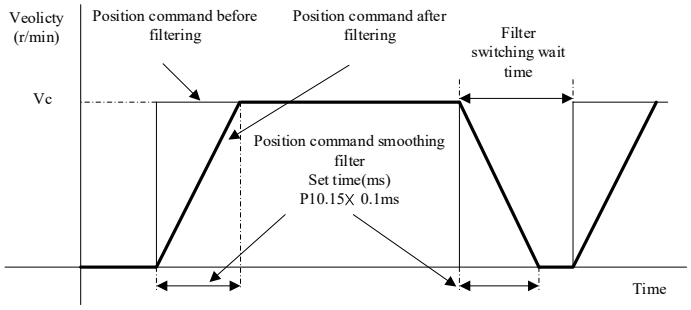


- This parameter is generally used when the command is relatively rough or the command acceleration is too large, causing overshoot or undershoot of the motor. It can smooth the command mutation, reduce the impact on the equipment, and eliminate vibration. It should be noted that setting this parameter too large may increase the settling time.
- After modifying P10.14 (Position Command Low-Pass Filter), the parameters will not be immediately applied to the internal calculation of the driver, and there will be a fixed delay. If the "Filter Switching Waiting Time" is triggered during this period, the effective time of the parameter change will be further delayed.

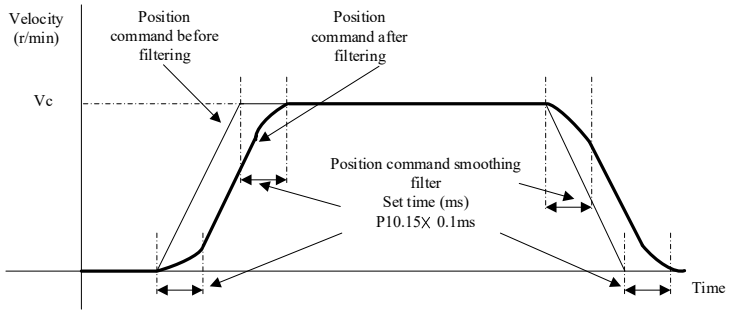
P10.15	Label	Position Command FIR Filter					
	Range	0~250		Default	0	Unit	Ms
	Activation	Immediate	Attribute	RW		PNU	11615

Sets the time constant of the FIR filter for the position command.

For the square command of the target speed Vc, set the time taken to reach Vc as shown in the figure below; after filtering, the waveform is trapezoidal.



For the trapezoidal command of the target speed Vc, set the time taken to reach Vc as shown in the figure below; after filtering, the waveform is S-shaped.



- This parameter is generally used when the command is relatively rough or there is no acceleration/deceleration, causing the motor to overshoot or undershoot due to abrupt acceleration. It can smooth the command mutation, reduce the impact on the equipment, and eliminate vibration. It should be noted that setting this parameter too large may increase the settling time.
- Please stop the command, and perform the change of P10.15 (Position Command FIR Filter) after the duration reaches the filter waiting time. The filter waiting time = (Set value × 0.1ms + 0.25ms). If P10.15 (Position Command FIR Filter) is changed when a command is input, the change cannot be applied immediately. It will be updated in the subsequent command-free state and after the duration reaches the filter waiting time.
- From the change of P10.15 (Position Command FIR Filter) until it is applied to the internal calculation, there will be a delay. During this period, if the switching time is reached, the change may be delayed.
- It takes effect when stopping at rest.

P10.19	**Label**	Positioning Completion Range					
	Range	0.0000~1.0000		**Default**	0.0020	**Unit**	rev
	Activation	Immediate	**Attribute**	RW		**PNU**	11619
	Sets the position deviation range for the output of the positioning completion signal (INP1). The positioning completion signal (INP1) can be output when the position deviation is within the set range. Note: The default unit is ten-thousandths of a revolution. This can be set to the command unit or encoder unit via P00.51 (Position Setting Unit Selection).						

P10.20	Label	Positioning Output Setting					
	Range	0~4		Default	1	Unit	
	Activation	Immediate	Attribute	RW		PNU	11620

Sets the output conditions for the positioning completion signal (INP1).

0: **Position deviation condition**: The INP1 output signal is valid when the position deviation is less than P10.19 (Positioning Range).

1: **No command + zero speed detection condition**: The INP1 output signal is valid when there is no position command, the zero speed detection signal ZSP is valid, and the position deviation is less than P10.19 (Positioning Range).

3: **Position command + delay condition**: The INP1 output signal is valid after the expiration of the time set by P10.21 (INP Delay Output Time) when the position deviation is less than P10.19 (Positioning Range). It remains OFF during the set time of P10.21 (INP Delay Output Time).

4: **Command change + delay condition**: Positioning judgment starts after the expiration of the delay time set by P10.21 (INP Delay Output Time) when a change from a command to no command occurs. If there is no position command, INP1 is turned OFF immediately when the position deviation is less than P10.19 (Positioning Range).

P10.21	Label	INP Delay Arrival Output Time					
	Range	0~10000		Default	0	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	11621

Sets the delay time for the INP signal output when P10.20 (Positioning Setup) = 3.

0: The INP output signal turns ON immediately.

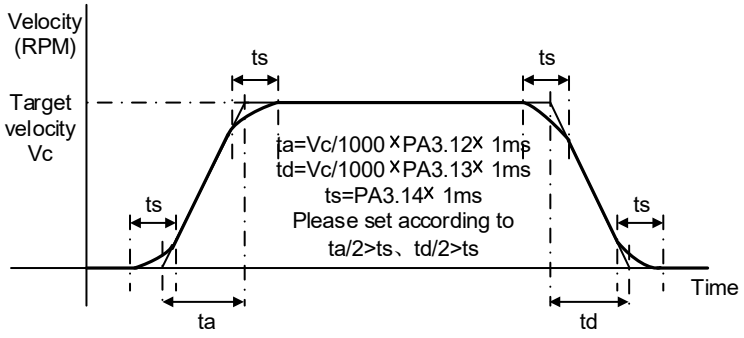
1-10000: The INP output signal remains OFF during the set time (in ms), and turns ON after the set time elapses. It then remains ON until a position command is received, upon which it turns OFF.

3.3.2【Class P11】Velocity Control

P11.07	Label	Sigmoid acceleration/deceleration settings					
	Range	0~1000		Default	0	Unit	ms
	Activation	After re-enable	Attribute	RW		PNU	11707

To set sigmoid acceleration and deceleration turning point in accordance to acceleration and deceleration time.

Sets the S-curve time range centered on the acceleration/deceleration inflection point for the acceleration time (P36.19) and deceleration time (P36.20) settings.



P11.08	Label	Zero speed clamp function select					
	Range	0~2000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	11708

Sets the zero-speed clamp function.

Value	Zero-Speed Clamp Function
0	Disables the zero-speed clamp function.
1	When the zero-speed clamp (ZEROSPD) input signal is valid, the speed command is forcibly set to 0.
2	When the speed command in speed control mode is less than the set value of P11.09 (Zero-Speed Clamp Level), the speed command is forcibly set to 0.
3	When the zero-speed clamp (ZEROSPD) input signal is valid or the speed command in speed control mode is less than the set value of P11.09 (Zero-Speed Clamp Level), the speed command is forcibly set to 0.
4	When the zero-speed clamp (ZEROSPD) input signal is valid and the speed command in speed control mode is less than the set value of P11.09 (Zero-Speed Clamp Level), the speed command is forcibly set to 0.

P11.09	Label	Zero speed clamp level					
	Range	0~2000		Default	30	Unit	rpm
	Activation	Immediate	Attribute	RW		PNU	11709

Sets the judgment level for zero speed.
P11.08 is set to 2, 3, or 4 for this function to take effect.
When P11.08=2 or 3: If the speed command in speed control mode is less than the zero-speed clamp level setting, the speed command is forcibly set to 0.
When P11.08=4: The speed command is forcibly set to 0 when the zero-speed clamp (ZEROSPD) input signal is valid and the speed command in speed control mode is less than the set value of P11.09 (Zero-Speed Clamp Level).

P11.10	Label	Zero speed clamp static time					
	Range	0~2000		Default	0	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	11710

Sets the zero-speed stop delay time in speed mode; that is, the time taken for the motor to come to a complete stop after reaching the zero-speed clamp position.This prevents the motor from creeping slowly when stationary in speed mode.

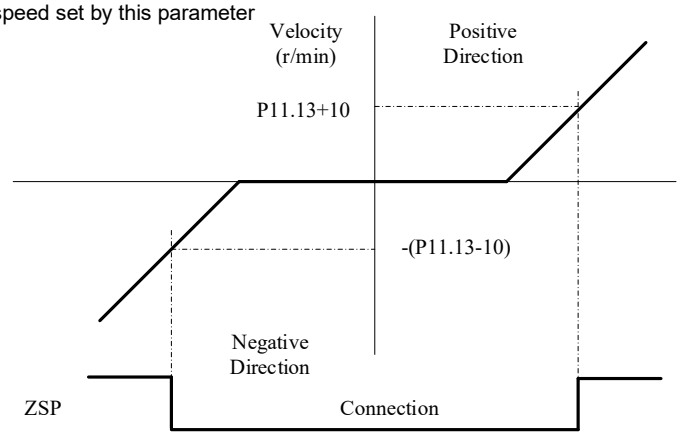
Setting 0: The zero-speed stop delay function is ineffective in speed mode.

Setting 1~2000: The motor comes to a complete stop after the speed reaches P11.09 (Zero-Speed Clamp Level) and the set time has elapsed.

P11.13	Label	Zero Speed Setting					
	Range	1~2000		Default	50	Unit	rpm
	Activation	Immediate	Attribute	RW		PNU	11713

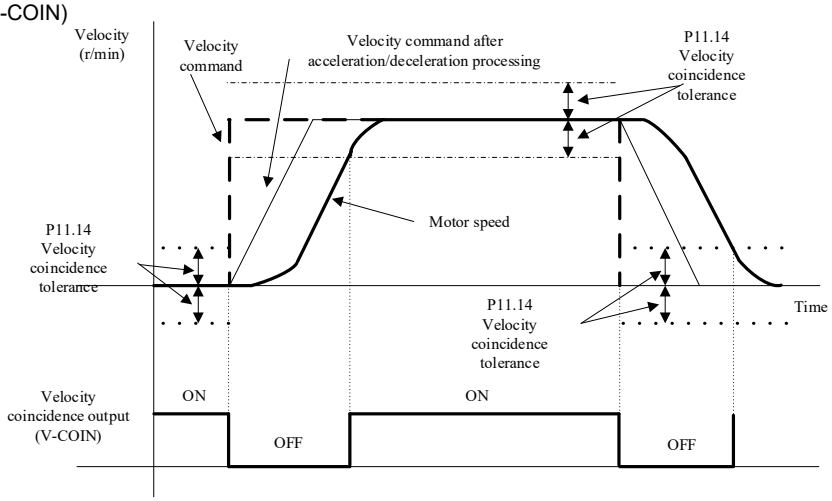
Sets the threshold for the Zero Speed Detection (ZSP).

The Zero Speed Detection signal (ZSP) is output when the motor speed is lower than the speed set by this parameter



P11.14	Label	Speed Coincidence Range Setting		Mode	S	PV	CSV
	Range	10~2000		Default	50	Unit	rpm
	Activation	Immediate	Attribute	RW		PNU	11714

Set the maximum speed allowed for motor operation.If the difference between the speed command and the motor speed is below this set value, the output speed shall be consistent (V-COIN)



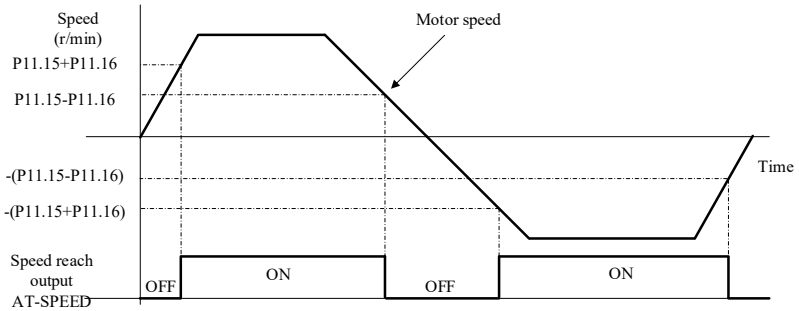
speed consistency output:
Timing of ON → OFF: (P11.14-10)r/min;
Timing of ON ↔ OFF when: (P11.14+10)r/min.

P11.15	Label	Speed Reached Setting					
	Range	10~2000		Default	1000	Unit	rpm
	Activation	Immediate	Attribute	RW		PNU	11715

Sets the detection timing for the Speed Reach Output (AT-SPEED).

The Speed Reach Output (AT-SPEED) is output when the motor speed exceeds the set value.

Hysteresis for detection is specified using P11.16.



P11.16	Label	Speed Reached Hysteresis Band					
	Range	0~100		Default	10	Unit	rpm
	Activation	Immediate	Attribute	RW		PNU	11716

Sets the hysteresis bandwidth for speed arrival detection.
Timing for OFF → ON transition (motor speed absolute value is between P11.15 ± P11.16).
Timing for ON → OFF transition (motor speed absolute value is outside P11.15 ± P11.16).

3.3.3【Class P12】Torque Control

P12.00	**Label**	Torque Mode Selection					
	Range	0~5		**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RW		**PNU**	11800

Set Value	Positive Torque Limit Value	Negative Torque Limit Value
0	P12.01 (1st Torque Limit)	
1	P12.02 (2nd Torque Limit)	
2	TL-SEL OFF	P12.01 (1st Torque Limit)
	TL-SEL ON	P12.02 (2nd Torque Limit)
4	Reserved	
5	P12.01 (1st Torque Limit)	P12.02 (2nd Torque Limit)

In Emergency Stop mode: The torque limit value is determined by P00.39 (Instant Stop Torque Limit Value);
In Jog mode: The torque limit is determined by P47.24 (Jog Mode Instruction Torque Limit);
In Torque Return mode: The torque limit value is determined by P30.09 (Torque Return Torque Limit Value);
In other operating states, the torque limit value selected by P12.00 is used;

P12.01	**Label**	1st Torque Limit					
	Range	0~500		**Default**	350	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	11801

Set the 1st torque limit value of the drive output, which is the percentage of the maximum output current of the driver that the motor cannot exceed

P12.02	**Label**	2nd Torque Limit					
	Range	0~500		**Default**	350	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	11802

Set the 2nd torque limit value of the drive output, which is the percentage of the maximum output current of the driver that the motor cannot exceed.

3.4 Servo Control

3.4.1【Class P20】Gain Parameters

P20.00	Label	1st Position Loop Gain					
	Range	0~3000.0		Default	48.0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13200
	Higher position loop gain value improves the responsiveness of the servo driver and lessens the positioning time. Position loop gain value shouldn't exceed responsiveness of the mechanical system and take in consideration velocity loop gain, if not it might cause vibration, mechanical noise and overtravel. As velocity loop gain is based on position loop gain, please set both values accordingly. Recommended range: 12≤P20.00/P20.01≤18						

P20.01	Label	1st velocity loop gain					
	Range	0.1~3276.7		Default	27	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13201
	To determine the responsiveness of the velocity loop. If inertia ratio of P00.04 is uniform with actual inertia ratio, velocity loop responsiveness = P20.01. To increase position loop gain and improve responsiveness of the whole system, velocity loop gain must be set at higher value. Please notice that if the velocity loop gain is too high, it might cause vibration.						
P20.02	Label	1st Integral Time Constant of Velocity Loop					
	Range	1~1000.0		Default	21.0	Unit	Ms
	Activation	Immediate	Attribute	RW		PNU	13202
	If auto gain adjusting function is not enabled, P20.02 is activated. The lower the set value, the closer the lag error at stop to 0 but might cause vibration. If the value set is overly large, overshoot, delay of positioning time duration and lowered responsiveness might occur. Set 10000 to deactivate P20.02. Recommended range: 50000≤P01.01xP20.02≤150000 For example: Velocity loop gain P20.01=500(0.1Hz), which is 50Hz. Integral time constant of velocity loop should be 100(0.1ms)≤P20.02≤300(0.1ms)						

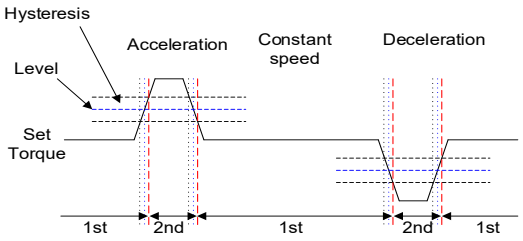
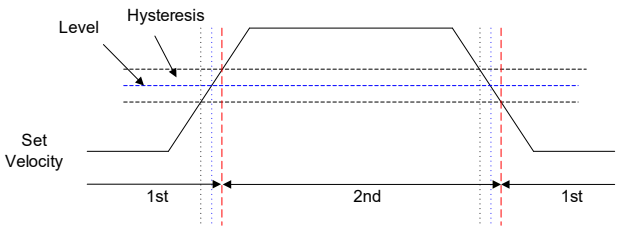
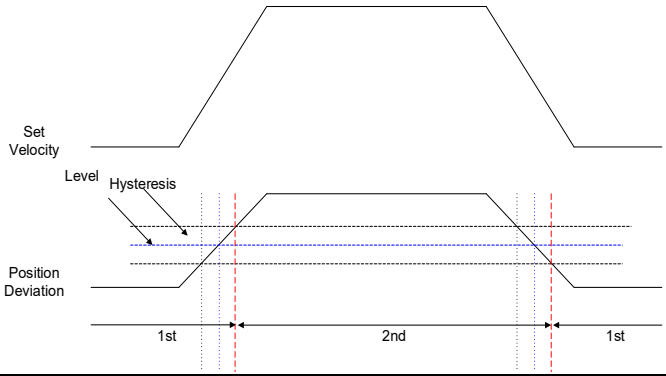
P20.04	Label	1st torque filter time constant Time Constant					
	Range	0.00~25.00		Default	0.84	Unit	Ms
	Activation	Immediate	Attribute	RW		PNU	13204
	To set torque command low-pass filter, add a filter delay time constant to torque command and filter out the high frequencies in the command. Often used to reduce or eliminate some noise or vibration during motor operation, but it will reduce the responsiveness of current loop, resulting in undermining velocity loop and position loop control. P01.04 needs to match velocity loop gain. Recommended range: 1,000,000/(2π×P01.04) ≥P01.01×4 For example: Velocity loop gain P01.01=180(0.1Hz) which is 18Hz. Time constant of torque filter should be P01.01≤221(0.01ms) If mechanical vibration is due to servo driver, adjusting P01.04 might eliminate the vibration.						

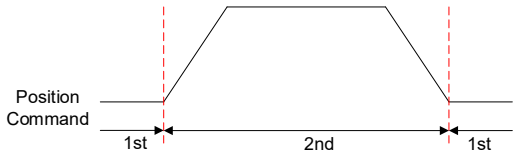
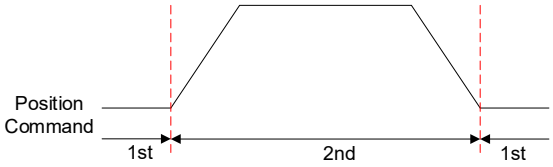
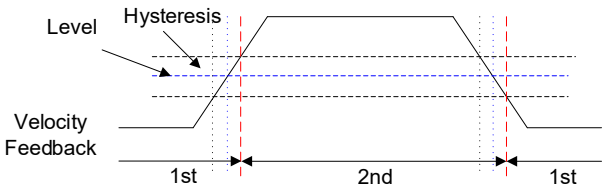
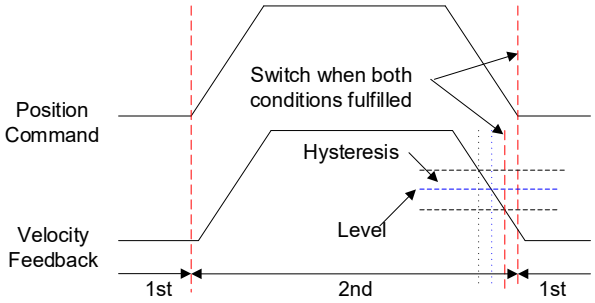
P20.05	Label	2nd Position Loop Gain					
	Range	0.0~3000.0		Default	57.0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13205
P20.06	Label	2nd velocity loop gain					
	Range	0.1~3276.0		Default	27.0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13206
P20.07	Label	2nd Integral Time Constant of Velocity Loop					
	Range	0.1~1000.0		Default	1000	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	13207
P20.09	Label	2nd Torque Filter Time Constant					
	Range	0.0~25.0		Default	0.84	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	13209
	Same as above						

P20.10	Label	Velocity feed forward gain					
	Range	0.0~1.000		Default	0.3	Unit	1
	Activation	Immediate	Attribute	RW		PNU	13210
	According to the position command feedforward compensation amount calculated by the differentiation, the speed command calculated by the differentiation is multiplied by the setting value of this parameter, skipping the "position controller" and directly added to the speed command input. This parameter is often used to reduce the following error and stabilize the setting value during slow speed response. **Increasing the setting value**: It can enhance the front feedback compensation amount, further reduce the following error, and improve the response agility of the system. However, please note that if the setting value is too large, it may easily cause system overshoot or oscillation. It is recommended to set it in combination with the actual commissioning situation. **Decreasing the setting value**: The front feedback compensation effect is weakened, and the system stability is improved. But it may lead to an increase in the following error and a slower response speed. This setting is suitable for working conditions that require high stability of the dynamic response of the system.						

P20.11	**Label**	Velocity feed forward filter time constant					
	Range	0.0~64.00		**Default**	0.50	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	13211
	Set velocity feed forward low pass filter to eliminate high or abnormal frequencies in velocity feed forward command. Often used when position command with low resolution or high electronic gear ration to smoothen velocity feed forward. Position deviation under constant velocity can be lowered with higher velocity feed forward gain. Please to refer to the equation below. Position deviation[Uint]= $\frac{Set\ velocity[\frac{Uint}{s}]}{Position\ loop\ gain[Hz]} x \frac{100 - Velocity\ feed\ foward\ gain[\%]}{100}$						
P20.12	**Label**	Torque feedforward gain					
	Range	0.0~1.0		**Default**	0	**Unit**	1
	Activation	Immediate	**Attribute**	RW		**PNU**	13212
	Before using torque feed forward, please set correct inertia ratio P20.04. By increasing torque feed forward gain, position deviation on constant acceleration/deceleration can be reduced to close to 0. Under ideal condition and trapezoidal speed profile, position deviation of the whole motion can be reduced to close to 0. In reality, perturbation torque will always exist, hence position deviation can never be 0.						
P20.13	**Label**	Torque feed forward filter time constant					
	Range	0.0~64.00		**Default**	0.00	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	13213
	Low pass filter to eliminate abnormal or high frequencies in torque feed forward command. Usually used when encoder has lower resolution or precision. Noise reduces if torque feed forward filter time constant is set higher but position deviation will increase at acceleration varied points.						

P20.15	Label	Position control gain switching mode					
	Range	0.0~12		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13215

Set Value	Condition	Gain switching condition
0	1st gain fixed	Fixed on using 1st gain(P20.00-P20.04)
1	2nd gain fixed	Fixed on using 2nd gain (P20.05-P20.09)
2	Reserved	
3	High set torque	Switch to 2nd gain when set torque command absolute value larger than (level + hysteresis)[%] Switch to 1st gain when set torque command absolute value smaller than (level + hysteresis)[%] 
4	Reserved	Reserved
5	High set velocity	 Valid for position and velocity control. Switch to 2nd gain when set velocity command absolute value larger than (level + hysteresis)[r/min] Switch to 1st gain when set velocity command absolute value smaller than (level-hysteresis)[r/min]
6	Large position deviation	Valid for position control. Switch to 2nd gain when position deviation absolute value larger than (level + hysteresis)[pulse] Switch to 1st gain when position deviation absolute value smaller than (level-hysteresis)[pulse] 

7	Pending position command	Valid for position control. Switch to 2nd gain if position command ≠ 0 Switch to 1st gain if position command remains = 0 throughout the duration of delay time. 
8	Not yet in position	Valid for position control. Switch to 2nd gain if position command is not completed. Switch to 1st gain if position command remains uncompleted throughout the duration of delay time. 
9	High actual velocity	Valid for  position control. Switch to 2nd gain when actual velocity absolute value larger than (level + hysteresis)[r/min] Switch to 1st gain when actual velocity absolute value remains smaller throughout the duration of delay time than (level-hysteresis)[r/min]
10	Pending position command +actual velocity	Valid for position control. Switch to 2nd gain if position  command ≠ 0 Switch to 1st gain if positional command = 0 throughout the duration of delay time and absolute value of actual velocity remains smaller than (level - hysteresis) (r/min)

For position control mode, set P20.15=3,5,6,9,10;

For velocity control mode, set P20.15=3,5,9;

*** Above 'level' and 'hysteresis' are in correspondence to P20.17 Position control gain switching level and P20.18 Hysteresis at position control switching.*

P20.16	**Label**	Position Control Switching Delay					
	Range	0.0~1000.0		**Default**	0.0	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	13216
	When P20.15 is set to 2, 3, or 10, it represents the time from the detection trigger to the actual gain switchover when switching from the 1st gain to the 2nd gain.						
P20.17	**Label**	Position control gain switching level					
	Range	0~20000		**Default**	50	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	13217

Set threshold value for gain switching to occur.
Unit is mode dependent.

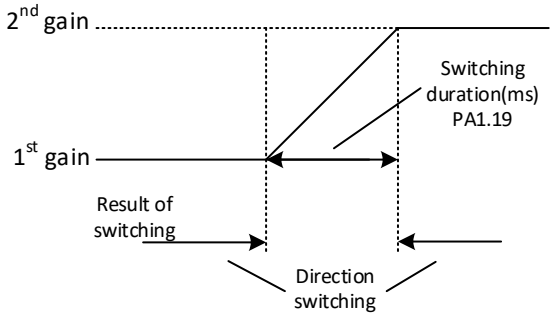
Switching condition	Unit
Position	Encoder pulse count
Velocity	RPM
Torque	%

Please set level ≥ hysteresis

P20.18	**Label**	Hysteresis at position control switching					
	Range	0~20000		**Default**	33	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	13218
	To eliminate the instability of gain switching. Used in combination with P20.17 If level< hysteresis, drive will set internally hysteresis = level.						

P20.19	**Label**	Position gain switching time		**Mode**	**P/PP/HM/CSP**		
	Range	0~1000.0		**Default**	3.3	**Unit**	Ms
	Activation	Immediate	**Attribute**	RW		**PNU**	13219

During position control, if 1st and 2nd gain difference is too large, to ease torque changes and vibration due to rapid changes in position loop gain, set suitable P01.19 value
For example: 1st (P20.00) <-> 2nd (P20.05)



P20.21	**Label**	Speed Regulator - kr					
	Range	0~200		**Default**	100	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	13221
	Speed command adjustment coefficient: used to adjust the relationship between the target value and feedback, and affect the system's response to errors.						
P20.22	**Label**	Speed Feedback Filter Level					
	Range	0~15		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	13222

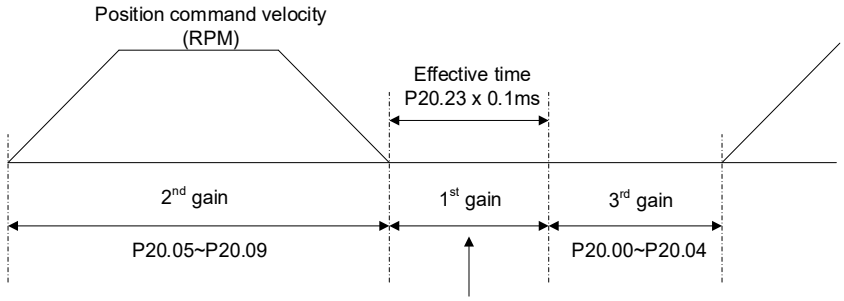
Set the filtering times for speed feedback. The larger the filtering times, the smaller the fluctuation will be, but the greater the delay will be.

P20.23	**Label**	3rd Position Gain Active Time					
	Range	0~10000		**Default**	0	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	13223

Set the effective time of the 3rd gain.
When not in use, please set P20.23=0 and P20.24=100.

P20.24	**Label**	3rd Position Gain Multiplier					
	Range	0~1000		**Default**	100	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	13224

The 3rd gain becomes effective after the position command speed reaches zero and the time set by



P20.23 has elapsed.
3rd gain = 1st gain × P20.24 / 100.
The 3rd gain does not change the original speed loop integral time, speed filter, or torque filter values.

P20.28	**Label**	Speed Observer Gain					
	Range	0~32767		**Default**	160	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	13228

The servo system usually obtains the motor position through encoder feedback and then calculates the speed through differentiation. The differentiation calculation will introduce noise and delay.
The speed observer is a technology based on motor mathematical models and real-time current sampling. It can estimate a smoother and lower-latency speed signal, serving as a supplement or alternative to speed control.
P20.28 is the gain of the observer. It determines the correction force of the observer on the speed estimation error.
(1) A higher gain value: The system responds faster to speed changes and can track actual speed changes more quickly, but it is also more sensitive to feedback noise.
(2) A lower gain value: The observer responds more slowly, and the noise suppression capability is stronger, but the estimation will have a lag.

P20.29	**Label**	Speed Observer Bandwidth					
	Range	0~32767		**Default**	160	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	13229

The servo system obtains motor position feedback via an encoder and calculates speed through differentiation. This process introduces noise and delay.
The speed observer is an algorithm based on motor mathematical models and real-time current sampling. It can estimate a smoother speed signal with lower latency, serving as a supplement or alternative to speed control.

P20.29 directly sets the bandwidth of this observer algorithm.
(1) Higher numerical value: The observer has a wider bandwidth and a faster response, enabling it to track actual speed changes more quickly. However, it is more sensitive to feedback noise and may cause high-frequency system oscillations.
(2) Lower numerical value: The observer has a narrower bandwidth and a slower, more stable response. It has strong noise suppression capabilities and stable estimation, but this introduces lag, leading to dynamic state hysteresis.

3.4.2【Class P21】Self-Tuning Parameters

P21.00	Label	Model-following bandwidth(MFC)					
	Range	0~2000.0		Default	0.1	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13300

Model-following bandwidth, also known as model-following control (MFC), is used to control the position loop to improve the responsiveness to commands, speed up positioning time and reduce following error. The effect is obvious especially in low and medium mechanical stiffness. Use mainly for MFC or ZTC tuning.

Value	Description
0	Disable the function.
0.1	Enable the function to set bandwidth automatically
0.2~0.9	Reserved
1~2000.0	Manually set the bandwidth; belt application recommend 3.0~10.0

P21.01	Label	Real-time auto adjustment mode					
	Range	0x0~0xFFF		Default	0x5	Unit	
	Activation	Immediate	Attribute	RW		PNU	13301

Set up the mode of the real time auto gain adjusting.

Data bits	Category	Settings	Application
0x00_	Motion setting mode	Used to set motion setting mode, which can be selected according to the motion characteristics or setting requirements. Generally, it is recommended to select mode 1 with good generality when there is no special requirement, mode 2 when rapid positioning is needed If mode 1 and mode 2 cannot meet the requirements, please choose mode 0.	
		0:Manual	P21.02 invalid. Gain value must be adjusted manually and accordingly.
		1:Standard	P21.02 valid. Quick gain adjusting can be achieved by changing P00.03 stiffness value. Gain switching is not used in this mode, suitable for applications with requirements for stability.
		2:Positioning	P21.02 valid. Quick gain adjusting can be achieved by changing P00.03 stiffness value. This mode is suitable for applications requiring quick positioning. Not recommended for load mounted vertical to ground, or please compensate for the load using P21.25
		3: Standard Expansion	Consistent with the 1-standard mode; the difference lies in that the gain used in the same rigid software is different.

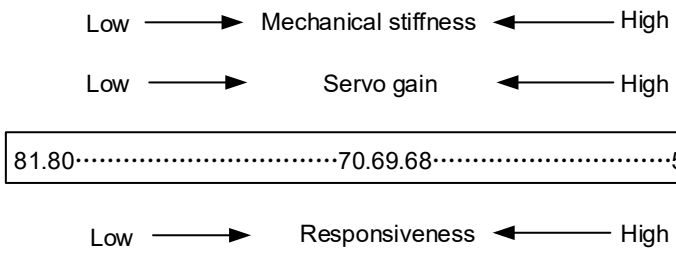
		4: Positioning Expansion	Consistent with the 2-positioning mode; the difference lies in that the gain used in the same rigid software is different.
		5: Standard + Inertia Identification & Notch Auto-Setting	On the basis of the 1-standard mode, add inertia identification and notch auto-setting; after the setting is completed, automatically return to the standard mode 0x5 → 0x1.
		6: Positioning + Inertia Identification & Notch Auto-Setting	On the basis of the 2-positioning mode, add inertia identification and notch auto-setting; after the setting is completed, automatically return to the positioning mode 0x6 → 0x2.
0x0_0	Load type setting	Used to select the load type, choose according to load-inertia ratio and mechanical structure.	
		0: Rigid structure	This mode prioritizes system responsiveness. Use this mode when there is a relatively rigid structure with low load inertia. Typical application including directly connected high-precision gearbox, lead screw, gears, etc.
		1:High inertia	For applications with higher load inertia (10 times or above), gain settings take into account both machine stability and responsiveness. Not recommended to set stiffness above 15 for high load inertia.
		2: Flexible structure	This mode prioritizes system stability. Use this mode when there is low rigidity structure with high load inertia. Typical applications included belts and chains.
0x_00	*Reserved*		

The setting type combination is a hexadecimal standard, as follows:

Setting type combination	Application type
0X000	Rigid structure + Manual
0X001	Rigid structure +Standard
0X002	Rigid structure +Positioning
0X010	High inertia + Manual
0X011	High inertia + Standard
0X012	High inertia + Positioning
0X020	Flexible structure + Manual
0X021	Flexible structure +Standard
0X022	Flexible structure +Positioning

P21.02	Label	Real time Auto stiffness adjusting					
	Range	50~81		Default	70	Unit	
	Activation	Immediate	Attribute	RW		PNU	13302

Valid when P21.02 = 1,



Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Please stop the motor before doing any changes to the stiffness settings.
When P21.01 = 0x010, please set stiffness level to around 65.

P21.03	Label	Inertia ratio					
	Range	0~20000		Default	250	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13303

P21.03=(load inertia/motor rotational inertia)×100%

Set inertia ratio according to actual load inertia. When both are uniform, actual motor velocity loop responsiveness and gain settings will be consistent. If inertia ratio is greater than actual value, velocity loop gain settings will be higher and vice versa.
For motor with high inertia, P21.03 can be left unfilled but optimal setting of P21.03 could improve system performance.

P21.04	Label	MFC Curve Damping Correction Coefficient					
	Range	-100.00~100.00		Default	0.00	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13304

Used to improve positioning smoothness and positioning time.

P21.05	Label	Forward/Reverse Torque Comp Gain Difference Percentage					
	Range	-20.00~20.00		Default	0.00	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13305

Used to set the difference ratio of torque compensation gains between the forward rotation and reverse rotation of the servo motor, with the forward torque being P21.05×100% of the reverse torque.

P21.06	Label	MFC Type					
	Range	0~5		Default	3	Unit	
	Activation	Immediate	Attribute	RW		PNU	13306

Set value	Description
【0】	Model following control
1	Zero tracking control
2	3 inertia (future upgrade)
3	Path following (future upgrade)
4	Traditional Feedforward
5	Vibration Suppression Type

P21.07	Label	Velocity feedforward compensation coefficient					
	Range	-10000~ 10000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	13307

This parameter is used for feedforward compensation of speed to reduce system tracking errors and improve dynamic response speed. As an open-loop control technology, it predicts load changes or command changes to adjust control output in advance, making the system more stable and accurate.

P21.08	Label	Torque feedforward compensation coefficient					
	Range	-10000~ 10000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	13308

This parameter enables feedforward compensation for torque control when set, enhancing the system's ability to predict and compensate for load changes (such as external torque disturbances). This improves the system's response speed and reduces tracking errors. As an open-loop control strategy, feedforward compensation, when combined with feedback control, significantly improves overall system stability.

P21.09	Label	Dynamic friction compensation coefficient					
	Range	0~1000		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13309

To set ratio of rated torque/rated rotational speed, to compensate for dynamic friction during motion and have better control over acceleration/deceleration.

$$\text{Dynamic friction coefficient} = \left| \frac{\text{Torque(Rotational speed 1)} - \text{Torque(Rotational speed 2)}}{\text{Rotational speed 1} - \text{Rotational speed 2}} * \text{rated rotational speed} \right|$$

When there is an excess position deviation during acceleration/deceleration, please adjust friction coefficient to reduce the deviation to 0.

P21.10	Label	Overtravel time coefficient					
	Range	0~10000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	13310

By setting this time constant, the system's overshoot suppression capability can be adjusted. The settling time refers to the time it takes for the system (such as position, speed, etc.) to return to and stabilize within a specified range after a target value disturbance. This parameter adjusts the damping characteristic of the control algorithm, reducing overshoot and making the system run more smoothly.

P21.11	Label	Overtravel suppression gain					
	Range	0~1000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	13311
	Suppression improves with larger set value but might affect the performance of MFC. Please use with caution for any value above 100.						

P21.12	Label	One-click Tuning Mode					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13312

Functions	Bit	Value	Description
Response Level Setting	bit0~3	0	Medium response
		1	Low response
		2	High response
Operation Mode Setting	bit4~7	0	Positioning
		1	Interpolation
Operation Direction Setting	bit8~9	1	Forward/Reverse operation
		1	Forward operation
		2	Reverse operation
Inertia Identification Failure Alarm Shielding Setting	bit10	0	Do not shield inertia identification failure alarm
		1	Shield inertia identification failure alarm

P21.14	Label	One-click Tuning Progress					
	Range	0~100		Default	0	Unit	
	Activation	Immediate	Attribute	RO		PNU	13314
	Displays the current progress of the One-click Tuning.						

P21.15	Label	One-click Tuning Error Code					
	Range	0x0~0xFFFF		Default	0x1	Unit	
	Activation	Immediate	Attribute	RO		PNU	13315
	Displays the error code for the current One-click Tuning.						

P21.16	Label	One-click Tuning Velocity Limit					
	Range	10~6000		Default	1500	Unit	r/min
	Activation	Immediate	Attribute	RW		PNU	13316
	Displays the One-click Tuning Velocity Limitation						

P21.19	Label	Auxiliary Tuning Mode					
	Range	0x0~0x6		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13319
	Set auxiliary adjustment mode: Bit0: Automatic softness Bit1: Automatic rigidity						

P21.20	Label	Ltune Close Time					
	Range	0~6000		Default	0	Unit	s
	Activation	Immediate	Attribute	RW		PNU	13320
	Set Ltune tuning time						

P21.21	Label	Ltune Progress					
	Range	0~100		Default	0	Unit	%
	Activation	Immediate	Attribute	RO		PNU	13321
	Displays the Ltune progress in tuning.						

P21.22	Label	Friction Compensation Function Setting					
	Range	1~1000		Default	1	Unit	r/min
	Activation	Immediate	Attribute	RW		PNU	13322
	This parameter is used by the driver's main output to set additional torque compensation for overcoming mechanical transmission friction, addressing issues such as low-speed crawling, shaking, and error following, and improving the smoothness of motor movement. The larger the value, the stronger the compensation effect, and the greater the output compensation torque. =0: The default value is equivalent to 1, indicating a fixed and small friction compensation value. =x, Range 1~1000: Represents the friction compensation strength. The calculation formula for the compensated torque rate is: (x+1)/10000 Example: If set to 499, the compensation rate is (499+1)/10000=500/10000=5%					

P21.23	Label	Positive Torque Compensation Value					
	Range	-100~100		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13323
	Set to add feedforward torque superposition to the torque command, mainly for friction compensation in horizontal movement.It reduces the impact of friction in mechanical transmission on operation effects and provides positive and negative compensation values for torque in the same forward and reverse direction. Example: When the motor speed is at a constant speed, the monitored torque output value for forward operation is recorded as T1, and the torque output value for reverse operation is recorded as T2. If T2 = |T1-T2|/2, the friction torque is Tf = |T1-T2|/2. The magnitude of Tf is determined by the settings of P21.23 and P21.24. Note: Positive and negative compensation directions are determined based on the actual position command. The forward torque compensation value is set to positive (P21.23=+Tf), and the reverse direction friction compensation value is set to negative (P21.24=-Tf).					

P21.24	Label	Negative Torque Compensation Value					
	Range	-100~100		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13324
	Check 21.23						

P21.25	Label	Torque Command Additive Value					
	Range	-100~100		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13325
	Set the feedforward addition value of the vertical torque. It is applied to vertical load conditions to compensate for the torque caused by gravity. Example: When moving along the vertical direction, select any position within the stroke as the load point. When the load moves to that point, the motor is controlled to stop but not move. Record the torque value T output at that time as the torque command addition value (gravity compensation value).						

P21.27	Label	Vibration Detection Threshold					
	Range	0~10		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13327
	Set the threshold value for the alarm when the position error exceeds the set value (Er190). 0:optical 5%, Magnetic 10%						

P21.30	Label	Inertia Identification Value					
	Range	-2147483648~2147483647		Default	0	Unit	%
	Activation	Immediate	Attribute	RO		PNU	13330
	Displays the Inertia Identification Value						

P21.32	Label	Tuning Completion Count					
	Range	-2147483648~2147483647		Default	0	Unit	
	Activation	Immediate	Attribute	RO		PNU	13332
	Displays the Tuning Completion Count						

P21.33	Label	Tuning Completion Time					
	Range	-2147483648~2147483647		Default	0	Unit	s
	Activation	Immediate	Attribute	RO		PNU	13333
	Displays the Tuning Completion Time						

P21.34	Label	Tuning Overshoot					
	Range	-2147483648~2147483647		Default	0	Unit	%
	Activation	Immediate	Attribute	RO		PNU	13334
	Displays the Tuning Overshoot						

P21.35	Label	Tuning Jitter Count					
	Range	-2147483648~2147483647		Default	0	Unit	counts
	Activation	Immediate	Attribute	RO		PNU	13335
	Displays the Tuning Jitter Count						

P21.36	Label	Tuning Maximum Current					
	Range	-2147483648~2147483647		Default	0	Unit	%
	Activation	Immediate	Attribute	RO		PNU	13336
	Displays the Tuning Maximum Current						

P21.37	Label	Tuning Maximum Velocity					
	Range	-2147483648~2147483647		Default	0	Unit	r/min
	Activation	Immediate	Attribute	RW		PNU	13337
	Displays the Tuning Maximum Velocity						

P21.41	Label	Vibration Monitor Value					
	Range	-2147483648~2147483647		Default	0	Unit	%
	Activation	Immediate	Attribute	RO		PNU	13341
	Displays the Vibration Monitor Value						

3.4.2【Class P22】Filter Parameter

P22.00	Label	Adaptive filtering mode settings					
	Range	0~4		Default	3	Unit	
	Activation	Immediate	Attribute	RW		PNU	13400

Set value	Description	
0	Adaptive filter: invalid	Parameters related to 3rd and 4th notch filter remain unchanged
1	Adaptive filter: 1 filter valid for once.	1 adaptive filter becomes valid. 3rd notch filter related parameters updated accordingly. P22.00 switches automatically to 0 once updated.
2	Adaptive filter: 1 filter remains valid	1 adaptive filter becomes valid. 3rd notch filter related parameters will keep updating accordingly.
3	Adaptive filter: 1&2 filter remains valid	1 & 2 adaptive filter becomes valid. 3rd & 4th notch filter related parameters will keep updating accordingly.
4	-	Filtering clearing.

P22.01	Label	1st notch frequency					
	Range	50~8000		Default	8000	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13401
	Set center frequency of 1st torque command notch filter. Set P22.01 to 8000 to deactivate notch filter						

P22.02	Label	1st notch bandwidth					
	Range	0~20		Default	4	Unit	
	Activation	Immediate	Attribute	RW		PNU	13402
	Set notch bandwidth for 1st resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P22.01 and P22.03, P22.02 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.						

P22.03	Label	1st notch depth					
	Range	0~99		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13403
	Set notch depth for 1st resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P22.01 and P22.02, P22.03 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings						

P22.04	Label	2nd notch frequency					
	Range	50~8000		Default	8000	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13404
	Set center frequency of 2nd torque command notch filter. Set P22.04 to 8000 to deactivate notch filter						

P22.05	Label	2nd notch bandwidth					
	Range	0~20		Default	4	Unit	
	Activation	Immediate	Attribute	RW		PNU	13405
	Set notch bandwidth for 2nd resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P22.04 and P22.06, P22.05 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.						

P22.06	Label	2nd notch depth					
	Range	0~99		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13406
	Set notch depth for 1st resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P22.04 and P22.05, P22.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings						

P22.07	Label	3rd notch frequency					
	Range	50~8000		Default	8000	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13407
	Set center frequency of 3rd torque command notch filter. Set P22.07 to 8000 to deactivate notch filter						

P22.08	Label	3rd notch bandwidth					
	Range	0~20		Default	4	Unit	
	Activation	Immediate	Attribute	RW		PNU	13408
	Set notch bandwidth for 3rd resonant notch filter. Same as above.						

P22.09	Label	3rd notch depth					
	Range	0~99		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13409
	Set notch depth for 3rd resonant notch filter. Same as above.						

P22.10	Label	4th notch frequency					
	Range	50~8000		Default	8000	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13410
	Set center frequency of 4th torque command notch filter. Set P22.10 to 8000 to deactivate notch filter						

P22.11	Label	4th notch bandwidth					
	Range	0~20		Default	4	Unit	
	Activation	Immediate	Attribute	RW		PNU	13411
	Set notch bandwidth for 4th resonant notch filter. Same as above.						

P22.12	Label	4th notch depth					
	Range	0~99		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13412
	Set notch depth for 4th resonant notch filter. Same as above.						

P22.13	Label	1st Vibration Suppression Frequency					
	Range	0~200		Default	0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13413
	Set the vibration suppression frequency to suppress end shaking. After measuring the vibration frequency of the load, set it in units of 0.1 [Hz]. 0.0: Turn off the vibration suppression function. 1.0~200.0: Set the vibration suppression frequency. Note: The suppression function targets end shaking. It is specifically used to suppress end shaking caused by high deceleration impacts during motor stops, which is particularly effective for shaking at frequencies around 100Hz. During use, set this parameter to the frequency of the shaking. (For vibration frequencies, you can try to use servo adjustment software to collect waveform analysis for acquisition).						

P22.14	Label	1st Vibration Suppression Filter					
	Range	0~99		Default	1	Unit	
	Activation	Immediate	Attribute	RW		PNU	13414
	Set the gain of the 1st-order low-pass filter; a higher gain results in a more significant vibration suppression effect, but it may also introduce time delay and reduce the response speed.						

P22.15	Label	2nd Vibration Suppression Frequency					
	Range	0~200		Default	0	Unit	H
	Activation	Immediate	Attribute	RW		PNU	13415
	Check 22.13						

P22.16	Label	2nd Vibration Suppression Filter					
	Range	0~9		Default	1	Unit	
	Activation	Immediate	Attribute	RW		PNU	13416
	Check 22.14						

P22.17	Label	MFC vibration damping frequency 1					
	Range	0.0~2000.0		Default	0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13417
	Set the MFC vibration damping frequency; set P21.06 – MFC type to Mode 5 to enable it.						

P22.18	Label	MFC Vibration Damping 1					
	Range	0~1000		Default	1	Unit	
	Activation	Immediate	Attribute	RW		PNU	13418
	Set the MFC vibration damping; set P21.06 – MFC type to Mode 5 to enable it.						

P22.19	Label	MFC vibration damping frequency 2					
	Range	0.0~2000.0		Default	0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13419
	Set the MFC vibration damping frequency; set P21.06 – MFC type to Mode 5 to enable it.						

P22.20	Label	MFC Vibration Damping 2					
	Range	0~1000		Default	1	Unit	
	Activation	Immediate	Attribute	RW		PNU	13420
	Set the MFC vibration damping; set P21.06 – MFC type to Mode 5 to enable it.						

P22.47	Label	d-axis Current Filter Time Constant					
	Range	0~2500		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13417
	Sets the time constant for the d-axis current low-pass filter. A larger value provides stronger ripple suppression, but also increases delay and reduces response speed.						

3.5 Basic Functions

3.5.1【Class P30】Homing Function

P30.00	**Label**	Homing Mode					
	Range	-6~37		**Default**	19	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	14800
Homing Mode setting , check homing page for more details.							

P30.01	**Label**	Homing High Speed					
	Range	0~2147483647		**Default**	13981013	**Unit**	unit/s
	Activation	Immediate	**Attribute**	RW		**PNU**	14801
Homing High Speed setting							
P30.02	**Label**	Homing Low Speed					
	Range	0~2147483647		**Default**	139810 1	**Unit**	unit/s
	Activation	Immediate	**Attribute**	RW		**PNU**	14802
Homing Low Speed setting							
P30.03	**Label**	Homing Acceleration/Deceleration					
	Range	0~2147483647		**Default**	139810 1333	**Unit**	unit/s2
	Activation	Immediate	**Attribute**	RW		**PNU**	14803
Homing Acceleration/Deceleration setting							
P30.04	**Label**	Current position as origin					
	Range	0~1		**Default**	0	**Unit**	unit
	Activation	Immediate	**Attribute**	RW		**PNU**	14804
Force-set the current servo position as the coordinate origin to establish a new coordinate reference for subsequent absolute positioning and relative positioning.							
P30.08	**Label**	Homing Position Offset					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	unit
	Activation	Immediate	**Attribute**	RW		**PNU**	14808
Homing Position Offset setting							
P30.09	**Label**	Torque Homing Force Limit					
	Range	0~150		**Default**	80	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	14809
Torque Homing Force Limit setting							
P30.10	**Label**	Torque Homing Time					
	Range	0~200		**Default**	50	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	14810

	Torque Homing & Torque Holding Time setting						
P30.11	**Label**	Homing Overtravel					
	Range	0~214748364.7		**Default**	0	**Unit**	r
	Activation	Immediate	**Attribute**	RW		**PNU**	14811
	Homing Overtravel setting						
P30.12	**Label**	Homing Timeout					
	Range	0~1000000		**Default**	60000	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	14812
	Set the threshold value for the return-to-zero timeout alarm. If the return-to-zero time exceeds the set threshold, the system will trigger the alarm Er741 (HomingTimeout).						
P30.14	**Label**	Homing In-Place Threshold					
	Range	0~100		**Default**	8	**Unit**	unit
	Activation	Immediate	**Attribute**	RW		**PNU**	14814
	Homing In-Place Threshold setting						
P30.15	**Label**	Homing Auxiliary Function					
	Range	0x0~0x1		**Default**	0x1	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	14815
	Bit0: Set 1, clear the origin position.						
P30.18	**Label**	Homing Axis Delay Time					
	Range	0~15000		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	14818
	Homing Axis Delay Time setting						
P30.22	**Label**	Homing Maximum speed limit					
	Range	0~3000		**Default**	0	**Unit**	rpm
	Activation	Immediate	**Attribute**	RW		**PNU**	14822
	Homing Maximum speed limit setting						

3.6 Advanced Functions

3.6.1【Class P41】Position Comparison Output

P41.00	**Label**	Position comparison enable					
	Range	0~3		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16500
	Set position comparison enable; position comparison will start after the enable becomes valid: 0: Disable;1: Enable (rising edge active).						

P41.01	**Label**	Position Comparison Mode Selection					
	Range	0~255		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16501
	Set position comparison mode: 0: Sequential comparison; 1: Reciprocal comparison.						
P41.02	**Label**	Position Comparison Output Width					
	Range	0.1~409.5		**Default**	0.1	**Unit**	Ms
	Activation	Immediate	**Attribute**	RW		**PNU**	16502
	Set the pulse width of the output signal when the position comparison point is reached.						
P41.03	**Label**	Position Comparison Pulse Output Compensation					
	Range	-1000.0~1000.0		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16503
	Set the position comparison output delay compensation to compensate for the delay caused by the DO/frequency division output circuit.						
P41.04	**Label**	Position Comparison Start Point Value					
	Range	1~42		**Default**	1	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16504
	Set Position Comparison Start Point Value						
P41.05	**Label**	Position Comparison Stop Point Value					
	Range	1~42		**Default**	1	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16505
	Set Position Comparison Stop Point Value						
P41.06	**Label**	Fixed-Count Mode Cycle Times					
	Range	0~60000		**Default**	1	**Unit**	Counts
	Activation	Immediate	**Attribute**	RW		**PNU**	16506
P41.07	**Label**	Set Current Position as Position Comparison Zero Point					
	Range	0~1		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16507
	Set the zero point for position comparison. When enabled (rising edge active), the current position can be set as the zero point: 0: Disable; 1: Enable (rising edge active).						

P41.08	**Label**	Position Comparison Zero Point offset					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16508
Set the position offset after taking the current position as the zero point for position comparison.							
P41.10	**Label**	Actual position of Position Comparison					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RO		**PNU**	16510
Displays the Actual position of Position Comparison							
P41.11	**Label**	Current Comparison Point of Position Comparison					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	16511
Displays the Current Comparison Point of Position Comparison							
P41.12	**Label**	Position Comparison Output times					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Counts
	Activation	Immediate	**Attribute**	RO		**PNU**	16512
Displays the Position Comparison Output times							
P41.13	**Label**	Position Comparison Cycle Times					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Counts
	Activation	Immediate	**Attribute**	RO		**PNU**	16513
Displays the Position Comparison Cycle Times							
P41.15	**Label**	Position Comparison resolution					
	Range	-2147483648~2147483648		**Default**	2500	**Unit**	Counts
	Activation	Immediate	**Attribute**	RO		**PNU**	16515
Set the position comparison resolution.							

P41.16	**Label**	Position Comparison filter					
	Range	0~32		**Default**	0	**Unit**	Counts
	Activation	Immediate	**Attribute**	RO		**PNU**	16516
Position comparison filter setting, used to suppress output jitter when the motor stops at the position comparison point. The higher the setting value, the stronger the filtering effect and the better the anti-jitter performance; however, this may result in a slight delay in triggering.							

3.6.2【Class P42】Target Position Parameter

P42.00	**Label**	Position Comparison 1 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16600
Set the target value for the position comparison point. When the position reaches this comparison point, the position comparison point's attribute (position comparison value) will be output.							

P42.01	**Label**	Position Comparison 1 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16601

bit	Position Comparison Point 1 Attribute
0	=0: No forward pass comparison; =1: Forward pass comparison
1	=0: No reverse pass comparison; =1: Reverse pass comparison
2~5	Reserved
6	Output attribute setting: =0: Pulse mode; =1: Toggle mode
7	DO1 output
8	DO2 output
9	DO3 output
10~12	Reserved
13	Frequency division phase A output
14	Frequency division phase B output
15	Frequency division phase Z output

P42.02	**Label**	Position Comparison 2 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16602
Check 42.00 for details							
P42.03	**Label**	Position Comparison 2 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16603
Check 42.01 for details							
P42.04	**Label**	Position Comparison 3 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16604
Check 42.00 for details							
P42.05	**Label**	Position Comparison 3 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16605
Check 42.01 for details							
P42.06	**Label**	Position Comparison 4 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16606
Check 42.00 for details							

P42.07	Label	Position Comparison 4 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16607
Check 42.01 for details							
P42.08	Label	Position Comparison 5 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16608
Check 42.00 for details							

P42.09	Label	Position Comparison 5 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16609
Check 42.01 for details							

P42.10	Label	Position Comparison 6 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16610
Check 42.00 for details							
P42.11	Label	Position Comparison 6 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16611
Check 42.01 for details							
P42.12	Label	Position Comparison 7 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16612
Check 42.00 for details							
P42.13	Label	Position Comparison 7 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16613
Check 42.01 for details							
P42.14	Label	Position Comparison 8 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16614
Check 42.00 for details							
P42.15	Label	Position Comparison 8 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16615
Check 42.01 for details							

P42.16	Label	Position Comparison 9 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16616
Check 42.00 for details							

P42.17	**Label**	Position Comparison 9 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16617
Check 42.01 for details							
P42.18	**Label**	Position Comparison 10 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16618
Check 42.00 for details							
P42.19	**Label**	Position Comparison 10 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16619
Check 42.01 for details							
P42.20	**Label**	Position Comparison 11 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16620
Check 42.00 for details							
P42.21	**Label**	Position Comparison 11 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16621
Check 42.01 for details							
P42.22	**Label**	Position Comparison 12 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16622
Check 42.00 for details							

P42.23	**Label**	Position Comparison 12 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16623
Check 42.01 for details							

P42.24	**Label**	Position Comparison 13 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16624
Check 42.00 for details							
P42.25	**Label**	Position Comparison 13 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16625
Check 42.01 for details							
P42.26	**Label**	Position Comparison 14 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16626
Check 42.00 for details							

P42.27	**Label**	Position Comparison 14 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16627
Check 42.01 for details							
P42.28	**Label**	Position Comparison 15 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16628
Check 42.00 for details							
P42.29	**Label**	Position Comparison 15 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16629
Check 42.01 for details							

P42.30	**Label**	Position Comparison 16 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16630
Check 42.00 for details							

P42.31	**Label**	Position Comparison 16 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16631
Check 42.01 for details							
P42.32	**Label**	Position Comparison 17 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16632
Check 42.00 for details							
P42.33	**Label**	Position Comparison 17 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16633
Check 42.01 for details							
P42.34	**Label**	Position Comparison 18 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16634
Check 42.00 for details							
P42.35	**Label**	Position Comparison 18 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16635
Check 42.01 for details							
P42.36	**Label**	Position Comparison 19 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16636
Check 42.00 for details							

P42.37	**Label**	Position Comparison 19 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16637
	Check 42.01 for details						

P42.38	**Label**	Position Comparison 20 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16638
	Check 42.00 for details						
P42.39	**Label**	Position Comparison 20 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16639
	Check 42.01 for details						
P42.40	**Label**	Position Comparison 21 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16640
	Check 42.00 for details						
P42.41	**Label**	Position Comparison 21 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16641
	Check 42.01 for details						
P42.42	**Label**	Position Comparison 22 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16642
	Check 42.00 for details						
P42.43	**Label**	Position Comparison 22 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16643
	Check 42.01 for details						

P42.44	**Label**	Position Comparison 23 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16644
	Check 42.00 for details						

P42.45	**Label**	Position Comparison 23 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16645
	Check 42.01 for details						
P42.46	**Label**	Position Comparison 24 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16646
	Check 42.00 for details						

P42.47	**Label**	Position Comparison 24 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16647
Check 42.01 for details							
P42.48	**Label**	Position Comparison 25 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16648
Check 42.00 for details							
P42.49	**Label**	Position Comparison 25 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16649
Check 42.01 for details							
P42.50	**Label**	Position Comparison 26 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16650
Check 42.00 for details							

P42.51	**Label**	Position Comparison 26 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16651
Check 42.01 for details							

P42.52	**Label**	Position Comparison 27 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16652
Check 42.00 for details							
P42.53	**Label**	Position Comparison 27 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16653
Check 42.01 for details							
P42.54	**Label**	Position Comparison 28 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16654
Check 42.00 for details							
P42.55	**Label**	Position Comparison 28 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16655
Check 42.01 for details							
P42.56	**Label**	Position Comparison 29 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16656
Check 42.00 for details							

P42.57	Label	Position Comparison 29 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16657
	Check 42.01 for details						

P42.58	Label	Position Comparison 30 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16658
	Check 42.00 for details						

P42.59	Label	Position Comparison 30 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16659
	Check 42.01 for details						
P42.60	Label	Position Comparison 31 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16660
	Check 42.00 for details						
P42.61	Label	Position Comparison 31 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16661
	Check 42.01 for details						
P42.62	Label	Position Comparison 32 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16662
	Check 42.00 for details						
P42.63	Label	Position Comparison 32 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16663
	Check 42.01 for details						
P42.64	Label	Position Comparison 33 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16664
	Check 42.00 for details						

P42.65	Label	Position Comparison 33 Attribute Value					
	Range	0x0~0xFFFF		Default	0x0	Unit	
	Activation	Immediate	Attribute	RW		PNU	16665
	Check 42.01 for details						
P42.66	Label	Position Comparison 34 Target Value					
	Range	-2147483648~2147483648		Default	0	Unit	Unit
	Activation	Immediate	Attribute	RW		PNU	16666
	Check 42.00 for details						

P42.67	**Label**	Position Comparison 34 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16667
Check 42.01 for details							
P42.68	**Label**	Position Comparison 35 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16668
Check 42.00 for details							
P42.69	**Label**	Position Comparison 35 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16669
Check 42.01 for details							
P42.70	**Label**	Position Comparison 36 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16670
Check 42.00 for details							
P42.71	**Label**	Position Comparison 36 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16671
Check 42.01 for details							

P42.72	**Label**	Position Comparison 37 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16672
Check 42.00 for details							
P42.73	**Label**	Position Comparison 37 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16673
Check 42.01 for details							
P42.74	**Label**	Position Comparison 38 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16674
Check 42.00 for details							
P42.75	**Label**	Position Comparison 38 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16675
Check 42.01 for details							
P42.76	**Label**	Position Comparison 39 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16676
Check 42.00 for details							

P42.77	**Label**	Position Comparison 39 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16677
Check 42.01 for details							
P42.78	**Label**	Position Comparison 40 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16678
Check 42.00 for details							

P42.79	**Label**	Position Comparison 40 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16679
Check 42.01 for details							

P42.80	**Label**	Position Comparison 41 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16680
Check 42.00 for details							
P42.81	**Label**	Position Comparison 41 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16681
Check 42.01 for details							
P42.82	**Label**	Position Comparison 42 Target Value					
	Range	-2147483648~2147483648		**Default**	0	**Unit**	Unit
	Activation	Immediate	**Attribute**	RW		**PNU**	16682
Check 42.00 for details							
P42.83	**Label**	Position Comparison 42 Attribute Value					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	16683
Check 42.01 for details							

3.6.7【Class P47】Special Functions 1

P47.00	Label	Collision Detection Mode					
	Range	0~1		Default	0	Unit	
	Activation	Re-enable	Attribute	RW		PNU	17100

Set collision detection mode.

Value	Mode	Direction	Detection Enable Condition	Judgment Logic and Action After Triggering
0	No detection	–	–	–
1	Symmetric collision current threshold + collision alarm	Forward / Reverse	|Speed| ≥ P47.04	If |collision current| > P47.02, report Er103; disable the drive.
2	Asymmetric collision current threshold + collision alarm	Forward	|Speed| ≥ P47.04	If |collision current| > P47.02, report Er103; disable the drive.
		Reverse		If |collision current| > P47.03, report Er103; disable the drive.
3	Symmetric collision current threshold + output current limiting after collision warning	Forward / Reverse	|Speed| ≥ P47.04	If |collision current| > P47.02, issue warning ArA12; limit output current to P47.05.
4	Asymmetric collision current threshold + output current limiting after collision warning	Forward	|Speed| ≥ P47.04	If |collision current| > P47.02, issue warning ArA12; limit output current to P47.05.
		Reverse		If |collision current| > P47.03, issue warning ArA12; limit output current to P47.06.
5	Symmetric collision current threshold + automatic collision retraction alarm	Forward / Reverse	|Speed| ≥ P47.04	If |collision current| > P47.02, retract by P47.12 (rebound distance) at P47.13 (rebound speed); then report Er103 and disable the drive.
6	Asymmetric collision current threshold + automatic collision retraction alarm	Forward	|Speed| ≥ P47.04	If |collision current| > P47.02, retract by P47.12 (rebound distance) at P47.13 (rebound speed); then report Er103 and disable the drive.
		Reverse		If |collision current| > P47.03, retract by P47.12 (rebound distance) at P47.13 (rebound speed); then report Er103 and disable the drive.
7	Symmetric collision current threshold + symmetric position limit + current limiting after	Forward	Position feedback > P47.07	If |collision current| > P47.02, issue warning ArA12; limit output current to P47.05. The warning clears after reverse rotation.

	collision warning	Reverse	Position feedback < P47.07	If |collision current| > P47.02, issue warning ArA12; limit output current to P47.05. The warning clears after forward rotation.
8	Asymmetric collision current threshold + asymmetric position limit + current limiting after collision warning	Forward	Position feedback > P47.07	If |collision current| > P47.02, issue warning ArA12; limit output current to P47.05. The warning clears after reverse rotation.
		Reverse	Position feedback < P47.08	If |collision current| > P47.03, issue warning ArA12; limit output current to P47.06. The warning clears after forward rotation.
9	Symmetric collision current threshold + symmetric position limit + collision alarm	Forward	Position feedback > P47.07	If |collision current| > P47.02, report Er103; disable the drive.
		Reverse	Position feedback < P47.07	If |collision current| > P47.02, report Er103; disable the drive.
10	Asymmetric collision current threshold + asymmetric position limit + collision alarm	Forward	Position feedback > P47.07	If |collision current| > P47.02, report Er103; disable the drive.
		Reverse	Position feedback < P47.08	If |collision current| > P47.03, report Er103; disable the drive.
11	Symmetric collision current threshold + symmetric position limit + automatic collision retraction alarm	Forward	Position feedback > P47.07	If |monitored collision current| > P47.02, retract by P47.12 (collision rebound distance) at P47.13 (collision rebound speed); after retraction, report Er103 and disable the drive.
		Reverse	Position feedback < P47.07	
12	Asymmetric collision current threshold + asymmetric position limit + automatic collision retraction alarm	Forward	Position feedback > P47.07	If |monitored collision current| > P47.02, retract by P47.12 (collision rebound distance) at P47.13 (collision rebound speed); after retraction, report Er103 and disable the drive.
		Reverse	Position feedback < P47.08	If |monitored collision current| > P47.03, retract by P47.12 (collision rebound distance) at P47.13 (collision rebound speed); after retraction, report Er103 and disable the drive.

P47.01	Label	Collision Detection current obseve source selection					
	Range	0~3		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	17101
	Collision Detection current source selection 0 – Observer collision current (default) 1 – Observer high-impact collision current 2 – High-impact collision current 3 – Current command						
P47.02	Label	Collision Detection Positive Current Threshold					
	Range	0~750		Default	100	Unit	%
	Activation	Immediate	Attribute	RW		PNU	17102
	Set the collision detection forward current threshold. When the speed and forward current threshold conditions are met during forward operation, a collision alarm will be output.						
P47.03	Label	Collision Detection Negative Current Threshold					
	Range	0~750		Default	100	Unit	%
	Activation	Immediate	Attribute	RW		PNU	17103
	Set the collision detection backward current threshold. When the speed and backward current threshold conditions are met during backward operation, a collision alarm will be output.						

P47.04	Label	Collision Detection Velocity Threshold					
	Range	0~10000		Default	0	Unit	Rpm
	Activation	Immediate	Attribute	RW		PNU	17104
	Set the collision detection speed threshold. After collision detection is enabled, when the drive detects that the motor speed is lower than this set value and the collision conditions are met, a motor collision alarm will be triggered.						

P47.05	Label	Holding Current After Positive-Direction Collision					
	Range	0~750		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	17105
	When the rotational speed meets the speed threshold, the motor is rotating forwards, and the load current exceeds the current setting threshold, the drive will issue a collision alarm and maintain the output current at the set value. This function is used in collision detection modes 3, 4, 7 and 8.						

P47.06	Label	Collision Detection Positive Current Filter Coefficient					
	Range	0~750		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	17106
	When the rotational speed meets the speed threshold, the motor is rotating backwards, and the load current exceeds the current setting threshold, the drive will issue a collision alarm and maintain the output current at the set value. This function is used in collision detection modes 3, 4, 7 and 8.						

P47.07	Label	Positive-Direction Collision Detection Start Position					
	Range	0x80000000~0x7FFFFFFF		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	17107
Set Positive-Direction Collision Detection Start Position							

P47.08	Label	Negative-Direction Collision Detection Start Position					
	Range	0x80000000~0x7FFFFFFF		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	17108
Set Negative-Direction Collision Detection Start Position							

P47.09	Label	Collision Detection time					
	Range	0~10000		Default	0	Unit	10us
	Activation	Immediate	Attribute	RW		PNU	17109
Collision Detection current hloding time							

P47.10	Label	Collision BLF Center Frequency					
	Range	1.00~4000.00		Default	100	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	17110
Set the center frequency of the frequency band for collision monitoring. Collision energy is usually concentrated at specific frequencies (such as mechanical resonance points). If the wrong frequency band is set, the collision signal may not be captured effectively. You can identify the characteristic frequency of the mechanical system during collision through a spectrum analyzer or the diagnostic function of the drive.							

P47.11	Label	Collision BLF Q-Value					
	Range	1~5000		Default	1000	Unit	1
	Activation	Immediate	Attribute	RW		PNU	17111
Set the quality factor (Q factor) of the band-pass filter, which determines the width of the monitoring frequency band (the higher the Q value, the narrower the frequency band). High Q value: Only monitors signals within a narrow band, offering strong anti-interference capability, but may miss collisions outside the frequency band. Low Q value: Monitors wide-band signals with broader coverage, but is susceptible to noise interference. Select the Q factor based on the frequency concentration of the collision signal (e.g., use a high Q value when the mechanical resonance point is clearly identified; use a low Q value when the collision spectrum is dispersed).							

P47.12	Label	Collision Rebound Distance					
	Range	0~0xFFFFFFFF		Default	0	Unit	unit
	Activation	Immediate	Attribute	RW		PNU	17112
Automatic detect distance following collision detection; a collision alarm is triggered once the rebound is complete. Suitable for collision detection modes 5, 6, 11 and 12.							

P47.13	Label	Collision Rebound Speed					
	Range	0~6000		Default	2000	Unit	rpm
	Activation	Immediate	Attribute	RW		PNU	17113
	Automatic detect speed following collision detection.						

P47.16	Label	Mechanical Analysis Injection Mode					
	Range	0~1		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	17116
	Set Mechanical Analysis Injection Mode 0: Speed mode 1: Current mode						

P47.17	Label	Emergency Stop					
	Range	-2147483648~2147483647		Default	0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	17117
	=0, cancel emergency stop;=1, enable emergency stop.						
P47.18	Label	Software Reset					
	Range	0~1		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	17118
	=1, execute the software reset function, valid on rising edge.						
P47.19	Label	Current Fault Clear					
	Range	0~1		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	17119
	=1, Current Fault Clear, valid on rising edge.						
P47.20	Label	Saving and restoring settings					
	Range	0~2		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	17120
	=0 Disable =1 Save all the parameters =2 Restore all the parameters						
P47.21	Label	Encoder Initial Angle Identification					
	Range	0~1		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	17121
	=1, starts Encoder Initial Angle Identification, valid on rising edge.						
P47.22	Label	Status Function Setting Source					
	Range	0~0xFF		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	17122
	bit0 =1: In-position judgment is based on relative position error; =0: In-position judgment is based on absolute position error.						
P47.24	Label	JOG Trial Operation Command Torque					
	Range	0~500		Default	100	Unit	%
	Activation	Immediate	Attribute	RW		PNU	17124
	JOG Trial Operation Command Torque setting						

P47.25	**Label**	JOG Trial Operation Command Velocity					
	Range	0~10000		**Default**	50	**Unit**	r/min
	Activation	Immediate	**Attribute**	RW		**PNU**	17125
JOG Trial Operation Command Velocity setting							
P47.26	**Label**	Trial Operation Distance					
	Range	0~120.0		**Default**	1.0	**Unit**	R
	Activation	Immediate	**Attribute**	RW		**PNU**	17126
JOG operation (position control): The travel distance per operation.							
P47.27	**Label**	Trial Operation Waiting Interval					
	Range	0~30000		**Default**	300	**Unit**	Ms
	Activation	Immediate	**Attribute**	RW		**PNU**	17127
JOG operation (position control): The waiting time after each operation							
P47.28	**Label**	Trial Operation Cycle Count					
	Range	0~32767		**Default**	5	**Unit**	counts
	Activation	Immediate	**Attribute**	RW		**PNU**	17128
JOG operation (position control): Number of cycles.							
P47.29	**Label**	Trial Operation Accel/Decel Time					
	Range	0~10000		**Default**	200	**Unit**	ms/1000r/min
	Activation	Immediate	**Attribute**	RW		**PNU**	17129
Acceleration and deceleration time for JOG test run from 0 to 1000 r/min.							

3.7 Safety Functions

3.7.1【Class P50】STO Functions

P50.00	**Label**	STO error sign					
	Range	0x80000000 ~0x7FFFFFFF		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	18000
STO fault detection flag, used to indicate the specific fault point.							

P50.01	**Label**	STO Buffer Diagnosis & Filter Time					
	Range	1~10		**Default**	2	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	18001
STO diagnosis and filter time. Adjust this value for heavy signal interference.							
P50.02	**Label**	STO diagnosis and filtering time					
	Range	1~2		**Default**	1	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	18002
STO diagnosis and filtering time. This parameter can be adjusted if the input signal is subject to significant interference.							
P50.04	**Label**	STO Version					
	Range	0~32767		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	18004
Displays the STO version							
P50.05	**Label**	STO real-time running timestamp					
	Range	0x80000000 ~0x7FFFFFFF		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	18006
STO real-time running timestamp display.							

3.8 Communication functions

3.8.1【Class P61】PROFINET Functions

P61.00	Label	Heartbeat Alarm Threshold					
	Range	0~65535		Default	5	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19700
	Set the heartbeat alarm threshold in IRT mode. Default: 5. If the error count exceeds the threshold, the drive reports Er72C (node protection or heartbeat timeout).						

P61.12	Label	Custom Receive Word Setting					
	Range	0~2		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19712
	Configure the custom receive word function of Telegram 111. 0: Disabled. 1: Torque limit (0x4000 represents 300%). 2: DO status (bit 0 represents DO1, etc.). Set bits 1 and 2 of P01.25 (Forced DI/DO Enable Switch) to 1 so that DO forcing via the Telegram 111 custom receive word takes effect.						

P61.13	Label	Custom Send Word Setting					
	Range	0~3		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19713
	Configure the custom send word function of Telegram 111. 0: Default; disabled. 1: Actual torque (0x4000 represents 300%). 2: Actual current (0x4000 represents 300%). 3: DI status (bit 0 represents DI1, etc.).						

P61.14	Label	Communication Timeout Setting					
	Range	0~32767		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19714
	Set the communication timeout monitoring time after the drive enters the OP (Operational) state. Unit: Tdc. Set to 0 to disable monitoring.						

P61.15	Label	Synchronization Cycle					
	Range	0~4294967295		Default	0	Unit	ns
	Activation	Immediate	Attribute	RO		PNU	19715
	PN bus synchronization communication cycle, in ns.						

P61.16	Label	IP Address					
	Range	0~4294967295		Default	0	Unit	-
	Activation	Immediate	Attribute	RO		PNU	19716
	IP address of the slave device.						

P61.17	Label	Subnet Mask					
	Range	0~4294967295		Default	0	Unit	-
	Activation	Immediate	Attribute	RO		PNU	19717
	Subnet mask of the slave device.						

P61.18	Label	Default Gateway					
	Range	0~4294967295		Default	0	Unit	-
	Activation	Immediate	Attribute	RO		PNU	19718
	Gateway of the slave device.						

P61.19	Label	MAC Address (Low)					
	Range	0~65535		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19719
	Lower 4 hexadecimal digits of the slave device MAC address.						

P61.20	Label	MAC Address (Middle)					
	Range	0~65535		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19720
	Middle 4 hexadecimal digits of the slave device MAC address.						

P61.21	Label	MAC Address (High)					
	Range	0~65535		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19721
	Upper 4 hexadecimal digits of the slave device MAC address.						

P61.22	Label	Enable User Data of Auxiliary Telegram 901					
	Range	0~1		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19722
	0: Disabled. 1: Enabled.						

P61.23	Label	PNU of Parameter to Be Modified					
	Range	0~2147483647		Default	6808	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19723
	PNU of the parameter to be modified via auxiliary Telegram 901.						

P61.24	Label	Save After Parameter Modification					
	Range	0~1		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	19724
	0: Do not save after modifying a parameter via auxiliary Telegram 901. 1: Automatically save after modifying a parameter via auxiliary Telegram 901.						

P61.29	Label	PN Uplink Packet Loss Count					
	Range	-2147483648~2147483647		Default	0	Unit	-
	Activation	Immediate	Attribute	RO		PNU	19729
Count of lost real-time process-data frames sent from the drive to the PLC.							

P61.30	Label	PN Downlink Packet Loss Count					
	Range	-2147483648~2147483647		Default	0	Unit	-
	Activation	Immediate	Attribute	RO		PNU	19730
Count of lost real-time process-data frames sent from the PLC to the drive.							

P61.31	Label	Main Telegram					
	Range	1~65535		Default	0	Unit	-
	Activation	Immediate	Attribute	RO		PNU	19731
Main telegram active on the slave device.							

P61.32	Label	Auxiliary Telegram					
	Range	0~4294967295		Default	0	Unit	-
	Activation	Immediate	Attribute	RO		PNU	19732
Auxiliary telegram active on the slave device.							

P62.00 ~P62.31	Label	Telegram Transmission and Reception					
	Range	-2147483648~2147483647		Default	0	Unit	-
	Activation	Immediate	Attribute	RO		PNU	19800 ~19831
PN telegram transmission and reception data. It is recommended to monitor these data on the “Telegram Configuration” screen of the commissioning software.							

3.9 System Parameters

3.9.1【Class PA0】Motor Parameters

PA0.11	**Label**	Motor Model					
	Range	0x0~0xFFFF		**Default**	0x0	**Unit**	
	Activation	After restart	**Attribute**	RW		**PNU**	26011
	Motor Type Setting: 0x00: AC rotary motor 0x01: DC rotary motor 0x10: AC linear motor 0x11: DC linear motor						

3.9.2【Class PA1】Encoder Parameters

PA1.00	**Label**	Encoder selection					
	Range	0x0~0xFFFFFFFF		**Default**	0x0	**Unit**	
	Activation	After restart	**Attribute**	RW		**PNU**	26100
	Encoder Type Setting: 0: RS communication encoder 1: ABZ encoder 2: BISS encoder						

PA1.17	**Label**	Encoder Feedback Pulse Digital Filter					
	Range	0~300		**Default**	5	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	26117
	This parameter configures the filter time for encoder feedback pulses to smooth raw signals and suppress high-frequency noise, enhancing position/velocity feedback stability. Larger filter time: Better noise suppression, but introduces minor control delay. Smaller filter time: Faster system response, but reduced noise immunity.						

3.9.3【Class PA2】Driver Parameters

PA2.00	**Label**	MCU1 Version Number					
	Range	0~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	26200
	Displays the MCU1 Version Number						

PA2.01	**Label**	MCU2 Version Number					
	Range	0~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	26201
	Displays the MCU2 Version Number						
PA2.02	**Label**	FPGA Version Number					
	Range	0~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	26202
	Displays the FPGA Version Number						

PA2.06	**Label**	Driver Voltage Level					
	Range	0~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	26206
Displays the Driver Voltage Level							
PA2.07	**Label**	Driver Rated Power					
	Range	0~2147483647		**Default**	0	**Unit**	W
	Activation	Immediate	**Attribute**	RO		**PNU**	26207
Displays the Driver Rated Power							
PA2.08	**Label**	Driver Rated Current					
	Range	0.00~21474836.47		**Default**	0	**Unit**	A
	Activation	Immediate	**Attribute**	RO		**PNU**	26208
Displays the Driver Rated Current							
PA2.09	**Label**	Driver Maximum Current					
	Range	0.00~21474836.47		**Default**	0	**Unit**	A
	Activation	Immediate	**Attribute**	RO		**PNU**	26209
Displays the Driver Maximum Current							
PA2.12	**Label**	Dead Zone Compensation Coefficient 1					
	Range	0~32767		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	20212
This parameter compensates for the dead zone effect of inverter IGBTs. Dead time avoids upper/lower arm shoot-through but introduces voltage distortion, current ripple, torque pulsation, and low-speed vibration. By injecting compensation voltage, this parameter cancels dead-time errors. Larger values improve compensation but increase harmonic distortion and current noise.							
PA2.13	**Label**	Dead Zone Compensation Coefficient 2					
	Range	0~100		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	26213
Check PA2.12							

PA2.19	**Label**	Current Loop Gain					
	Range	100~5000		**Default**	1500	**Unit**	Hz
	Activation	Immediate	**Attribute**	RW		**PNU**	26219
The default current loop gain of the servo has already ensured sufficient responsiveness and generally does not require adjustment. Current loop gain refers to the response degree of the current loop to the input error signal. The higher the gain, the faster the system responds to errors, but excessively high gain may lead to system instability and oscillation.							

PA2.20	**Label**	Current Loop Integral Time					
	Range	0.1~1000.0		**Default**	50.0	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	26220
Current Loop Integral Time setting							

PA2.21	**Label**	Current Differential Coefficient					
	Range	0~30000		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	26221
Current Differential Coefficient setting							
PA2.40	**Label**	Control Power Undervoltage Value					
	Range	125~350		**Default**	160	**Unit**	V
	Activation	Immediate	**Attribute**	RW		**PNU**	26240
This parameter sets the control undervoltage detection threshold. When the control voltage is detected to be lower than this threshold, a control undervoltage will be triggered.							
PA2.42	**Label**	Main Power-off Detection Delay					
	Range	20~100		**Default**	0	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	26242
This parameter sets the delay time for main power loss detection. When the main power voltage is detected to be below the undervoltage threshold and persists for the set duration, a power loss alarm will be triggered.							
PA2.43	**Label**	DC Bus Undervoltage (LV) Detection Delay					
	Range	0~200		**Default**	0	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	26243
This parameter sets the detection time required for identifying a main power circuit break or low-voltage condition when such a state persists. Example: When set to 200, lower the input power supply voltage so that the bus voltage drops below the undervoltage threshold. The drive will detect the undervoltage after 0.2 seconds and trigger the corresponding protection.							

PA2.52	**Label**	Bus Voltage Bleeding Control Mode					
	Range	0~1		**Default**	1	**Unit**	
	Activation	After Restart	**Attribute**	RW		**PNU**	26252

Sets the discharge mode.

For the L7N-S series, regenerative resistors are not included as standard for models with power of 400W and below.

Power (W)	Value	Description
100/400	1	Regenerative energy is only absorbed by the built-in bus capacitors of the drive.
750 and above	0	Regenerative energy can be discharged via a regenerative resistor.

PA2.94	**Label**	Hardware Version					
	Range	-2147483648~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	26294
Displays the Hardware Version.							

3.10 PN motion

3.10.1【Class PF3】

PF3.00	Label	Acceleration Time Setting (RFG)					
	Range	0~10000		Default	0	Unit	ms/krpm
	Activation	Immediate	Attribute	RW		PNU	34300
Set the acceleration time for the speed command input, in ms/(1000 r/min), i.e., the time required to accelerate from 0 to 1000 r/min. Generally used in speed-control mode when abrupt speed commands, excessive acceleration, or step-like commands from the internal multi-speed control function cause unstable motor operation.							

PF3.01	Label	Deceleration Time Setting (RFG)					
	Range	0~10000		Default	0	Unit	ms/krpm
	Activation	Immediate	Attribute	RW		PNU	34301
Set the deceleration time for the speed command input, in ms/(1000 r/min), i.e., the time required to decelerate from 1000 r/min to 0. Generally used in speed-control mode when abrupt speed commands, excessive acceleration, or step-like commands from the internal multi-speed control function cause unstable motor operation.							

PF3.02	Label	Sensor Header					
	Range	0~0xFFFFFFFF		Default	0x5112	Unit	-
	Activation	Immediate	Attribute	RO		PNU	979[0]
Sensor header: [bit 0-3] Lower bits of the reference structure version (default: 2). [bit 4-7] Upper bits of the reference structure version (default: 1). [bit 8-11] Number of sensors (default: 1). [bit 12-15] Data length corresponding to each sensor (default: 5).							

PF3.03	Label	Sensor Type					
	Range	0~0xFFFFFFFF		Default	0x80000002	Unit	-
	Activation	Immediate	Attribute	RO		PNU	979[1]

Displays the sensor type.
bit 0: 0 = rotary encoder; 1 = linear encoder.
bit 1: 0 = G1_XIST1 relative position; 1 = G1_XIST1 absolute position.
bit 29:
0 = Parameter 979 value Gx is static and does not change when the state switches from "parking" to "normal".
1 = Parameter 979 value changes when the state switches from "parking" to "normal".
bit 30:
0 = If parameter 979 is currently invalid (979[1] bit31 = 0), it may become valid (= 1) in the future. A transition from invalid to valid can occur only while the measuring system is in the "parking" state.
1 = 979[1] bit31 does not change.
bit 31: 0 = Parameter 979 value Gx is invalid; 1 = Parameter 979 value Gx is valid.

PF3.04	Label	Sensor Resolution					
	Range	0~0xFFFFFFFF		Default	0x100	Unit	-
	Activation	Immediate	Attribute	RO		PNU	979[2]

Rotary encoder: number of pulses per revolution (single turn).
Linear encoder: signal period length (unit: nm).

PF3.05	Label	Sensor Slip Factor 1					
	Range	0~0x18		Default	0xf	Unit	-
	Activation	Immediate	Attribute	RO		PNU	979[3]

Number of bits for quadrant information and subdivision in Gx_XIST1.

PF3.06	Label	Sensor Slip Factor 2					
	Range	0~0x18		Default	0xf	Unit	-
	Activation	Immediate	Attribute	RO		PNU	979[4]

Number of bits for quadrant information and subdivision in Gx_XIST2.

PF3.07	Label	Sensor Multiturn Revolution Count					
	Range	-2147483648~2147483647		Default	512	Unit	-
	Activation	Immediate	Attribute	RO		PNU	979[5]

0: Incremental encoder (reading the absolute value from G2_XIST2 is not supported).
1: Single-turn absolute encoder.

PF3.19	Label	EPOS Maximum Speed					
	Range	0~100000000		Default	25165820	Unit	1000LU/min
	Activation	Immediate	Attribute	RW		PNU	34319

Maximum speed limit in EPOS motion mode. Unit: 1000LU/min.

PF3.20	Label	EPOS Maximum Acceleration					
	Range	1~2000000		Default	10000	Unit	1000LU/s²
	Activation	Immediate	Attribute	RW		PNU	34320
Maximum acceleration limit in EPOS motion mode. Unit: 1000LU/s².							

PF3.21	Label	EPOS Maximum Deceleration					
	Range	1~2000000		Default	10000	Unit	1000LU/s²
	Activation	Immediate	Attribute	RW		PNU	34321
Maximum deceleration limit in EPOS motion mode. Unit: 1000LU/s².							

PF3.27	Label	EPOS Positioning Completion Window Time					
	Range	0~3000		Default	100	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	34327
Deviation window time in EPOS motion mode. Unit: ms.							

PF3.28	Label	EPOS JOG1 Set Speed					
	Range	-100000000~100000000		Default	-251658	Unit	1000LU/min
	Activation	Immediate	Attribute	RW		PNU	34328
EPOS JOG1 set speed. Unit: 1000LU/min.							

PF3.29	Label	EPOS JOG2 Set Speed					
	Range	-100000000~100000000		Default	251658	Unit	1000LU/min
	Activation	Immediate	Attribute	RW		PNU	34329
EPOS JOG2 set speed. Unit: 1000LU/min.							

PF3.30	Label	EPOS JOG1 Travel Distance					
	Range	0~2147483647		Default	838860	Unit	LU
	Activation	Immediate	Attribute	RW		PNU	34330
EPOS JOG1 travel distance setting. Unit: LU.							

PF3.31	Label	EPOS JOG2 Travel Distance					
	Range	0~2147483647		Default	838860	Unit	LU
	Activation	Immediate	Attribute	RW		PNU	34331
EPOS JOG2 travel distance setting. Unit: LU.							

PF3.46	Label	Positive Speed Limit in Torque Mode					
	Range	0~8000		Default	1000	Unit	rpm
	Activation	Immediate	Attribute	RW		PNU	34346
Set the positive speed limit in torque mode. Unit: rpm.							

PF3.47	Label	Negative Speed Limit in Torque Mode					
	Range	0~8000		Default	1000	Unit	rpm
	Activation	Immediate	Attribute	RW		PNU	34347
Set the negative speed limit in torque mode. Unit: rpm.							

PF3.48	Label	DSC Position Loop Gain Mode					
	Range	0~1		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	34348
	Set the DSC position loop gain mode: 0: Internal position loop gain. Use parameter P21.02 (stiffness) to match the gain and integral values. 1: PLC position loop gain. Use KPC to match the gain and integral values. In non-DSC mode, this function is internally forced to 0.						

PF3.49	Label	DSC Speed Feedforward Mode					
	Range	0~1		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	34349
	Set the DSC speed feedforward mode: 0: Internal speed feedforward. Use the P21.00 MFC function. 1: PLC speed feedforward. Use the speed feedforward value sent by the PLC. In non-DSC mode, this function is internally forced to 0.						

PF3.50	Label	DSC Position Loop Gain Factor					
	Range	1~1000		Default	100	Unit	-
	Activation	Immediate	Attribute	RW		PNU	34350
	Set the DSC position loop gain factor. Unit: %.						

Chapter 4 Servo Drive Operation

4.1 Get Started with Driver Operation

4.1.1 Checklist before operation

No.	Description
Power supply	
1	The voltage of main and control circuit power supply is within rated values.
2	Power supply polarity is rightly connected.
Wiring	
1	Power supply input is rightly connected.
2	Driver's power output UVW matches UVW terminals on the main circuit.
3	No short circuit of driver's input and output UVW terminals.
4	Signal cables are correctly and well connected.
5	Drivers and motors are connected to ground
6	All cables under stress within recommended range.
7	No foreign conductive objects inside/outside the driver.
Mechanical	
1	Driver and external holding brake are not place near combustibles.
2	Installations of driver, motor and axis is fastened.
3	Movement of motors and mechanical axes are not obstructed.

4.1.2 Power On

Connect 400V power supply into main power supply R, S, T terminals and 220V power supply into control circuit power supply L1C, L2C. After power on, light indicator will light up and front panel will display **rEAdy**, then LED initial status will be displayed. Driver is ready for operation if no alarm occurs.

4.1.3 Trial Run

Servo drive must be disabled before performing trial run. For safety precautions, please JOG under minimal velocity.

Related Parameters

No.	Parameters	Label	Set value	Unit
1	P47.25	JOG trial run command velocity	User defined	r/min
2	P47.29	Trial run acc-/deceleration time	User defined	ms/1000rpm

- *Please make sure the mechanical axis is within the range of motion and travelled distance should not be too long to avoid collision.*
- *Set optimal velocity and acceleration for trial run (not too high!)*
- *Do not modify any gain related parameters during motion to avoid vibration.*

Please refer to “AF_Jog Trial Run” for detailed explanations on how to perform trial run using front panel operation

4.1.4 Motor rotational direction settings

Motor rotational direction can be changed through P00.06 without changing the polarity of the input command.

P00.06	Label	Command polarity inversion				
	Range	0 ~ 1	Default	0	Unit	—
	Activation	After restart	Attribute	RW	PNU	10006

Used to change the rotational direction of the motor.

Set value	Details
0	Polarity of the command is not inversed. The direction of rotation is consistent with the polarity of command.
1	Polarity of command is inversed. The direction of rotation is opposite to the polarity of command.

Note: Rotational direction of the motor is recommended to be set through object dictionary 607E. However, P00.06 has higher priority than object dictionary 607E. 607E only takes effect when P00.06 = 0.

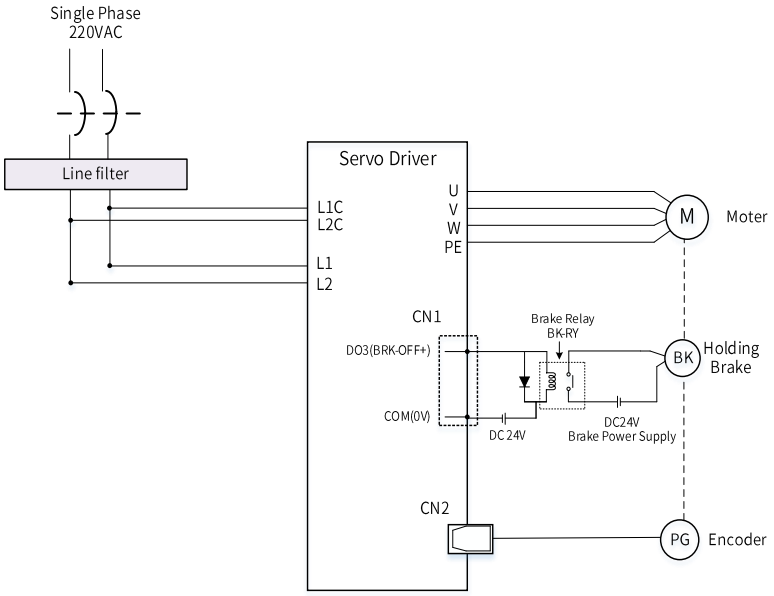
4.1.5 Holding Brake Settings

Holding brake is designed to hold the axis in position to prevent it from sliding due to applied external forces when the driver is disabled. Holding brake is optional and depends on the model of motor chosen for the application.

- *Please only use holding brake when motor is stopped. No applicable when motor is in motion.*
- *Holding brake coil has no polarity.*
- *Motor should be disabled after stopped.*
- *There is some noise when motors with brake are in motion but that doesn’t affect its functionality.*
- *Magnetic sensors might be affected when the holding brake is on. Please be aware.*

Holding brake wiring

Holding brake input signal is without polarity. An isolated 24V switching power supply is recommended to prevent abnormal holding brake behavior in case of sudden drop in working current or voltage.



Wiring diagram of motor holding brake

4.1.6 Servo Running

1. Enable servo driver

Check if CN3/CN4 is connected properly. Servo driver is in ready mode. Motor is stopped and holding brake is activated. Front panel display shows 402 state machine = Operational, PROFINET communication status = operational, Running mode = 8, servo is in stop mode.



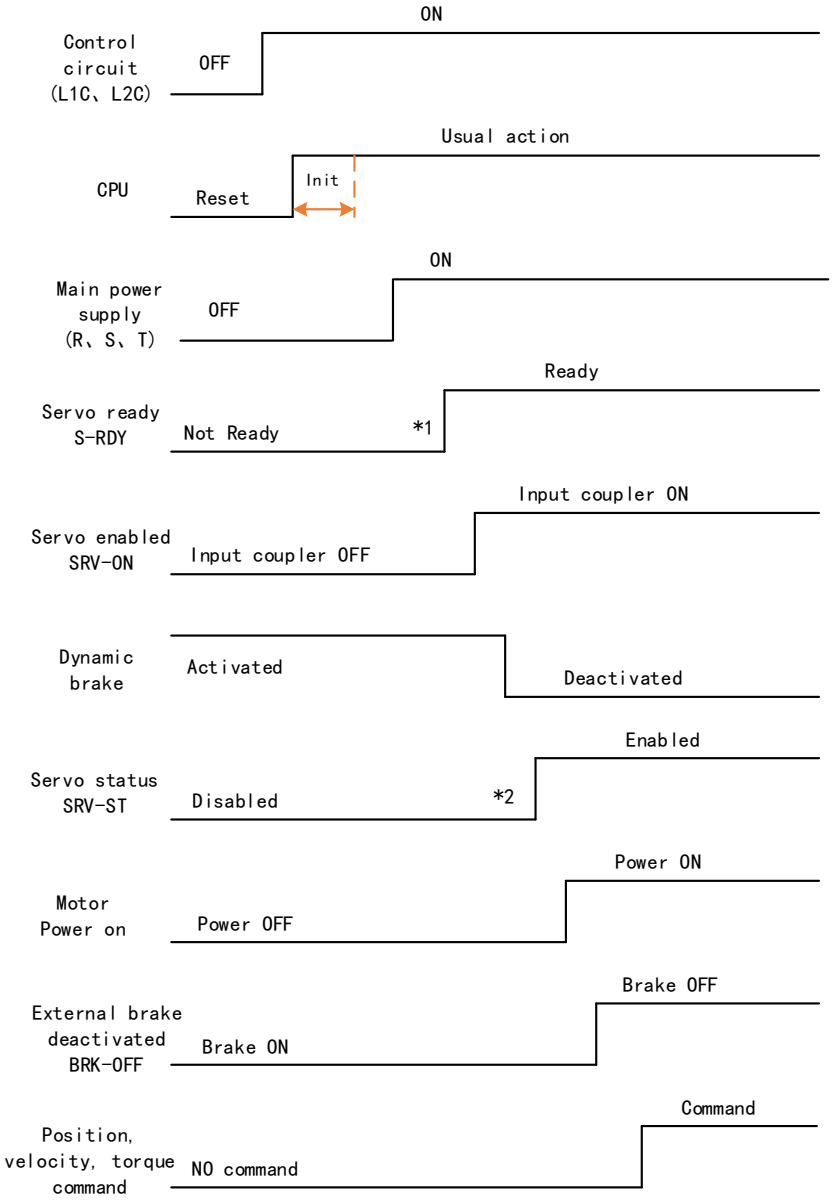
2. Motor starts to move after command input

i. On first time operation, please use suitable command at low velocity. Confirm if motor is working normally.

ii. Check if motor rotational direction is correct. If not, please check input command or parameter settings. (P00.06).

iii. If motor is working normally, motion data such as motor rotational velocity “d01SP” and actual torque feedback “d04tr” can be monitored on the front panel or through Motion Studio.

3. Power on sequence diagram



Please enter servo status, position, velocity, torque command as sequence diagram above.

*** 1. S-RDY signal is given after CPU initialization and main power supply powered on.*

2. SRV-ST signal is received when servo driver is enabled. Command input is not allowed yet.

4.1.7 Servo stop

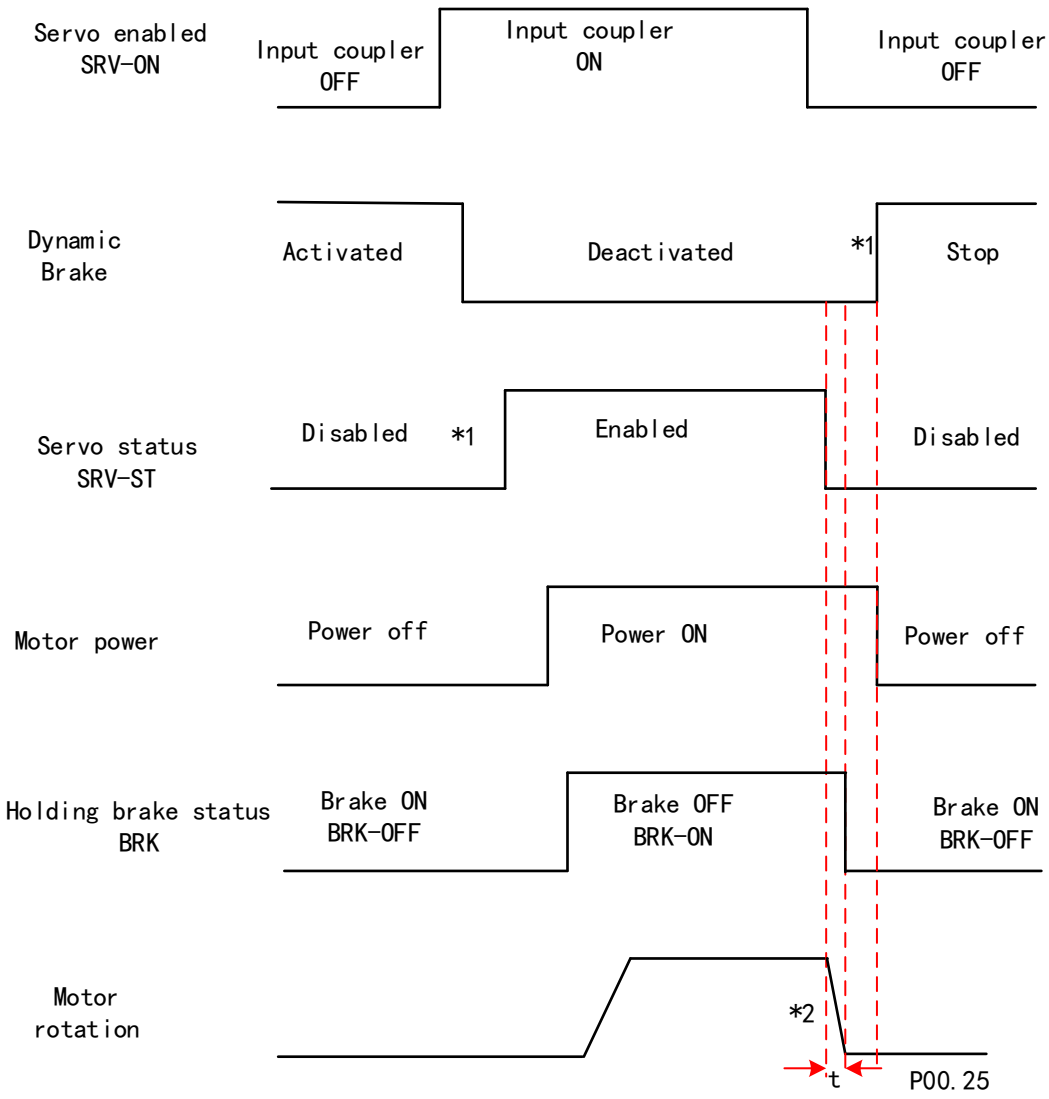
Servo stopping are of 3 different methods: Servo braking method, free stopping method, dynamic braking method.

Stopping method	Description	Details
Servo braking	Servo driver delivers braking torque in opposite direction	Quick stopping but mechanical impact might exist
Free stopping	Motor power cut off. Free to move until velocity = 0. Affected inertia, friction and other factors	Smooth deceleration, low mechanical impact but slow stopping
Dynamic braking	Brake activated when in motion	Quick stopping but mechanical impact might exist

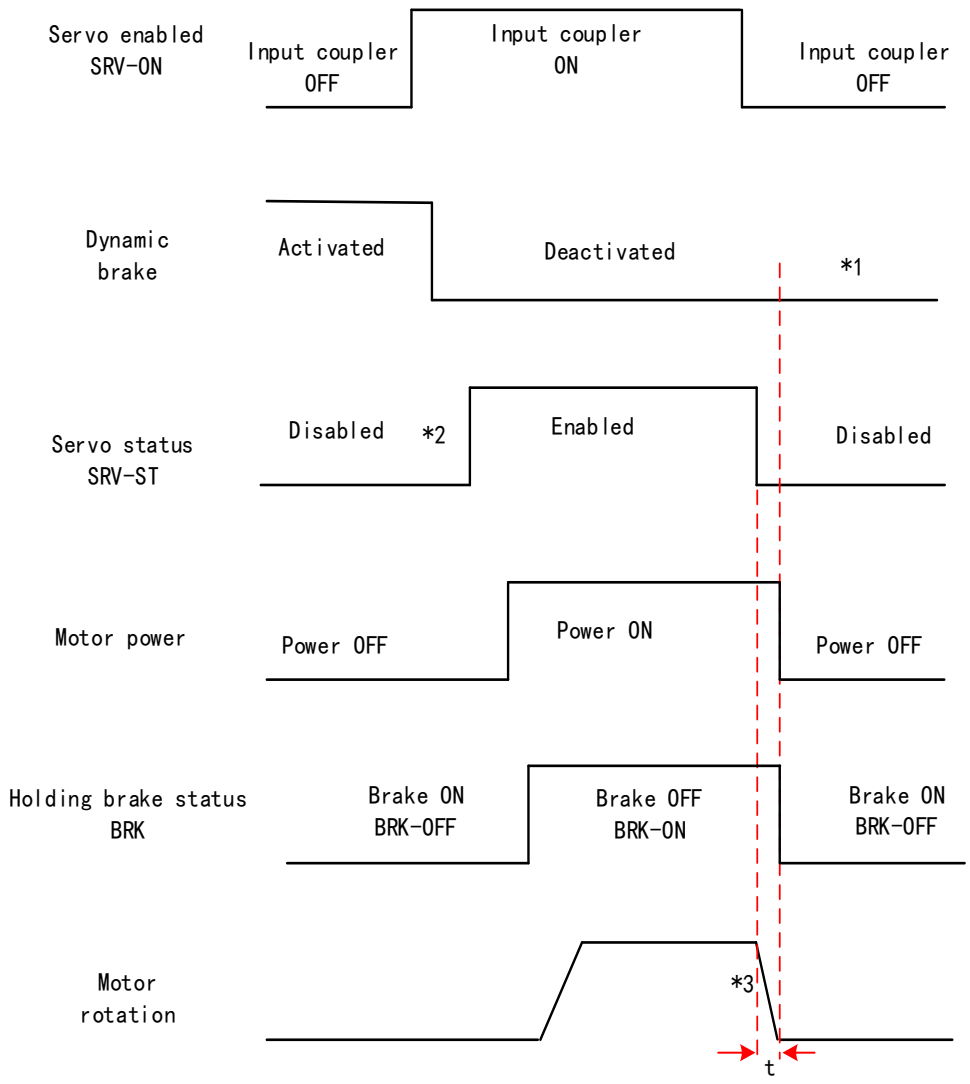
Stopping status	Status after stopped
Free moving	Motor is powered off, rotor is free to rotate
Dynamic braking	Motor is powered off, rotor is not free to rotate
Holding brake stopping	Motor axis is locked, cannot rotate freely

Motor stopping（Servo disabled）- Sequence Diagram

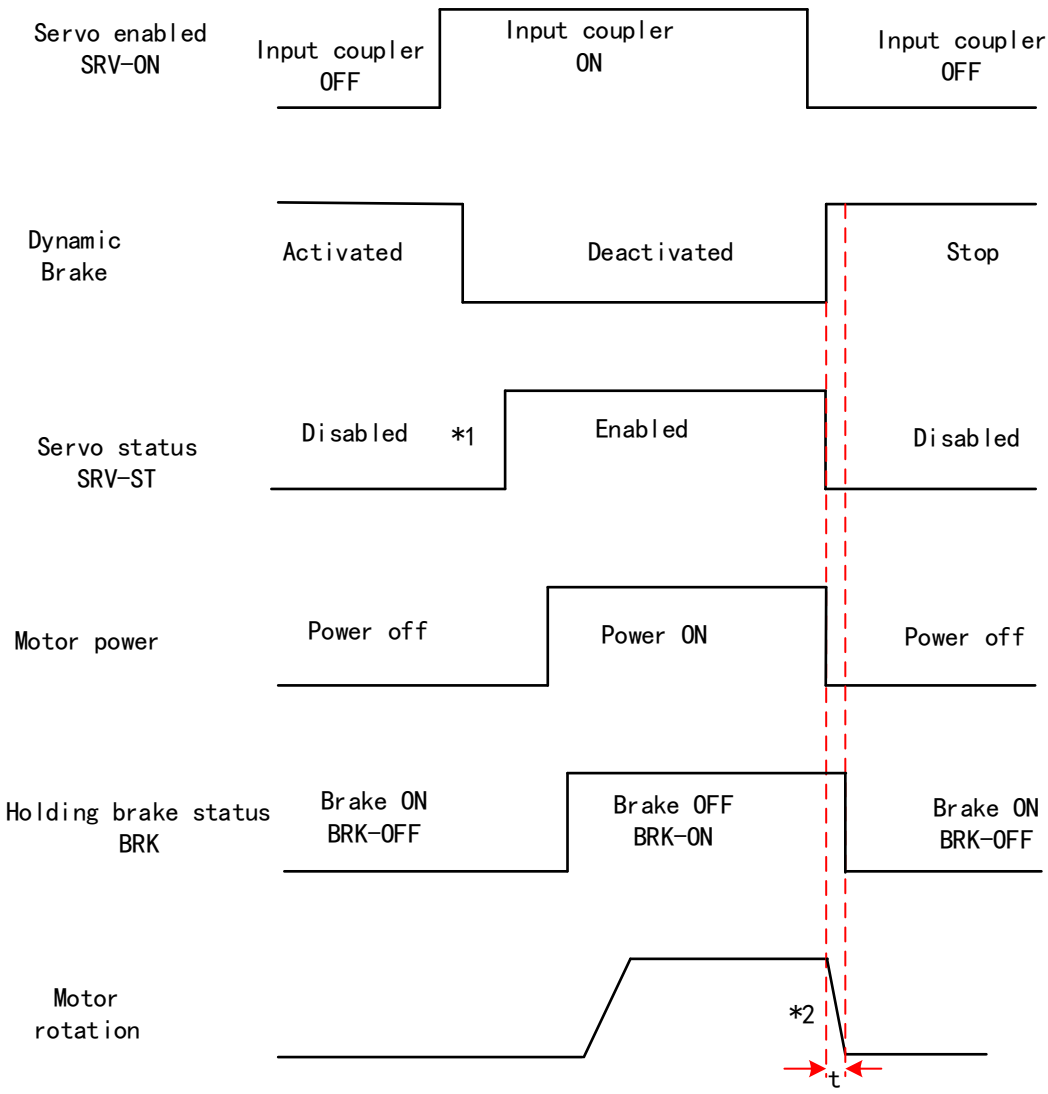
Servo braking method. Status after stopping: Dynamic braking(P00.30=0/1/2)



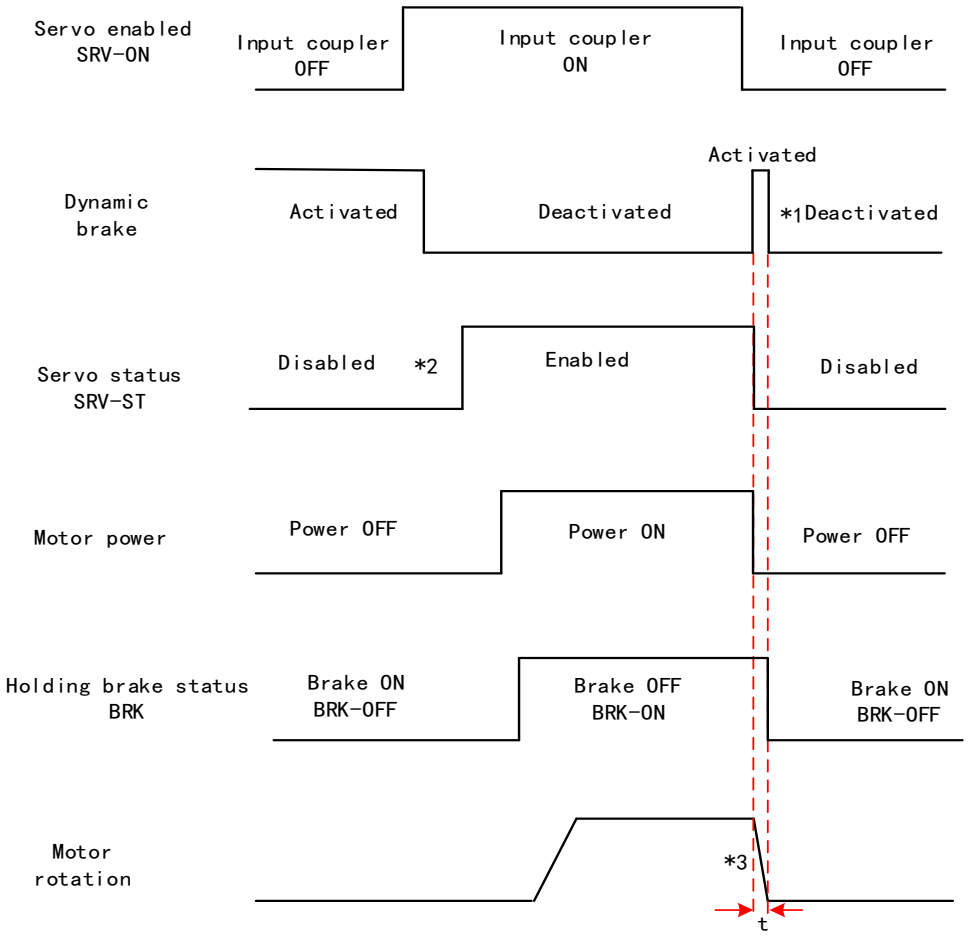
Servo stopping method. Status after stopping: free moving(P05.06 = 3/4/5)



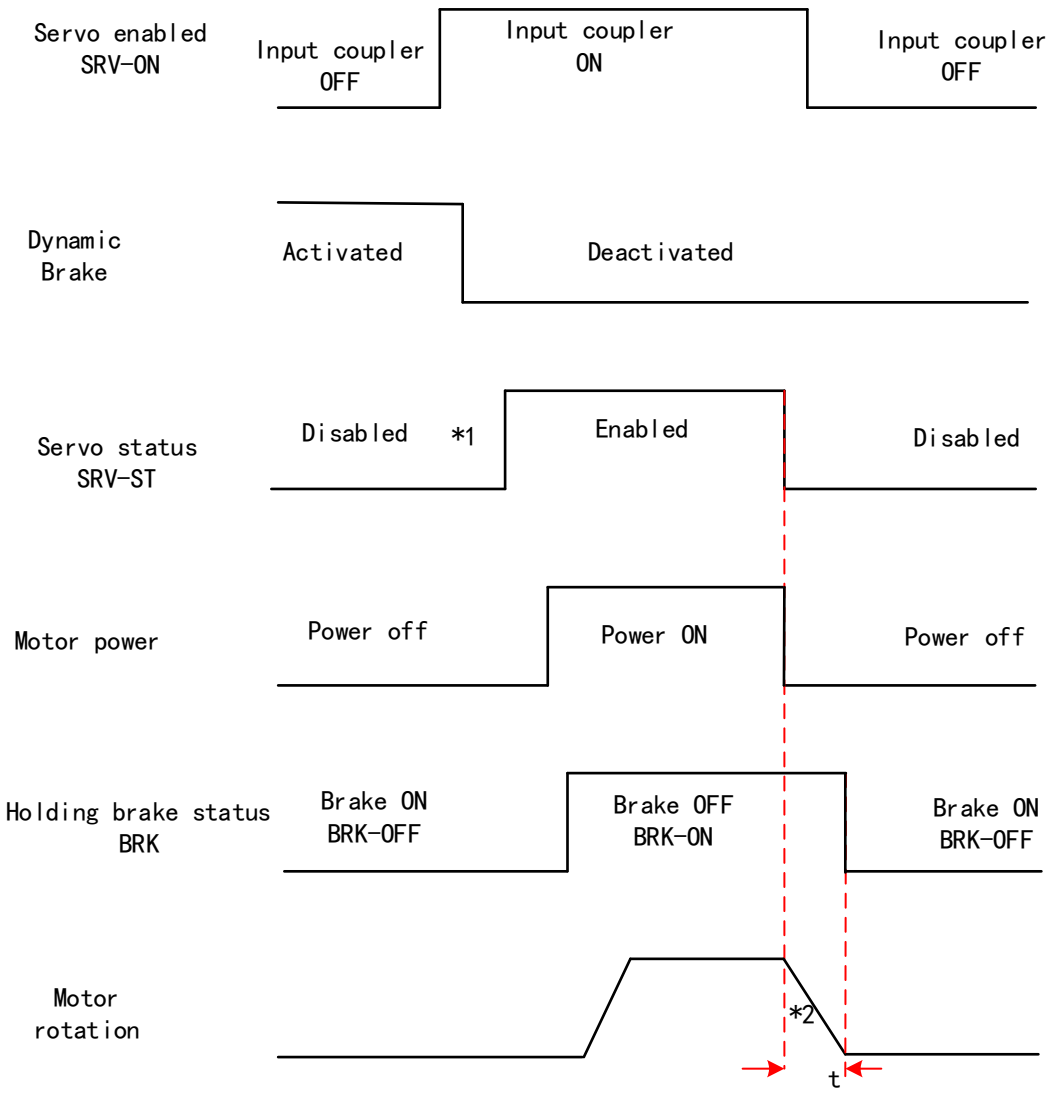
Free stopping method. Status after stopping: Free moving (P00.30 = 6)



Dynamic braking method. Status after stopping: Free moving (P05.06 = 7)



Free stoping method. Status after stopping: Free moving (P05.06 = 8)



*** 1. Status after stopping is as defined in P05.06.*

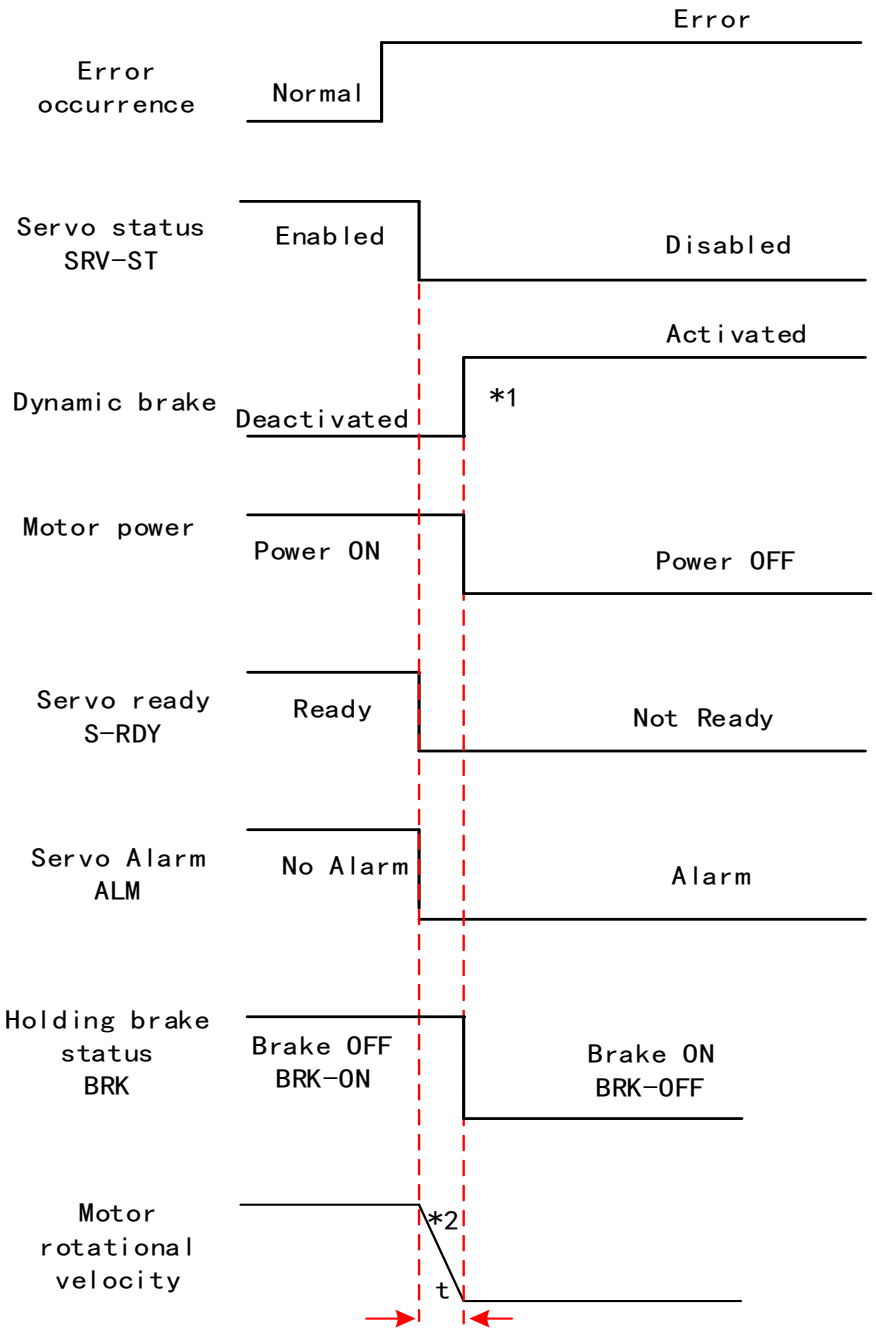
2. SRV-ST signal is received when servo driver is enabled. Command input is not allowed yet.

3. Servo stopping method is as defined in P05.06; braking torque in opposite direction to decelerate the motor is as defined in P05.11. Deceleration time t is determined by whichever comes first between time set in P06.14 and time needed for motor to drop below velocity set in P04.39. After deceleration time t, dynamic braking will be off and holding brake signal will be set to OFF (Holding brake is activated. Although BRK-OFF signal is valid, actual activation of holding brake is dependent on whether the motor comes with holding brake).

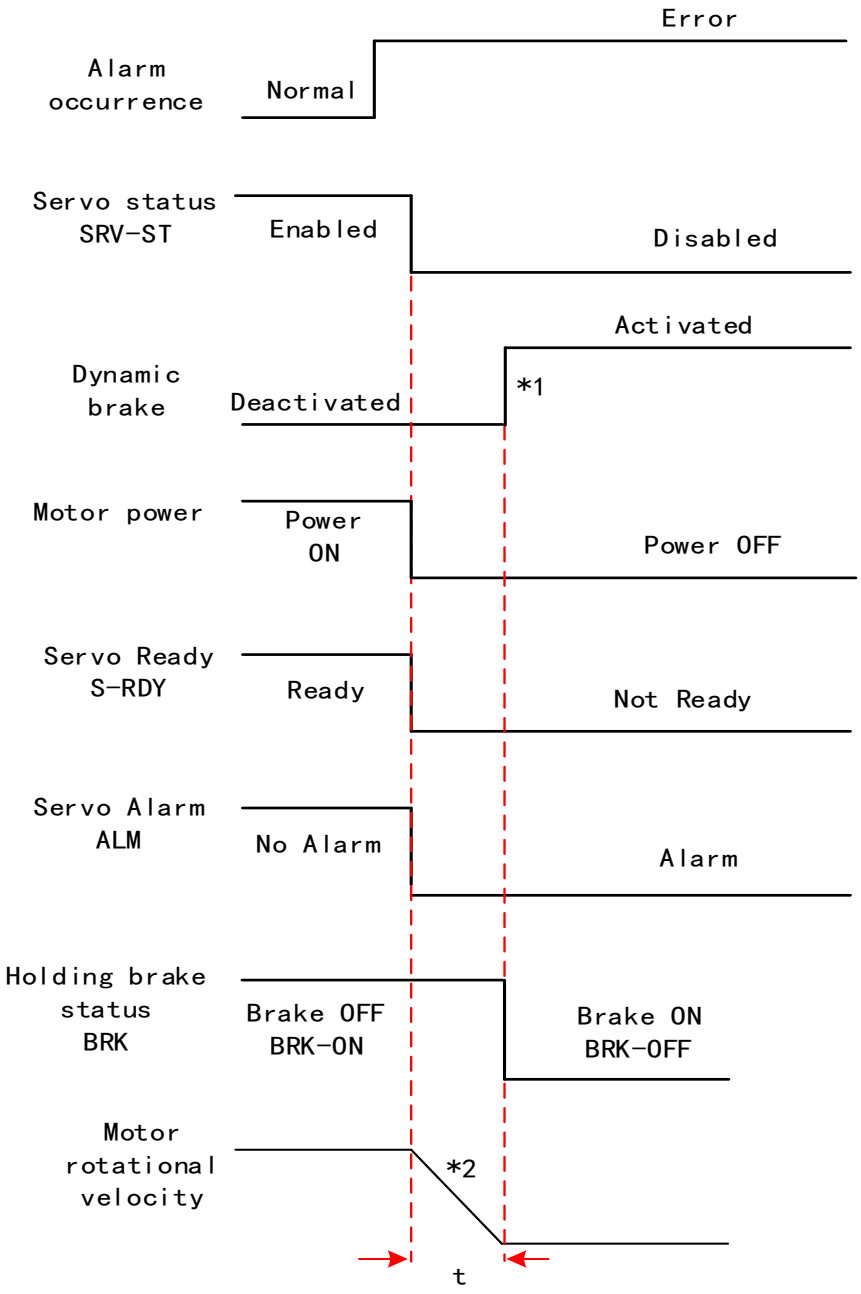
4. BRK-ON signal doesn't indicate the activation of holding brake but the validation of the signal. Holding brake is not applied when BRK-ON signal is valid. Same idea goes for BRK-OFF signal.

Stopping when alarm occurs – Sequence Diagram

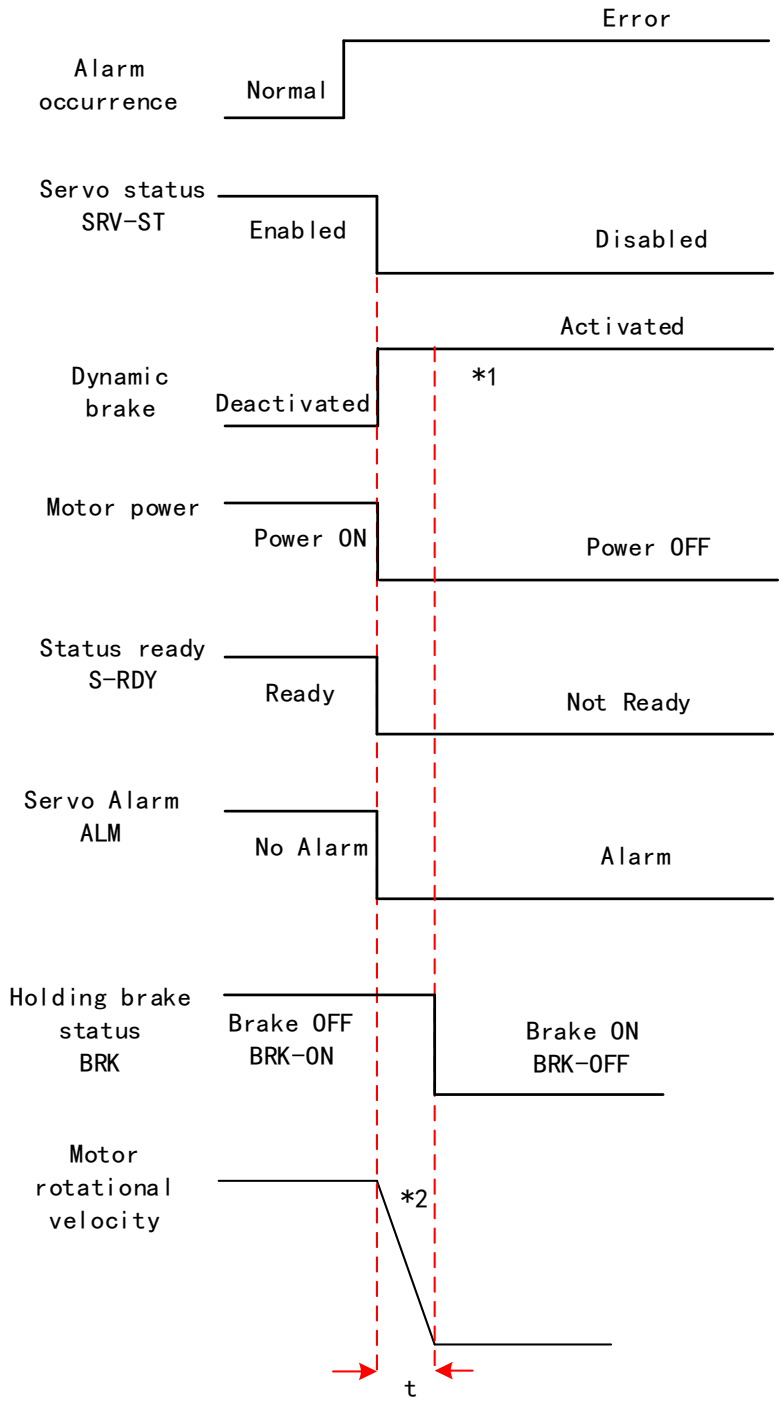
Servo braking method. Status after stopping: Dynamic braking



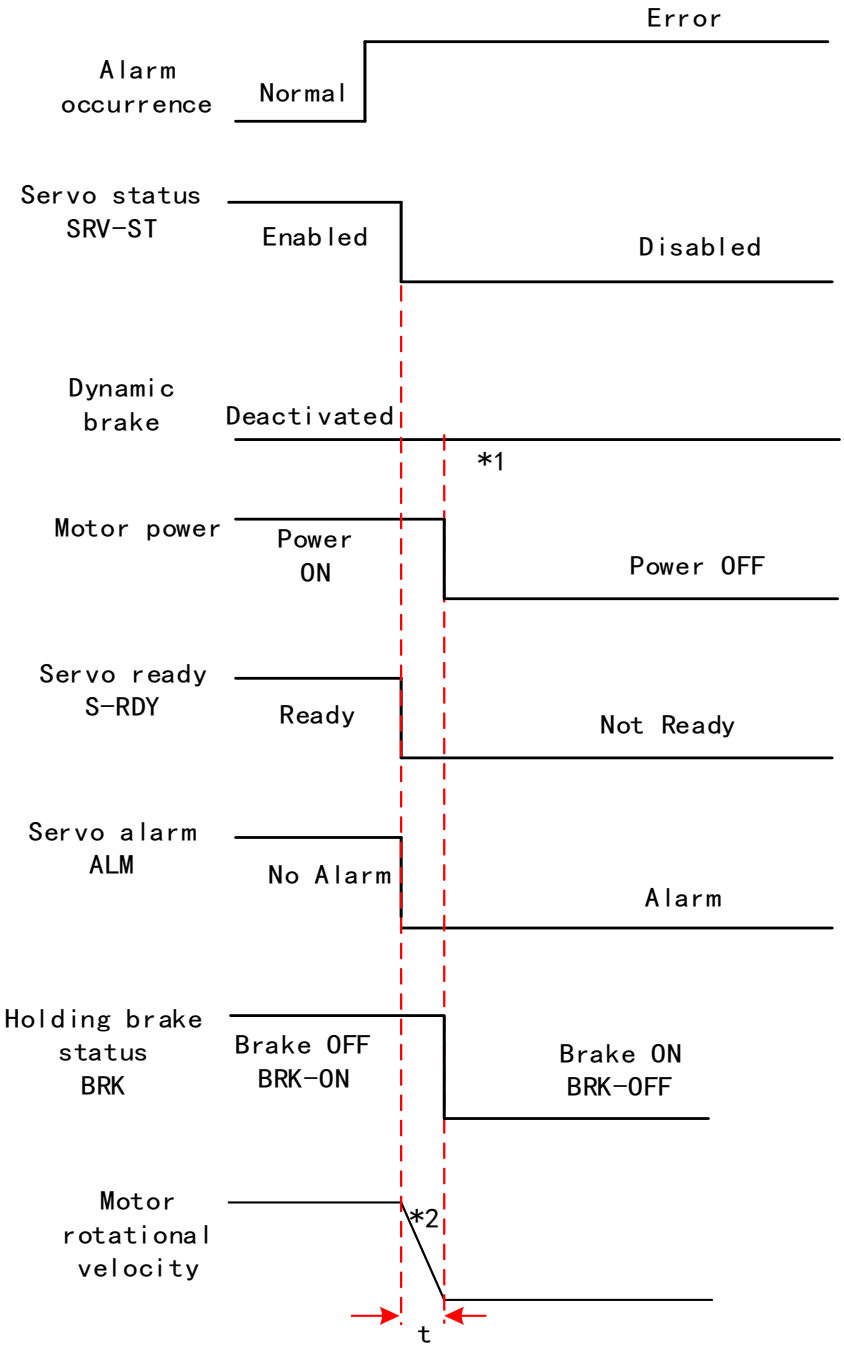
Free stopping method. Status after stopping: Dynamic braking



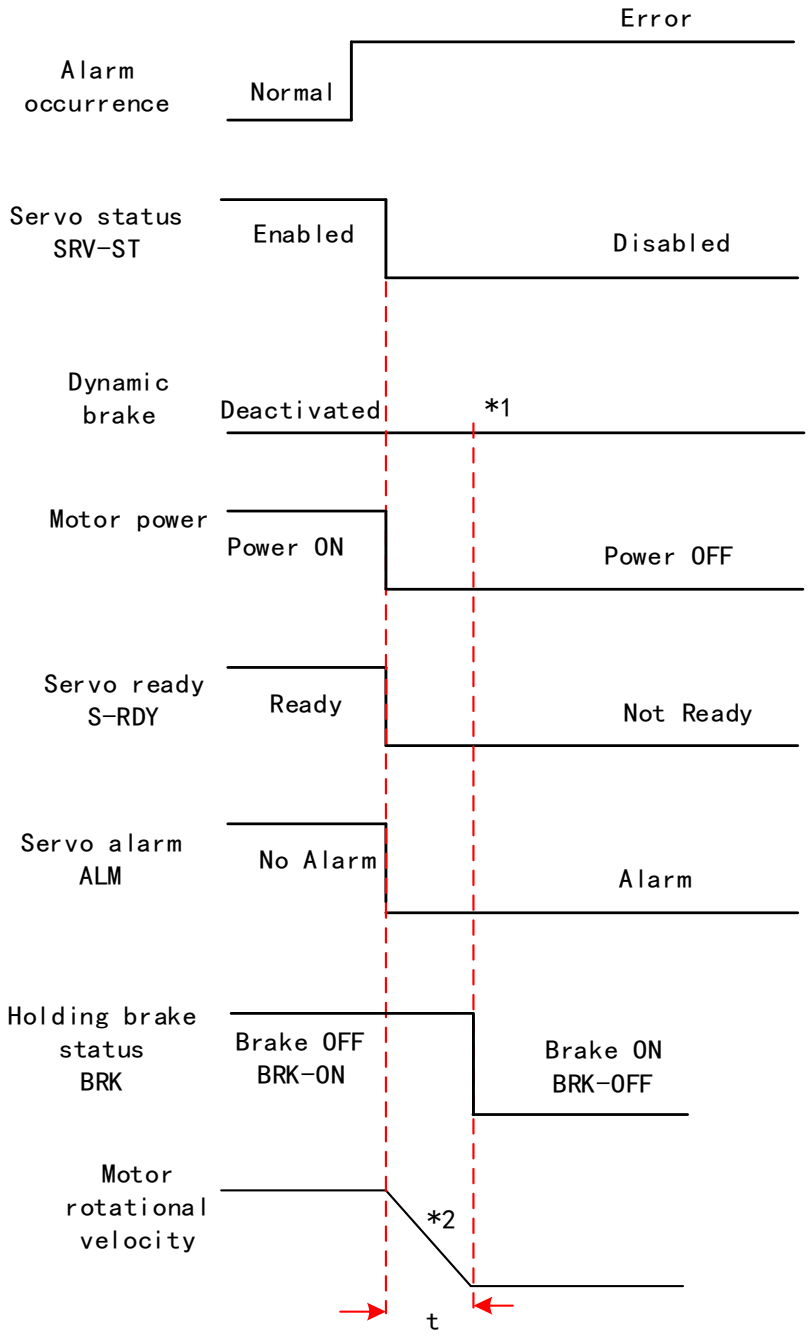
Dynamic braking method. Status after stopping: Dynamic braking


Error
Alarm occurrence
Normal
Servo status SRV-ST
Enabled
Disabled
Activated
Dynamic brake
Deactivated
*1
Motor power
Power ON
Power OFF
Status ready S-RDY
Ready
Not Ready
Servo Alarm ALM
No Alarm
Alarm
Holding brake status BRK
Brake OFF BRK-ON
Brake ON BRK-OFF
Motor rotational velocity
*2
t

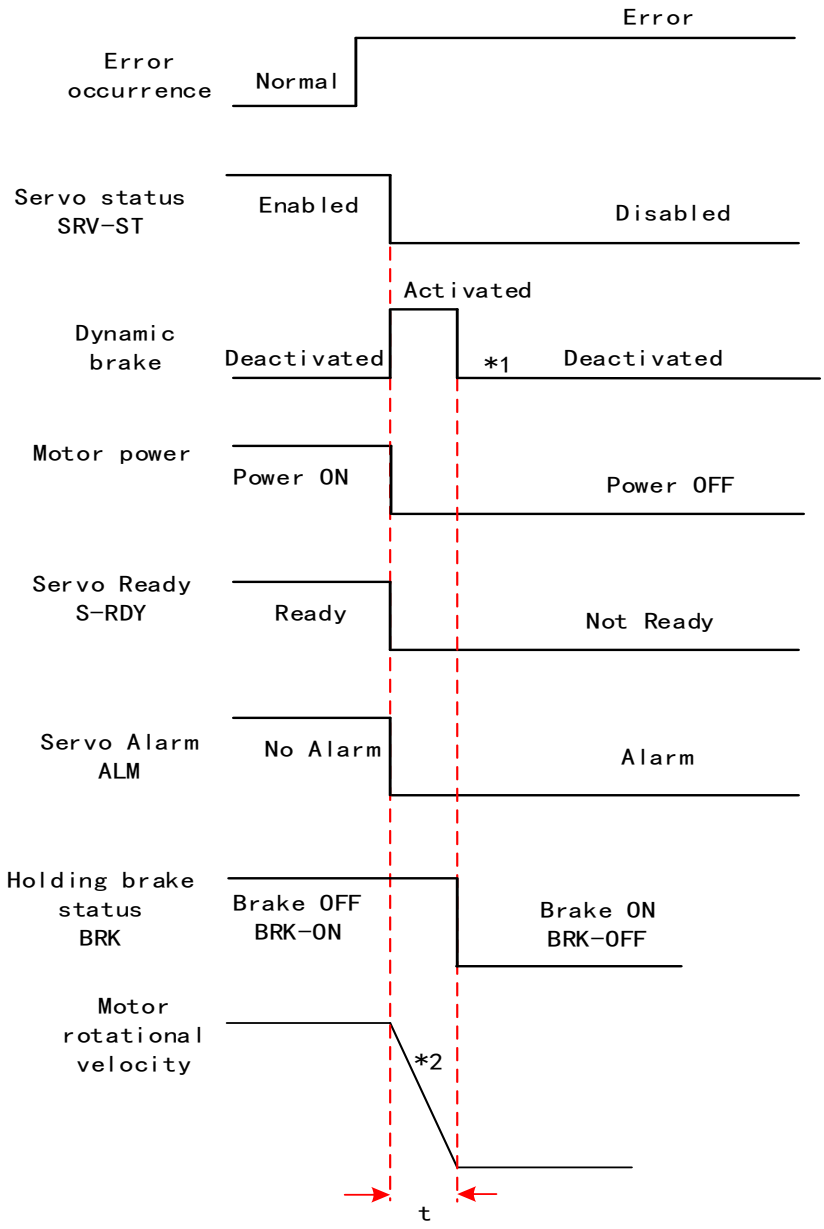
Servo braking method. Status after stopping: Free moving



Free stopping method. Status after stopping: Free moving



Dynamic braking. Status after stopping: Free moving

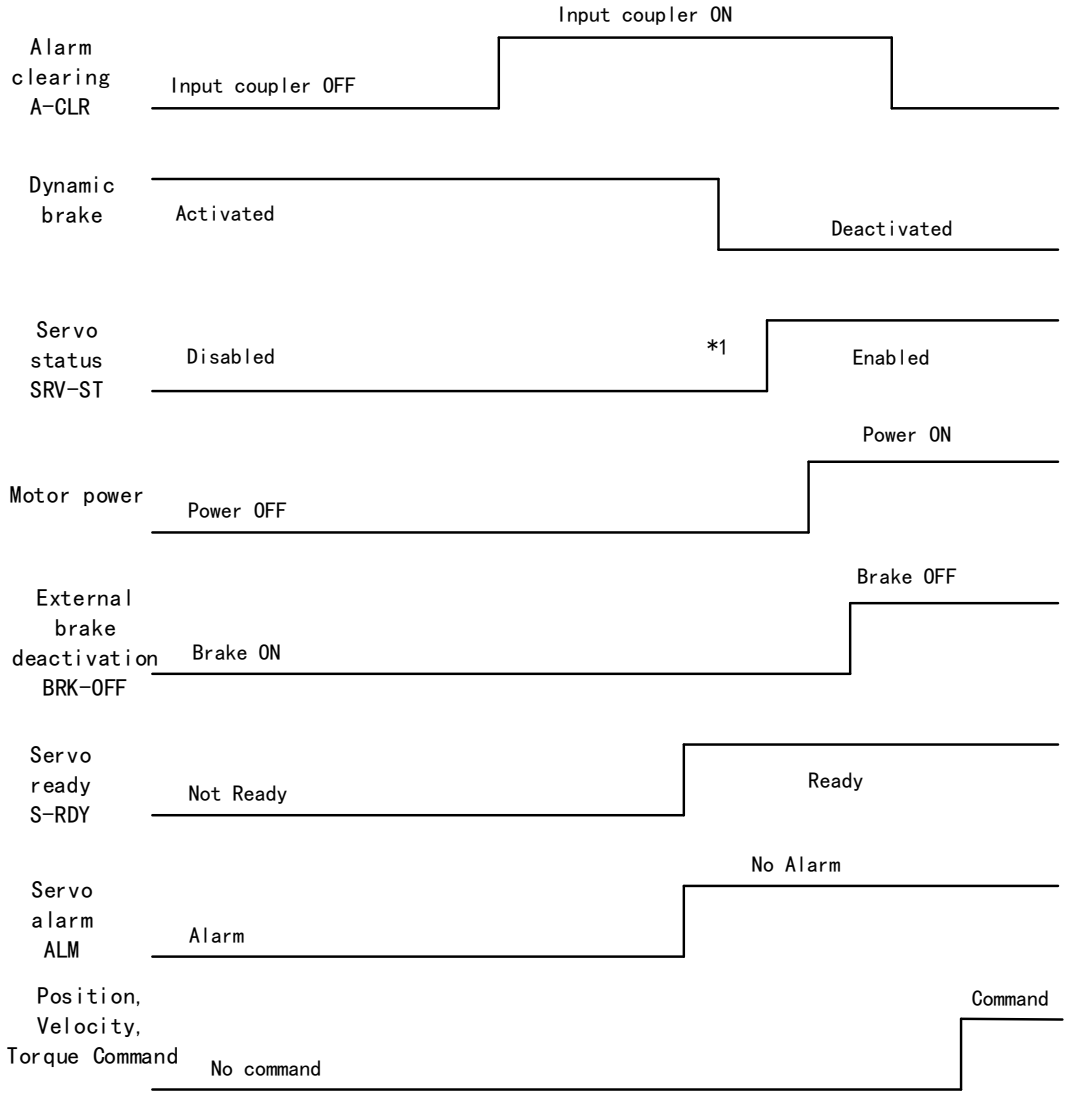


** *1. Status after stopping is as defined in P05.10.*

2. Servo stopping method is as defined in P05.10. Deceleration time t is determined by whichever comes first between time set in P06.14 and time needed for motor to drop below velocity set in P04.39. After deceleration time t, dynamic braking will be off and holding brake signal will be set to OFF (Holding brake is activated. Although BRK-OFF signal is valid, actual activation of holding brake is dependent on whether the motor comes with holding brake).

3. BRK-ON signal doesn't indicate the activation of holding brake but the invalidation of the signal. Holding brake is not applied when BRK-ON signal is valid. Same idea goes for BRK-OFF signal.

Alarm clearing - Sequence diagram



*** 1.SRV-ST signal is received when servo driver is enabled. Command input is not allowed yet*

2. BRK-OFF signal doesn't indicate the deactivation of holding brake but the invalidation of the signal. Holding brake is applied when BRK-OFF signal is invalid.

4.2 Front Panel

Servo Driver front panel consists of 5 push buttons and a 5-segments display. Can be used for displaying of status, alarms, functions, parameters setting and auxiliary functions.



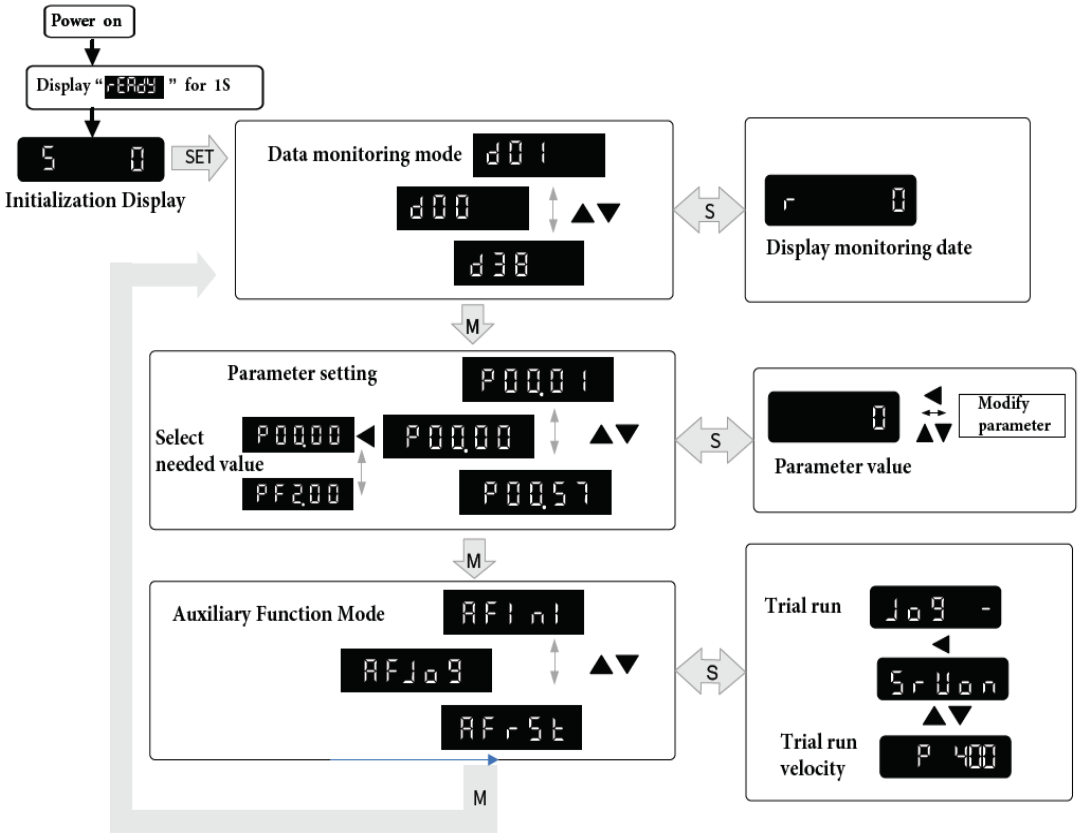
Front panel

Buttons and functions

Label	Symbol	Function
Display	/	Consists of 5 push buttons
Mode	**M**	To switch between 4 modes: 1. Data monitoring mode : To monitor changes of motion data values 2. Parameters setting mode : To set parameters 3. Auxiliary functions mode: To operate common functions, such as trial run, alarm clearing
Enter(set)	**S**	To enter or confirm
Up	▲	To switch between sub-menus / Increase
Down	▼	To switch between sub-menus / Decrease
Left	◄	To switch between values

4.4 Panel Display and Operation

4.4.1 Panel Operation



Flow diagram of panel operation

(1) rEAdy will be displayed for about 1 second after driver is powered on. Then, automatically enters data monitoring mode and displays initial data value. Otherwise, alarm code will be displayed if error occurs.

(2) Press **M** key to switch between modes.

Data monitoring mode → Parameters setting mode → Auxiliary functions mode

Alarm code will be displayed regardless of any mode if alarm occurs. Press **M** to switch to other modes.

(3) Press ▲or▼to select the type of parameters in data monitoring mode. Press **S** to confirm.

(4) Press◀ to select current segment in parameters settings mode. Press▲or▼to increase/decrease the value of segment. Press **S** to confirm the modified value(s) and save the parameters.

4.4.2 Data Monitoring Mode

EL7 series servo driver offers the function to monitor different types of data in data monitoring mode. After entering this mode, press **S** to monitor any data that starts with **d**. Press **S** again to get back to data monitoring mode and **M** to switch to any other modes.

Data list in data monitoring mode

Label	Descriptions	Display	Unit	Data Format (x /y= numerical value)
d00	Position command deviation	d00	unit	"xxxx"
d01	Motor velocity**(Post-filtering)**	d01	r/min	"r xxxx" – Motor actual velocity
d02	Position control command velocity	d02	r/min	"xxxx"
d03	Velocity control command velocity	d03	r/min	"xxxx"
d04	Actual feedback torque	d04	%	"xxxx"
d05	Feedback pulse sum	d05	unit	"xxxx"
d06	Command pulse sum	d06	unit	"xxxx"
d07	Maximum torque during motion(Within 2 s)	d07	/	"d xxxx" – Max torque % "J xxxx"- Average load ratio
d08	Input Command Pulse Frequency	d08	HZ	"xxxx"
d09	Control mode	d09	/	Position: "Ct PoS" Velocity: "Ct SPd" Torque: "Ct trq"
d10	I/O signal status	d 10	/	**Refer to the description for details.**
d11	Analog input	d 11	mV	**Refer to the description for details.**
d12	Alarm cause and record	d 12	/	"Er xxx" Alarm code
d13	Rated Drive Power	d 13	W	"Pxxx" Rated Drive Power
d14	Regeneration load factor	d 14	%	"xxxx"
d15	Motor overload factor	d 15	%	"L xxx" – Motor overload %
d16	Inertia ratio	d 16	%	"xxxx"
d17	Driver overload factor	d 17	%	"xxxx" %
d18	No. of changes in I/O signals	d 18	/	"xxxx"
d19	Single Power-on Duration	d 19	s	" xxxx"
d20	Cumulative Operating Time	d20	h	" xxxx"
d21	Single turn encoder data	d 21	pulse	"xxxx"
d22	Multiturn encoder data	d22	r	" xxxx"
d23	Control Power Voltage	d23	0.1V	"xxxx"

d24	Position deviation (External Encoder)	d24	Unit	"xxxx"
d25	Motor mechanical angle	d25	0.1°	" xxxx"
d26	Motor electrical Angle	d26	0.1°	" xxxx"
d27	DC bus voltage	d27	V	" xxxx"
d28	Software version	d28	/	"d xxx Servo software" "F xx Communication software" " h xxx Hardware Version" "C xx CPLD software"
d29	No. of times of external encoder communication error	d29	times	"xxxx"
d30	No. of times of encoder communication error	d30	times	"xxxx"
d31	External Encoder Position	d31	pulse	"xxxx"
d32	MCU Temperature	d32	℃	"C xxx "
d33	Driver temperature	d33	℃	"d xxx" – driver temperature
d35	Motor Temperature	d35	℃	"xxxx"

After the servo drive is purchased and powered on, it displays  (when servo is disabled).

To change the power-on display, set P00.43 (LED Initial Status Setting).

Description of data monitoring function

When monitoring data on the front panel, data has high/low words and positive/negative signs. Display rules for parameter values are shown below:



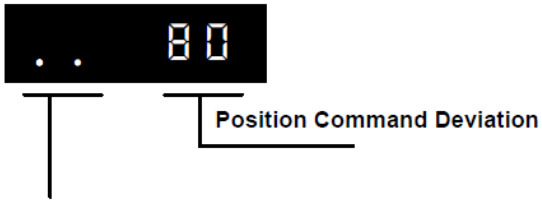
High word: Decimal points lit on the rightmost two digits.
Low word: Decimal points unlit on the rightmost two digits.



Negative: Decimal points lit on the leftmost two digits.
Positive: Decimal points unlit on the leftmost two digits.

d00 Position command deviation

Shows high bit and low bit of position deviation



Positive: Decimal points unlit on the leftmost two digits.
Negative: Decimal points lit on the leftmost two digits.

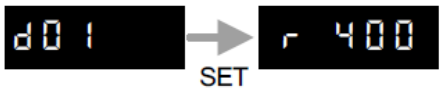
Press ◀ key to switch between high word and low word.
In the example below: Position Command Deviation = 2608850



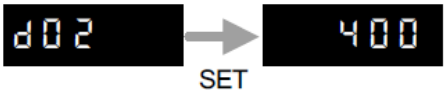
High word: Decimal points lit on the rightmost two digits.
Low word: Decimal points unlit on the rightmost two digits.

d01 Motor velocity, d02 Position control command velocity, d03 Velocity control command velocity

After normal power-on, the drive displays  indicating the drive is in the non-enabled state. After the drive is enabled, the panel displays  When the motor is running normally, the panel displays .



Motor Speed (r/min))

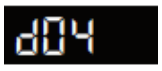


Position Control Command Speed (r/min)

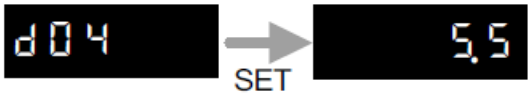


Velocity control command velocity (r/min)

d04 Actual torque feedback



reflects actual current.



Actual feedback torque (%)

d05 Feedback pulse sum d06Command pulse sum

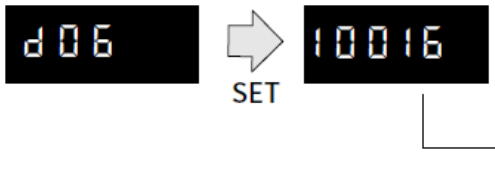
●Feedback pulse sum (Encoder feedback pulse)



Press ◀ key to switch between high/low bit
Example:Feedback pulse sum=2100160



●Command pulse sum(Command pulse)

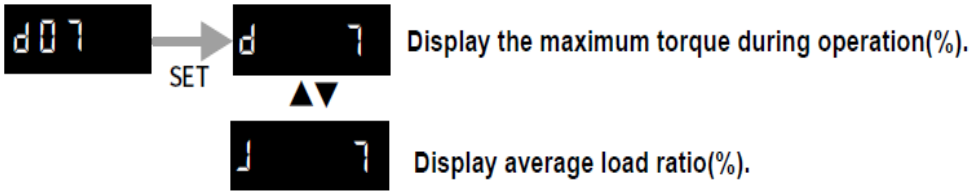


Press ◀ key to switch between high/low bit
Example:Command pulse sum=210017



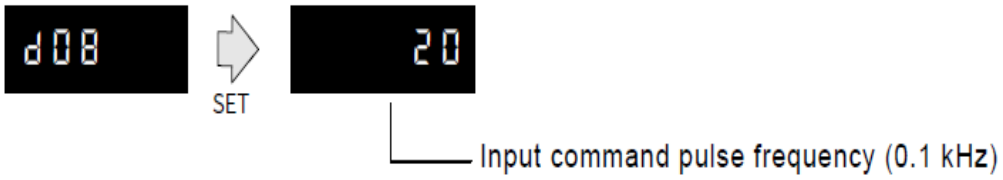
d07 Maximum torque (within 2 s)

■ Display the maximum torque during motor operation.



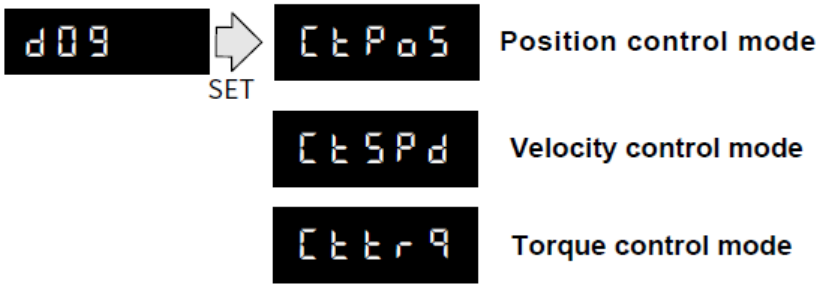
d08 Internal command pulse sum

■ Display the frequency of input command pulse sent from the host controller to the drive (pulses received within 1 s).



d09 Control mode

■ Display the current control mode of the servo drive.



d10Io I/O signal status

Display rule: Upper digital tube segment = active, lower segment = inactive. Lit decimal point for DI status; unlit for DO status. Press ▲▼ to toggle DI/DO display.

■ **Input:** From low bit to high bit (right to left): DI1, DI2… This example indicates that DI1 and DI2 input functions are active.



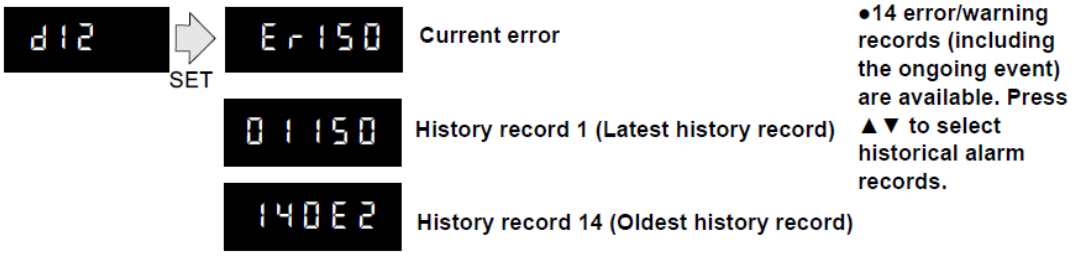
- **Output:** From low bit to high bit (right to left): DO1, DO2… This example indicates that DO1 and DO2 output functions are active.



d11 Analog input



d12 Alarm cause and historical record



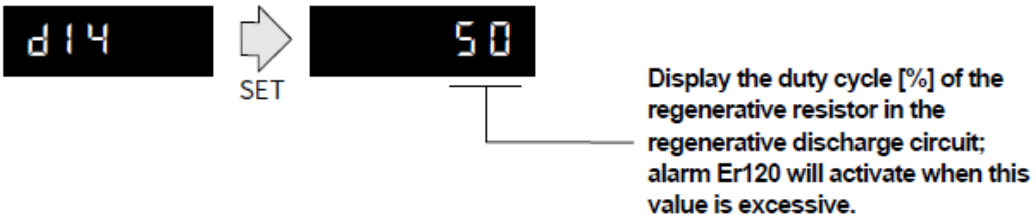
Please refer to the alarm list table in chapter 7 for alarms that can be recorded.

Description

- Save – This error will be saved to the historical records.
- Clearable – The alarm can be reset via the **AFACL** alarm clear function in auxiliary functions.For other alarms, power must be cycled after eliminating the cause of the error to clear the alarm.
- Emergency Stop – Executed in accordance with the emergency stop mode for Class 1 and Class 2 alarms.

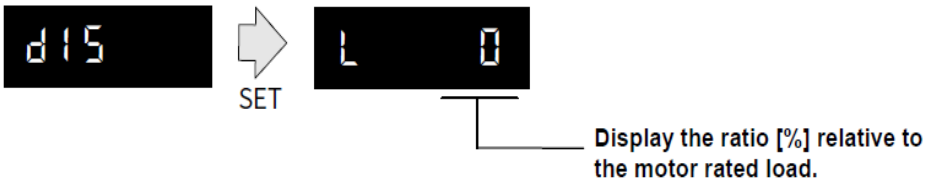
d14 Regenerative load factor

Regenerative load factor（Er120 might occur, if the value increases indefinitely）

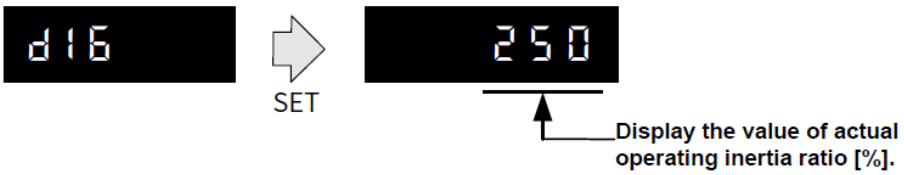


d15 Motor overload ratio

Motor Overload Ratio (If this value keeps rising, the drive will trigger alarm Er100)



d16 Inertia ratio



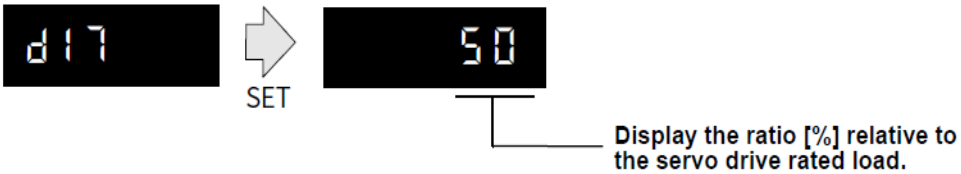
Use auxiliary function 

or Motion studio to measure the inertia ratio. The result will be shown on 

, hold M to write the value in P21.03.

d17 Drive overload ratio

Drive overload ratio (If this value keeps rising, the servo drive will trigger alarm Er101)



d18 No. of changes in I/O signals

Displays the number of DI/DO state changes.

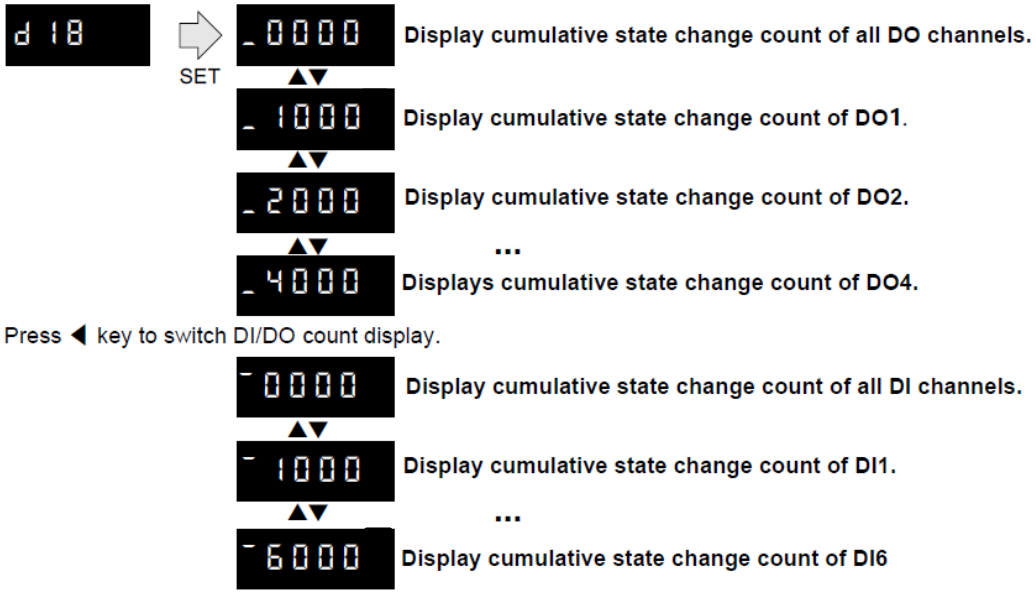
1st digit: Indicates DI/DO type

- Shows "-" : Currently displaying DO count
- Shows "--" : Currently displaying DI count

2nd digit: Channel selection

- 0: Displays cumulative state change count of all DI or DO channels
- x: Displays individual cumulative state change count of DIx or DOx, where x ranges from 1 to 6.

3rd~6th digits: Numeric value of change count.



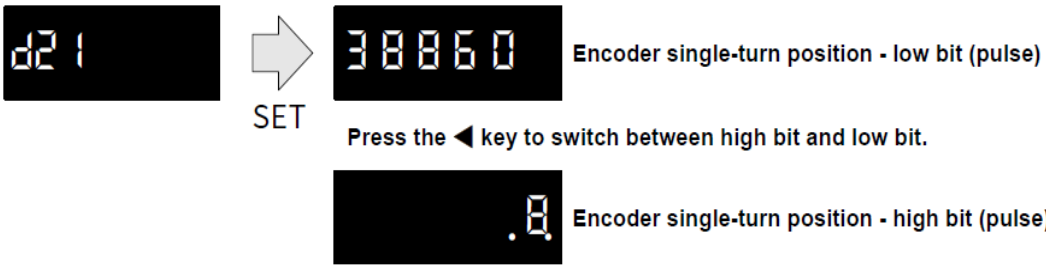
d19 Single Power-on Duration



d20 Cumulative Operating Time



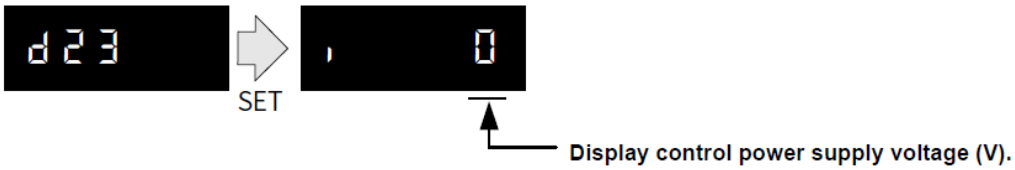
d21 Single turn encoder data



d22 Multiturn encoder data



d23 Control Power Voltage



d24 Position deviation (External Encoder)



d25 Motor mechanical angle



d26 Motor electrical Angle



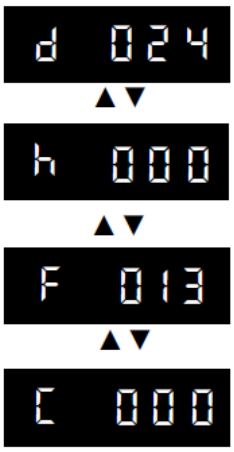
d27 DC bus voltage



Display DC bus voltage between terminals P and N (V). (For reference only; not intended as a measuring instrument.)

d28 Software version





Driver Software Version (DSP)

Hardware Version

Communication Software Version

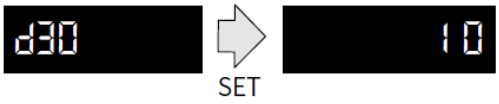
CPLD Software Version

d29 No. of times of external encoder communication error



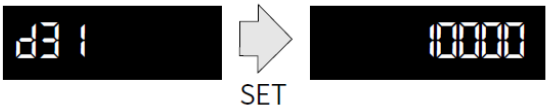
Displays external encoder communication error count (times).

d30 No. of times of encoder communication error



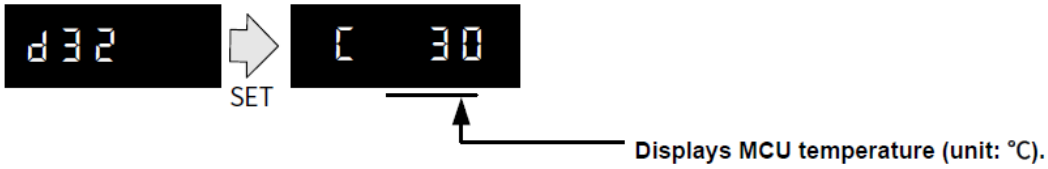
Displays encoder communication error count (times).

d31 External Encoder Position

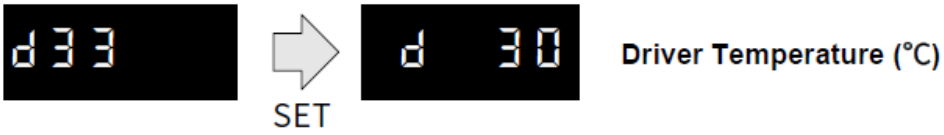


Display External Encoder Position (pulse)

d32 MCU Temperature



d33 Driver temperature

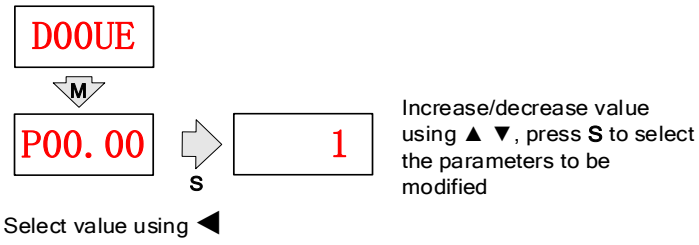


d35 Motor Temperature



Display setting at power on

Please refer to P00.43 for any display content required on the front panel during initialization



If you have changed a parameter but have not pressed the S key to confirm the change, you can press 'M' to exit the change if you do not want to change the parameter. After modifying the parameters, some parameters need to be powered up to take effect, we need to re-power up to make the parameters take effect.

P00.43	Label	LED Initial Status				
	Range	0~38	Default	34	Unit	-
	Activation	After restart	Attribute	RW	PNU	10043

To set content display on front panel of the servo driver at servo driver power on.

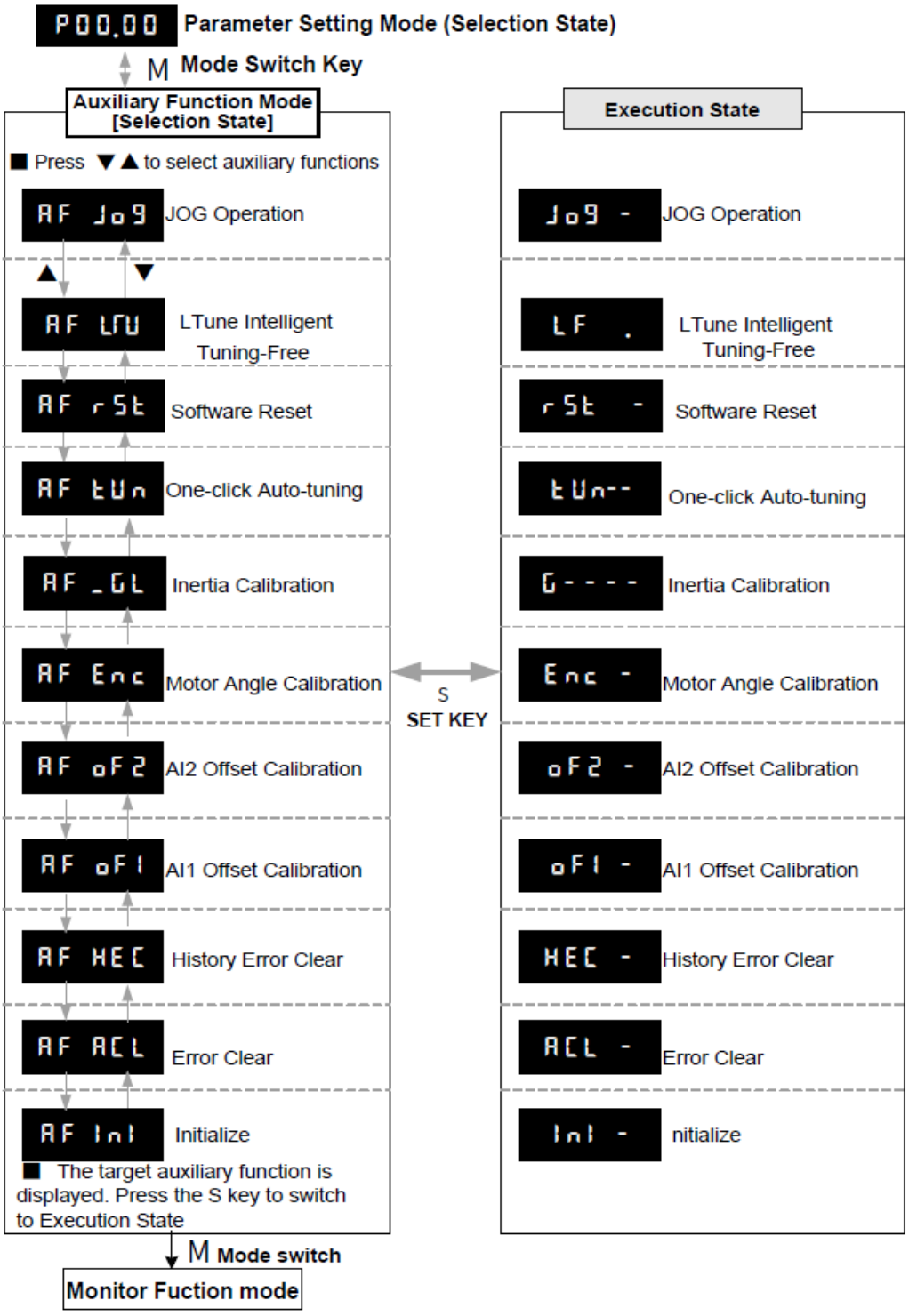
Set value	Content	Set value	Content	Set value	Content
0	Position command deviation	14	Regenerative load rate	27	Voltage across Bus
1	Motor speed	15	Motor overload rate	28	Software version
2	Position command velocity	16	Inertia ratio	30	No. of encoder communication error
3	Velocity control command	17	Driver overload rate	32	MCU temperature
4	Actual feedback torque	18	No. of changes in I/O signals	33	Driver temperature
5	Position feedback	19	Time per power-up	34	Servo status
6	Position command	20	Power on total time	35	Motor temperature
7	Maximum torque during motion	21	Single turn position		
8	Input commend pulse frequency	22	Multiturn position		
9	Control mode	23	Communication axis address		
10	DI/DO signal status	24	Encoder position deviation		
12	Error cause and history record	25	Motor electrical angle		
13	Driver power	26	Motor mechanical angle		

Description

The parameter values on the front panel can be displayed in hexadecimal or decimal format. Values prefixed with "H" are shown in hexadecimal; values without any prefix are displayed in decimal.

Example: If parameter P01.02 shows , it means the value of P01.02 is 0x11.

4.4.4 Auxiliary functions



AF jog Trial run

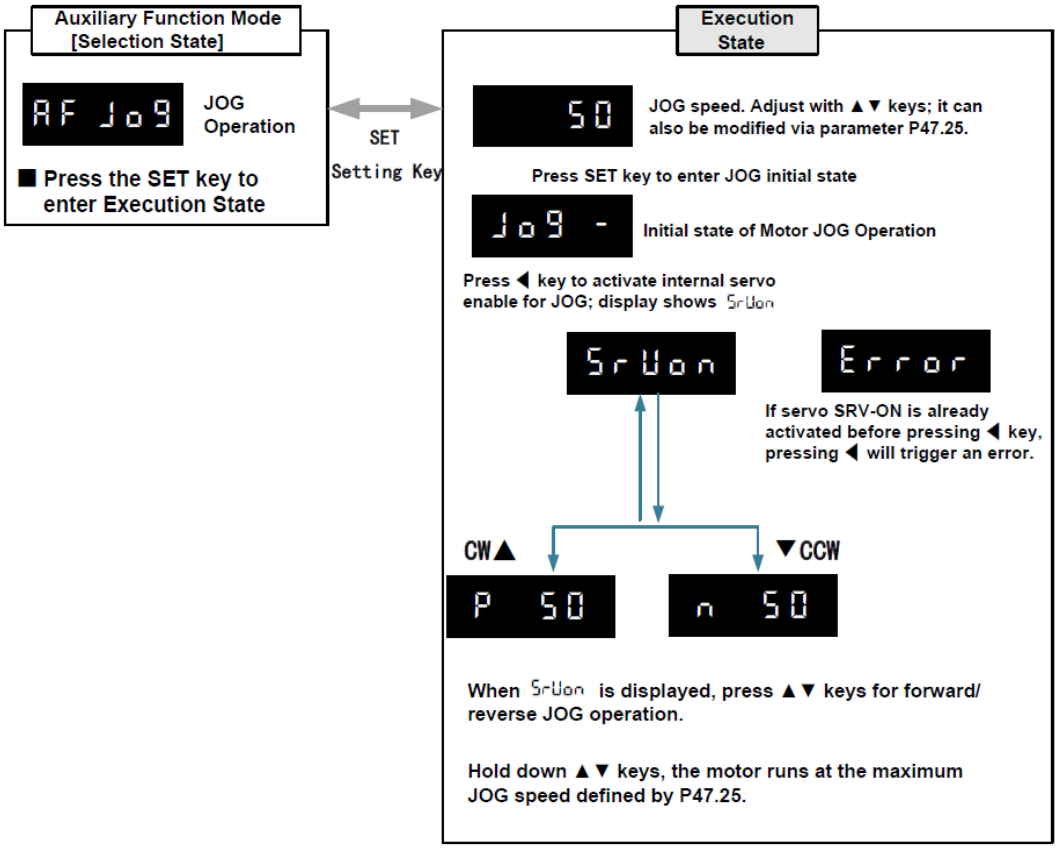
Test operation can be performed when the CN1 control signal terminal is not connected to upper-level controllers such as PLCs, to preliminarily verify whether the driver and motor operate normally.

■ Initialize all user parameter settings (especially P21.03 and gain-related parameters) to avoid undesirable phenomena such as oscillation.

■ Before test operation, check the relevant parameters as follows:

- **P47.25 JOG Command Speed:** Do not set the test speed too high to avoid machine collision.
- **P47.29 JOG Acceleration:** Do not set the acceleration too large to avoid machine collision.

■ **Test Operation Procedure**

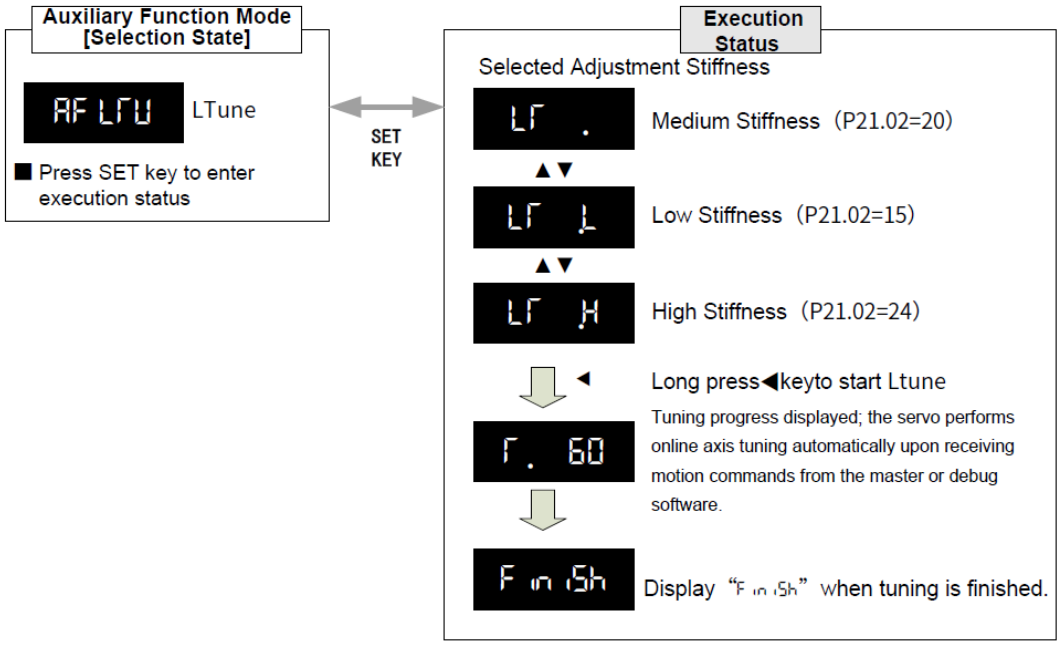


⚠ NOTICE

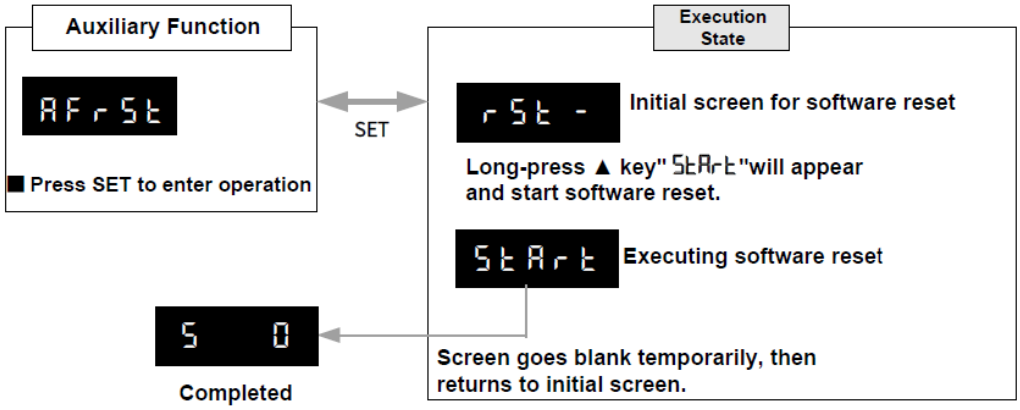
- During test operation, properly set gain-related parameters to avoid vibration and other abnormal conditions.
  After completing test operation, press the S key to return to the selection state, and the internal enable for test operation will be turned off simultaneously.

AF LTU LTune Intelligent Tuning-Free

Start LTune Intelligent Tuning-Free via the front panel. Front-panel-triggered LTune supports three stiffness values: P21.02=15, 20, 24. With LTune enabled, the servo executes online axis tuning automatically after receiving motion commands from the master or debug software. See the procedure below:



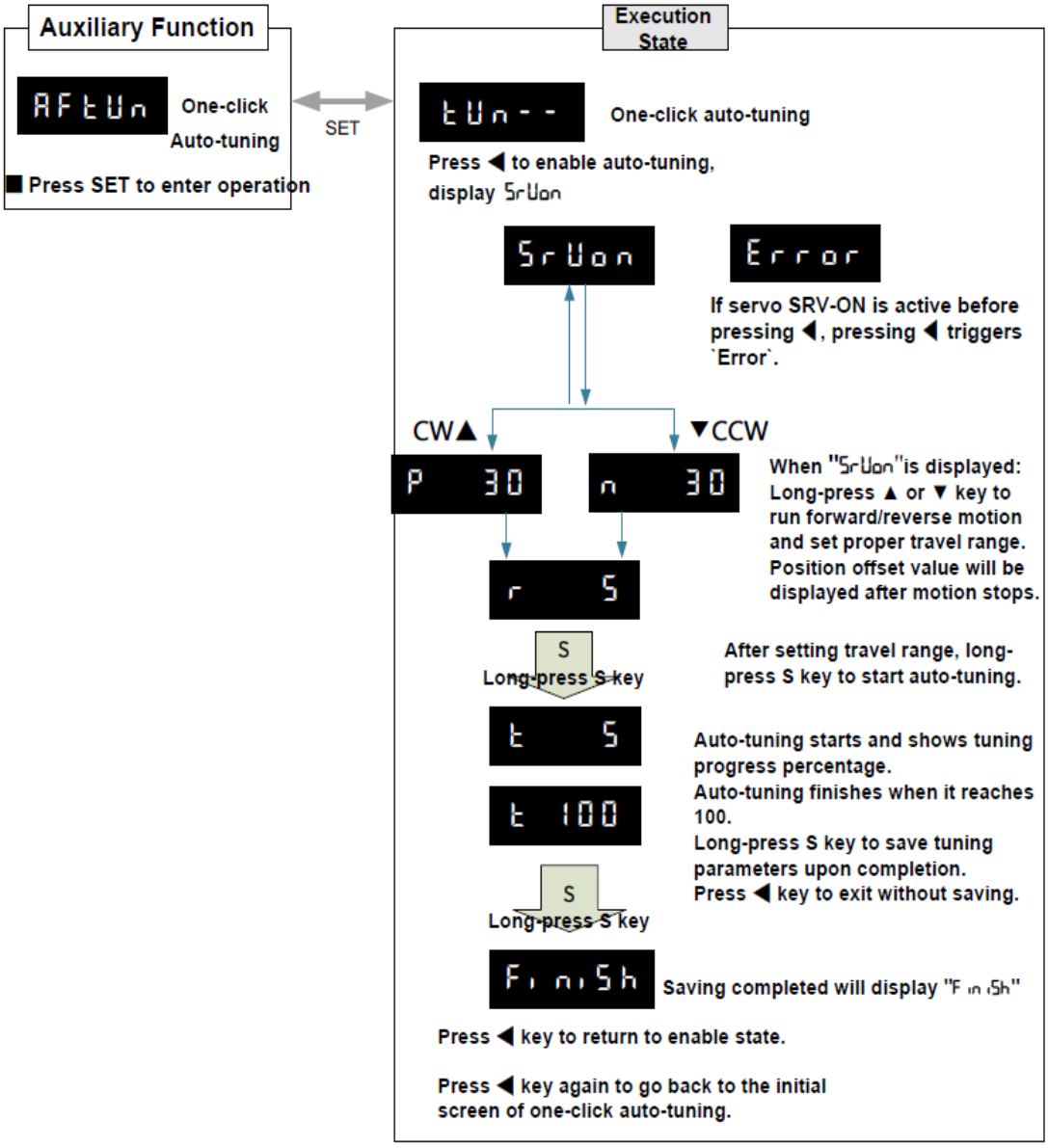
AF rSt Software reset



■ **Note :Use software reset for parameters requiring power-on to activate.**

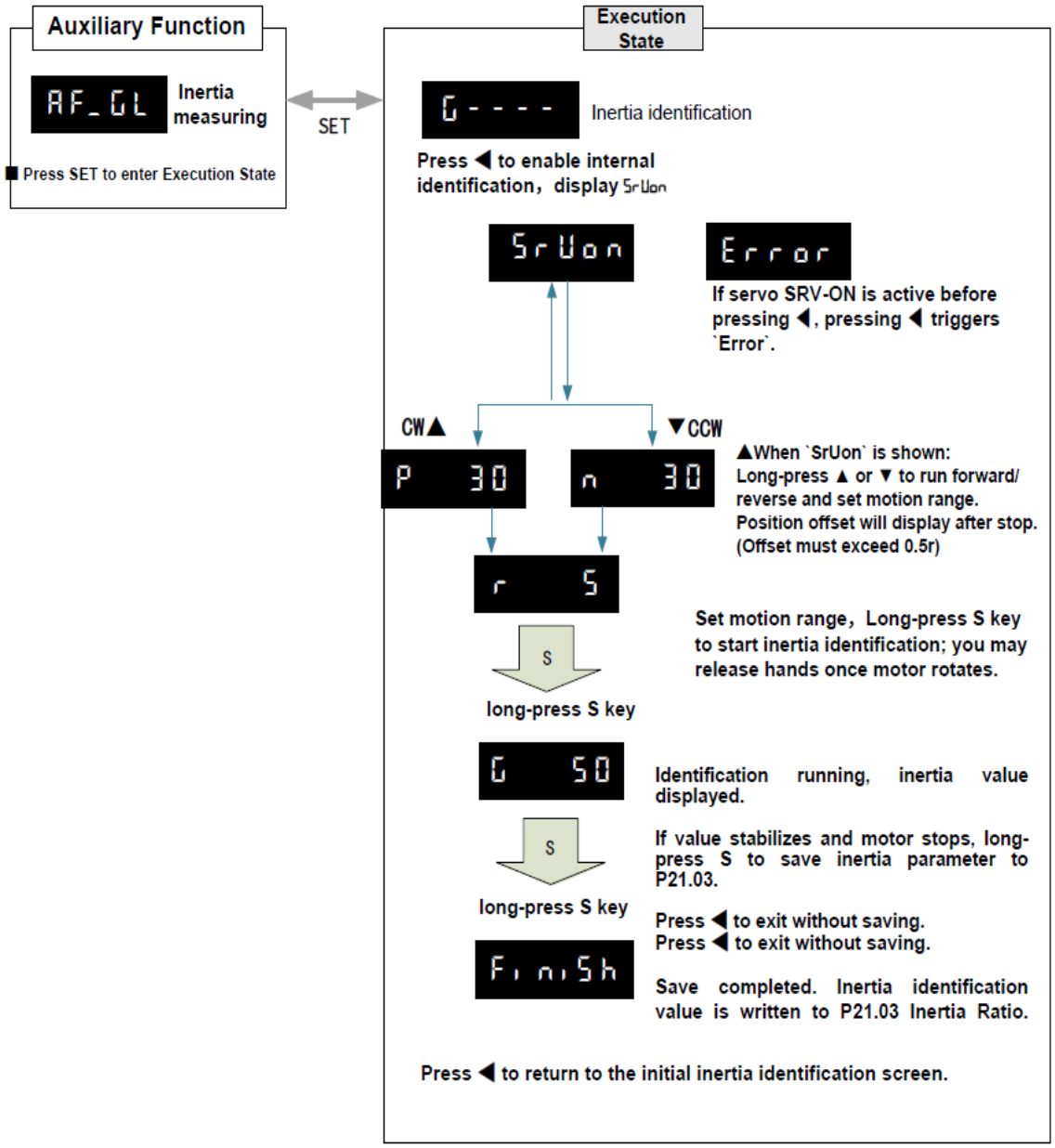
AF_tun One click auto tuning

One click auto tuning can be applied by operating the front panel. Set simple movement range and movement range has to be more than 0.5 motor revolution.



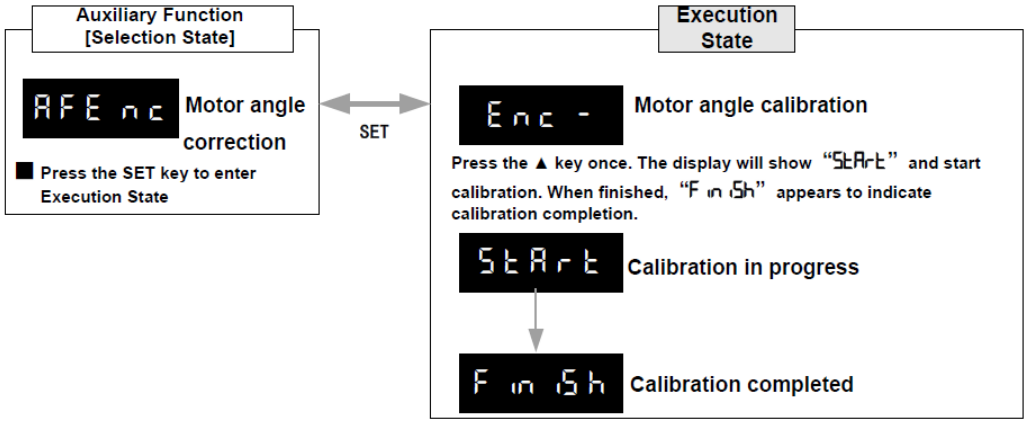
AF_GL Inertia measuring

Set proper test speed and acceleration during inertia identification to prevent collision.



■ When performing inertia test, pay attention to the velocity and acceleration of JOG operation to avoid collision.

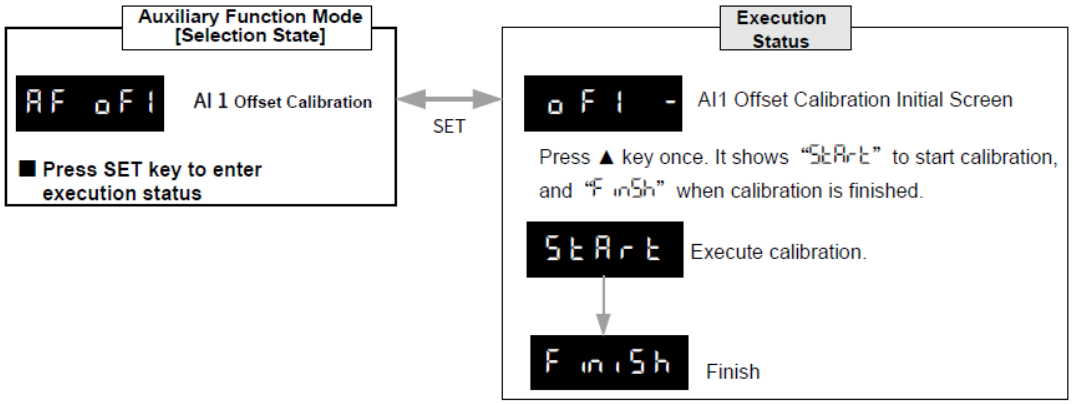
AF Enc Motor angle correction



AFoF1～oF2: Analog Offset Calibration

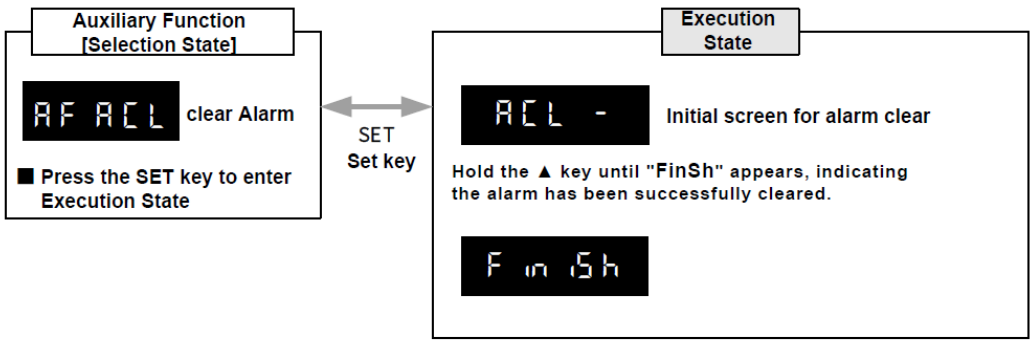
Auto adjust analog input offset calibration.

- Analog Input 1 (AI1) — PA2.65 (Analog 1 Offset Setting)
- Analog Input 2 (AI2) — PA2.66 (Analog 2 Offset Setting)



AF ACL Clear alarm

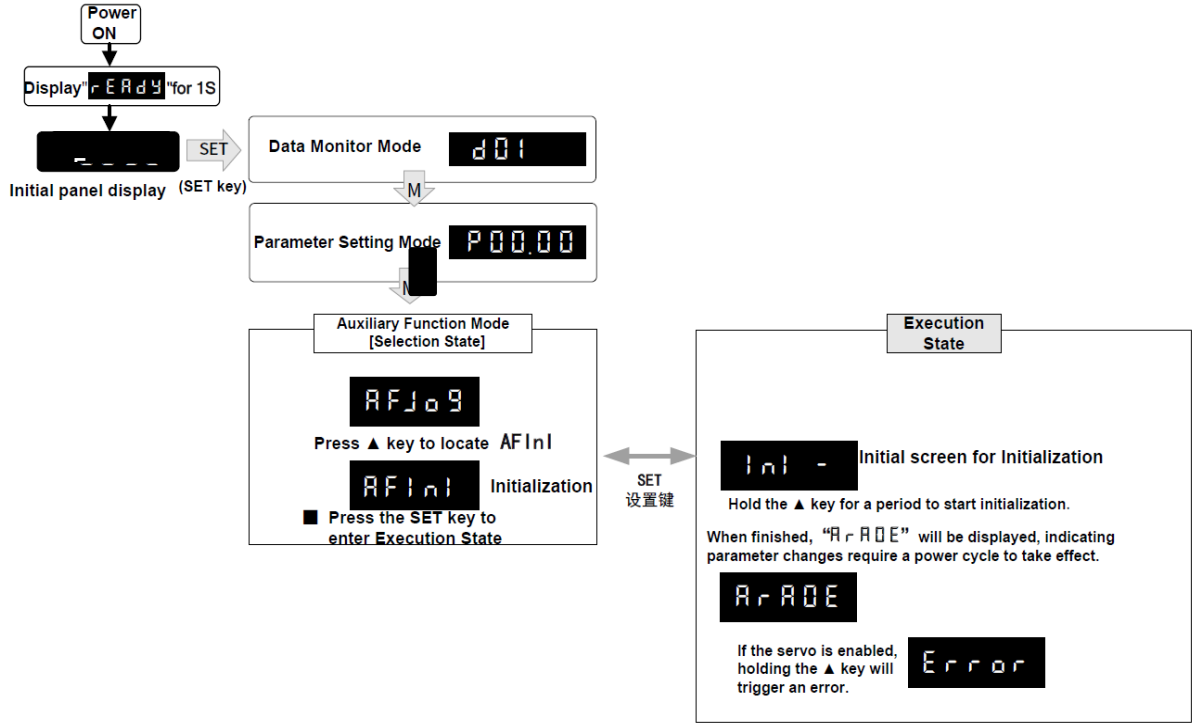
Alarms can be cleared via the **AF ACL** alarm reset function in auxiliary functions. For other alarms, troubleshoot the error cause first, then cycle the power to clear them.



For alarms that can be cleared using this function, please refer to table in Chapter 7. See Section 7.4 Alarm Handling Methods for alarm causes and reset methods.

AF InI Reset to factory default

To reset parameters settings to factory default.



4.4.5 Alarm

When a driver fault occurs, the front panel automatically enters the alarm display mode and shows the corresponding alarm code. Refer to Table 10-1 Alarm Code List for detailed information on alarm codes.

■ If the panel shows no display at all, check whether the main power supply voltage is abnormal. If the power voltage is within the normal range, the servo driver may be faulty. Please contact Leadshine technical support!

■ Resettable alarms can be cleared via the alarm reset function in auxiliary functions. For non-resettable alarms, power cycling is required after eliminating the root cause of the fault.

■ The servo adopts different stop modes for different fault types. Faults are classified as Type 1 and Type 2, and their corresponding stop modes are configured via parameters P00.31 and P00.32.

4.5 Motion Studio

Main Functions

■ System Monitoring: Monitors the operating status and alarms of the servo driver; captures and stores real-time instantaneous operation data of the servo.

Specific functional modules:
− Oscilloscope Function
− Alarm Display Function
− Status Monitoring Function (Corresponds to the motion data monitoring function on the front panel)
− Oscilloscope: Supports single-frame / multi-frame high-precision sampling, waveform overlay, analog channels and digital channels. Dual cursors are available for convenient waveform analysis.

■ One-click Auto-tuning: Configure simple operating conditions, then the servo automatically runs auto-tuning to obtain proper gain parameters.

■ Parameter Management: Read and download all servo driver parameters; load saved parameter files, edit parameters and download to the driver; save parameters to EEPROM and restore factory defaults.

■ I/O Setting: Configure and monitor servo I/O signals via the I/O setting page; force I/O input or output.

■ JOG Operation: Enable simple forward/reverse motor rotation. Supports position JOG and speed JOG.

■ Inertia Identification: Identify load inertia through a sequence of motions. Write the actual inertia ratio to P21.03 via Parameter Management.

■ Mechanical Characteristic Analysis: Detect the resonant frequency of the mechanical system and suppress vibration using notch filters.

■ Gain Adjustment: Adjust servo stiffness level and adjustment mode. Manual mode allows editing individual parameters. Standard and Real-time modes call preset stiffness tables; single parameters cannot be modified separately.

■ Position Compare: Configure up to 42 position comparison points.

■ Black Box: Read servo black box data via Motion Studio for data analysis.

Note

Supports connecting to the driver with USB power supply only. Parameters can be modified through Motion Studio for convenient driver configuration.

4.6 Pre-operation Preparation

Complete the following inspections before operating the servo driver and servo motor:

No.	Item	Content
1	Wiring Check	Properly wire and firmly connect power input terminals, motor power output terminals, encoder feedback terminal CN2, control signal terminal CN1 (may be disconnected during JOG operation), communication terminals CN3 / CN4 (may be disconnected during JOG operation; pulse version is not equipped with this interface).No short circuit between power input cables, between motor output cables, or to PE protective earth.Motor U, V, W and PE wires must be connected to corresponding terminals; incorrect wiring will trigger faults.Main power terminals L1/L2 shall be wired correctly.Servo driver and servo motor must be reliably grounded.
2	Power Voltage Check	Ensure correct power polarity.Main power input L1, L2 shall be within single-phase AC 200V~240V rated range.
3	Mounting Check	The motor and driver shall be securely fixed.
4	No-load Check	No mechanical load is coupled to the motor shaft.
5	Control Signal Check	All control switches are set to OFF.Servo enable input SRV-ON remains OFF.
6	Environment Check	Secure installation of servo motor and reliable connection between shaft and machinery.The machinery coupled to the servo motor is ready for operation.

After power-up, confirm the Charge DC-bus indicator operates normally. The display shows **-rEAdy** then enters the initial LED status. If no alarms appear, the servo drive is ready for operation.

NOTICE

- The driver and motor must be reliably grounded; the PE terminal of the driver shall be firmly connected to the equipment ground.
- It is recommended to supply power to the driver via an isolation transformer and power filter for improved safety and noise immunity.
- Verify all wiring is correct before switching on power.
- An emergency stop circuit must be installed to cut off power immediately in case of faults.
- After a driver alarm, confirm the fault is cleared and the SRV-ON signal is disabled before restarting.

- Do not touch the driver and motor for at least 5 minutes after power-off to avoid electric shock.
- The driver and motor may reach high temperatures during operation; avoid burns.
- If the driver front panel shows no response after power-up, check whether the input voltage is within the rated range and check for phase loss. If everything is normal, the driver may be defective.
- If an alarm appears on the driver panel after power-up, refer to Section "10.4 Alarm Handling". Resolve the alarm cause prior to operation.

4.7 Trial Operation

The JOG function tests the motor and driver to confirm normal motor operation and detect abnormal vibration or noise. JOG control supports two modes: panel trial operation and debugging software trial operation.

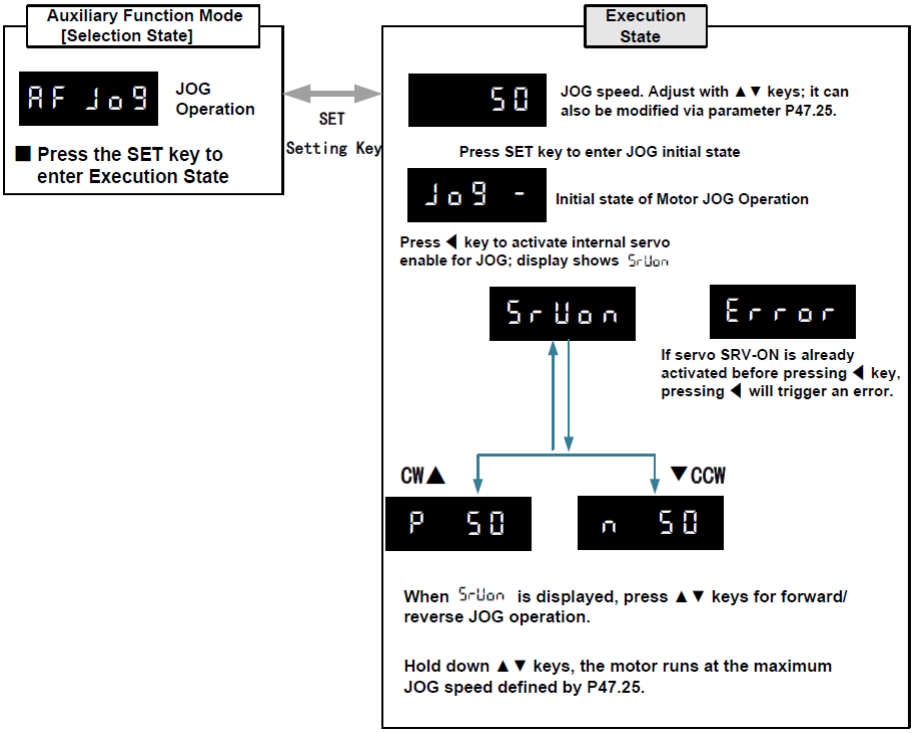
4.7.1 Panel JOG Operation

In this control mode, the control signal terminal CN1 does not need to be connected. For safety, JOG operation is recommended at low speed. The motor moves accordingly based on configured parameters under this mode.

■ Operation Setting Parameters

No.	Parameter	Name	Setting Value	Unit
2	P47.25	JOG Command Speed	User-defined	r/min
3	P47.29	JOG Acceleration / Deceleration Time	User-defined	ms/1000r/min

■ Panel JOG Operation Procedure



NOTICE

- Configure gain parameters properly during trial run to prevent vibration.
- Upon completing trial operation, press SET to return to selection mode; the internal trial run enable will turn off automatically.

■ Detailed Operation Procedure for JOG Trial Operation

1. First set all parameters corresponding to JOG control.
2. After parameters are saved, power off and restart the driver. Ensure the driver is in disabled status to enter JOG control mode.
3. Enter the submenu AF Jog under auxiliary function mode.
4. Press the SET key once; the display should show Jog -.
5. Press the ◀ key once. If normal, the display shows SrUon. If Error appears, press the ◀ key again to switch to SrUon. If Error still remains, enter the d17 submenu in data monitor mode to troubleshoot why the motor fails to run, then retry after fault clearance.
6. For position JOG mode with SrUon displayed: Hold the ▲ key continuously; the motor accelerates up to the maximum speed set by P47.25 and runs forward

continuously. Release the ▲iubei key for immediate deceleration to stop, and the display remains SrUon. Hold the ▼ key continuously; the motor accelerates up to the maximum speed set by P47.25 and runs backward continuously. Release the ▼ key for immediate deceleration to stop, and the display remains SrUon. If the motor does not move, enter the d17 submenu in data monitor mode for troubleshooting, then retry after fault clearance.

7. Press the SET key during JOG operation to exit JOG control.

4.7.2 Debugging Software Trial Operation

Use Motion Studio debugging software to perform trial operation on the servo driver and motor.

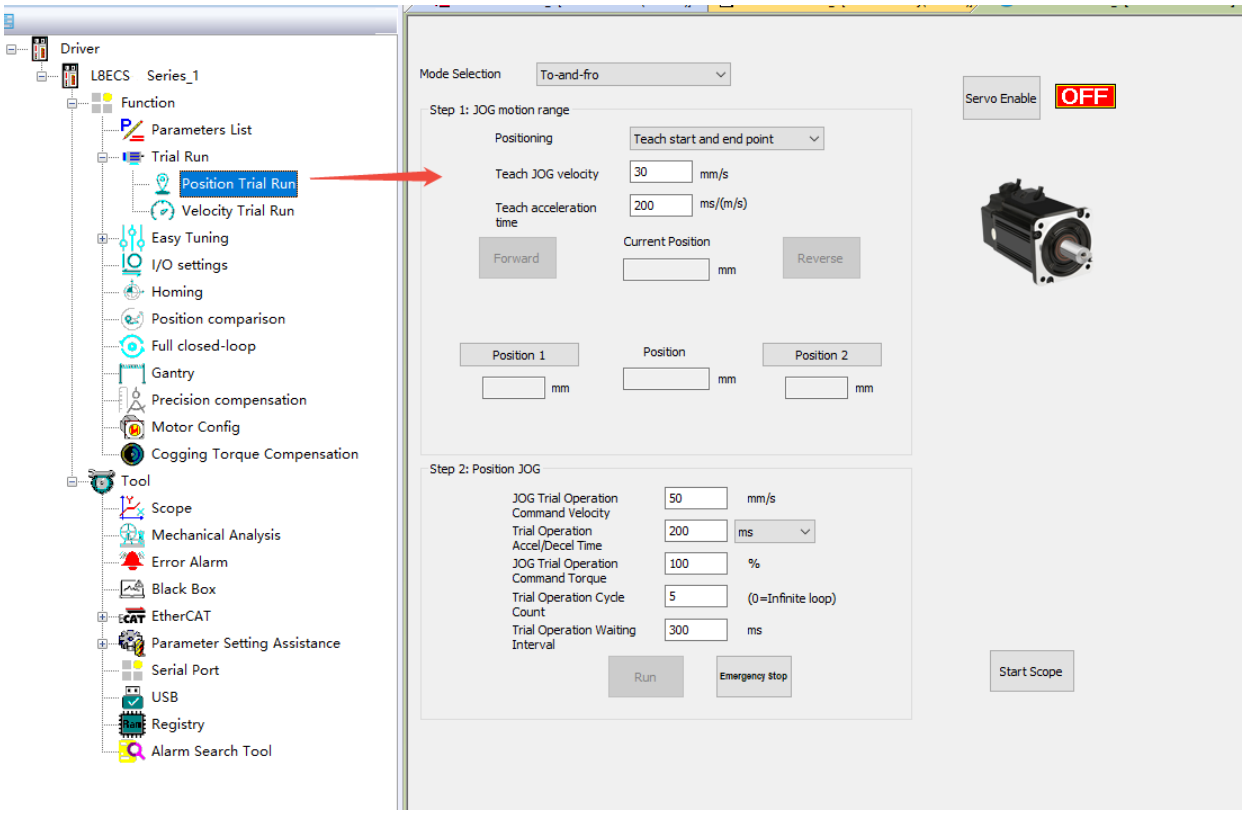
■ Trial Operation Procedure via Debugging Software

1）Wiring Check:

- Ensure the wiring for power input and motor output is correct.
- Establish communication between the servo driver and PC via a Type-C cable.

2）Verify that the power supply voltage is within the rated range.

3）After communication is established between the PC and driver, activate the trial operation function in Motion Studio. The trial operation interface is shown below:



4）Set the operation mode to Reciprocating Motion - Positioning with Start and End Points. After clicking Enable, the indicator changes from red OFF to green ON. You may first configure teach motion parameters above. The teach speed must not be excessively high to avoid machine collision. Click Forward/Reverse Motion to perform teach positioning and set the required start and end positions.

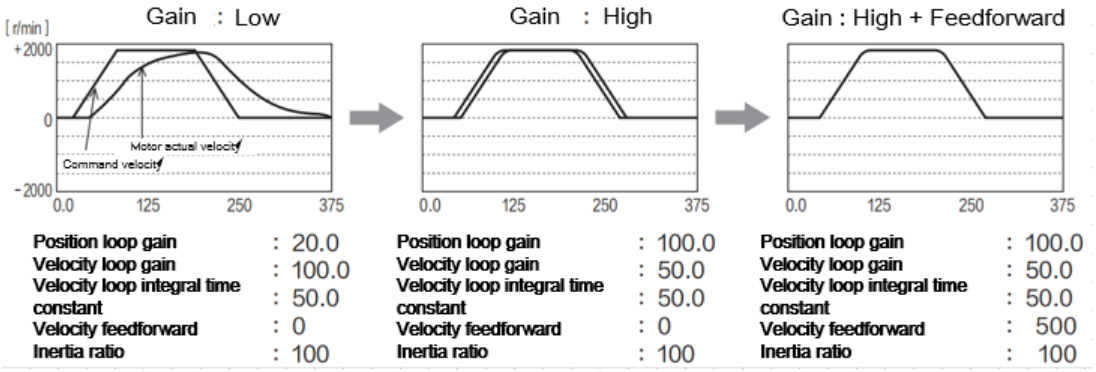
5）STEP-2 allows configuration of JOG motion properties to execute preset motion within the taught range. Set the number of cycles to perform repeated reciprocating motion along the planned path.

Note: During operation, view estimated inertia value, motor speed, motor load ratio and limit statuses via the monitoring panel on the right. Click Stop or Emergency Stop to interrupt motion during operation.

Chapter 5 Application

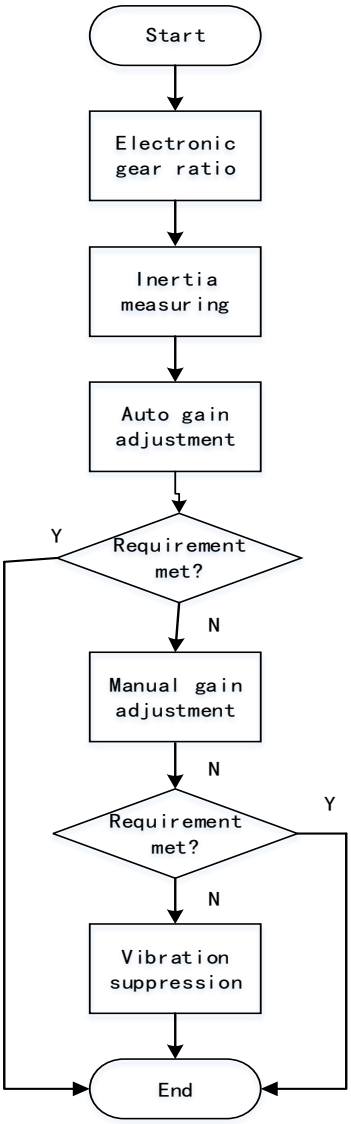
5.1 Gain Adjustment

In order for servo driver to execute commands from master device without delay and to optimize machine performance, gain adjustment has to be done.



Servo driver gain adjustment is done in combination with a few other parameters (Inertia ratio, Position loop gain, Velocity loop gain and Filters settings). These parameters will have an effect on each other so it always advisable to tune each parameter according in order to achieve optimal machine performance. Please refer to the steps below.

*Before adjusting the gain, it is advisable to carry out a test run in jog mode to ensure that the motor operates correctly.


Start
Electronic gear ratio
Inertia measuring
Auto gain adjustment
Requirement met?
Y
N
Manual gain adjustment
N
Requirement met?
Y
N
Vibration suppression
End

Gain Tuning Process	Function	Description
Inertia Identification	On-line Identification	Send commands via computer communication to drive motor motion; the drive automatically calculates the load inertia ratio
	Off-line Identification	Adopt the driver's inertia identification function; the drive automatically calculates the load inertia ratio
Automatic Gain Tuning	Automatic Gain Tuning	Real-time estimation of mechanical load characteristics, with automatic gain setting matching the estimation results. One click tuning: automatically set gain parameters and inertia matching on-site applications via the one-key tuning function of debugging software. Real-time automatic tuning: automatically adjust gain-matched parameters through the stiffness level selection function.
Manual Gain Tuning	Basic Gain	Manually adjust relevant parameters based on automatic gain tuning to optimize machine responsiveness and tracking performance.
	Basic Steps	Gain parameter tuning under position mode Gain parameter tuning under velocity mode Gain parameter tuning under torque mode
	Gain Switching Function	Switch gains via internal data or external signals to reduce stopping vibration, shorten settling time, and improve command tracking performance.
	Model Following Control	Improve responsiveness and shorten positioning time (for position control only).
	Command Filtering	Configure filtering settings for position, velocity and torque commands.
	Feedforward Gain	Enable the feedforward function to enhance tracking performance.
	Friction Compensation Function	Mitigate the impact of mechanical friction.
	Third-order Gain Switching	Based on regular gain switching, set gains for switching during the stopping phase to shorten positioning settling time.
Vibration Suppression	Mechanical Resonance	Enable the notch filter function to suppress mechanical resonance.
	Low-frequency Suppression	Enable the damping function to suppress low-frequency oscillation at the end effector.

5.2 Inertia measuring function

Inertia ratio = Total mechanical load rotational inertia / Electronic gear rotational inertia

Inertia ratio is an important parameter. Setting a suitable value can help with the precise tuning of the servo system. Inertia ratio can be set manually and also be determined automatically through servo driver

5.2.1 Online inertia determination

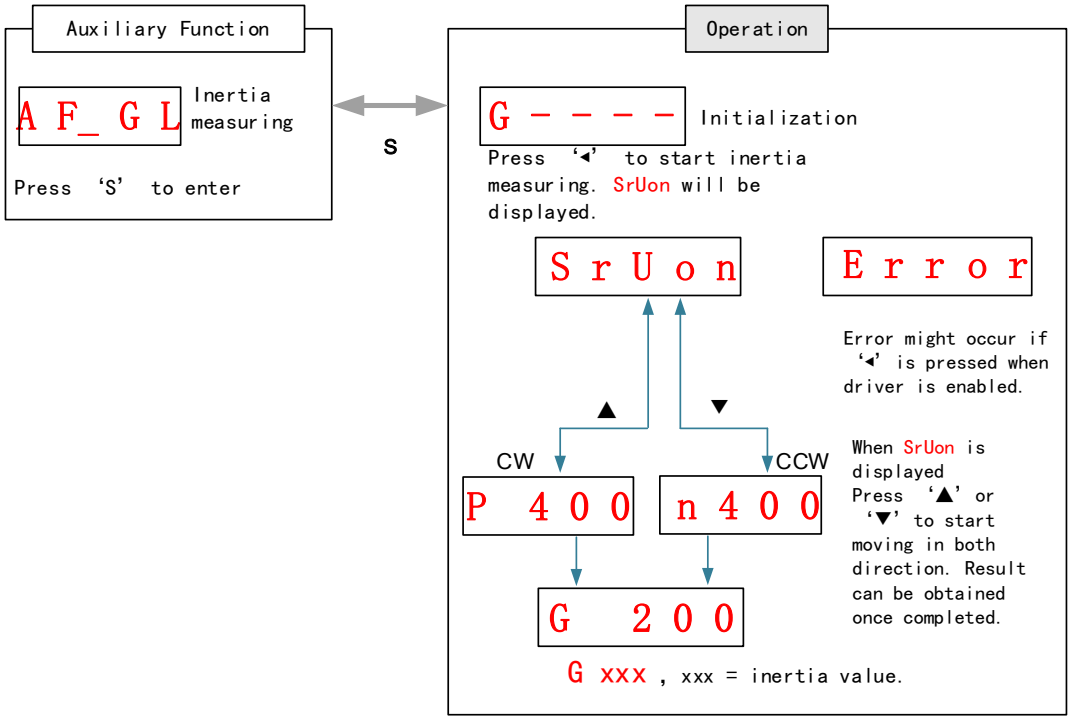
Enable motor using controller. Let motor run at above 400rpm, make sure there are acceleration, constant velocity and deceleration phase during the whole run. Cycle through 2-3 times to calculate load-inertia ratio. Result can be found on the front panel d16 or through Motion Studio system monitoring page. Enter the calculated value into P21.03 and save.

5.2.2 Offline inertia determination

Can be achieved through driver front panel or on Motion Studio.
Please make sure:
1. Servo driver is disabled.
2. Axis is within safe and allowed range and limit switch is not triggered prevent axis from over travelling.

Note:
1. Using the inertia recognition function, in order to accurately calculate the load inertia ratio, the following conditions should be met:
-Actual motor speed is greater than 300rpm, not too high to prevent crashing, it is recommended within 1000RPM.
-The motor acceleration setting is greater than 2000rpm/s;
-Motor acceleration is greater than 2000rpm/s, and the actual motor speed is greater than 300rpm and the time duration is greater than 50ms during the constant speed section;
-The load inertia ratio is within 20 times.
2. If the actual load inertia ratio is very large and the drive gain is low, it will lead to slow motor action and cannot reach the maximum speed and acceleration requirements of the motor, at this time, it can increase the speed loop gain and then re-identify the inertia. If vibration occurs during the identification process, the inertia identification should be stopped Immediately and the gain should be reduced.

5.2.3 Auxiliary function to determine inertia on front panel



Steps:

1、Set the trial run velocity **P47.25** and acceleration/declaration time **P47.29**. Value set shouldn't be too large, please keep it at around **400 r/min**.

2、Enter AF_GL for auxiliary function – Inertia ratio determination into front panel

3、Press S once to enter. "G---" will be displayed on the front panel.

4、Press ◀ once to display "StUon"

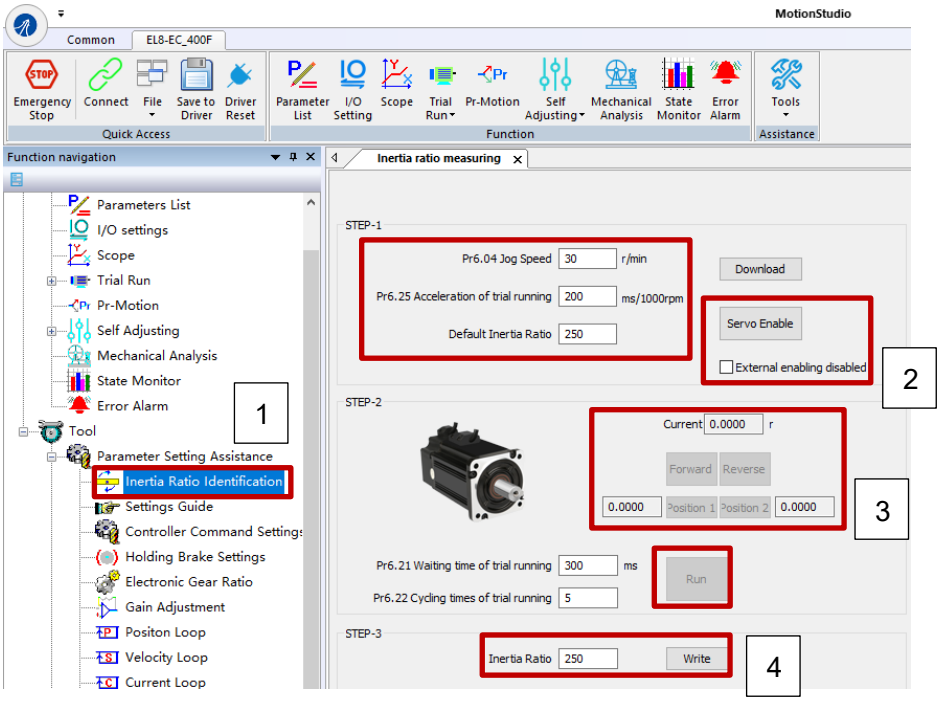
5、Press ▲ or ▼ once to start to calculate the inertia.

6、After the calculation is done, G **xxx** will be displayed and **xxx** is the value of inertia calculated.

7、Write the corresponding value into P00.04. Please refer to for parameter saving on servo driver.

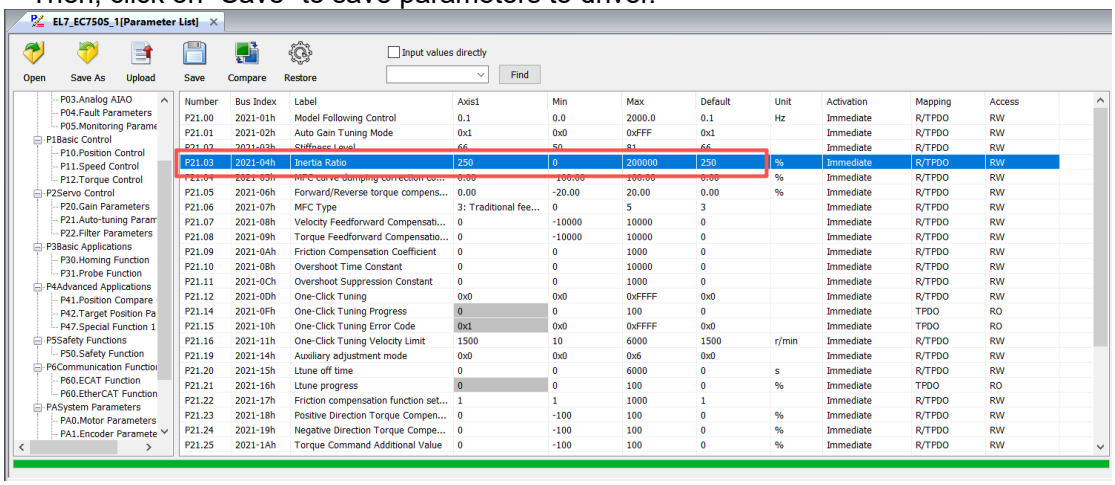
5.2.4 Inertia measuring using Motion Studio

1. Start Motion Studio and maneuver to inertia ratio identification page under Parameter Setting Assistance. Set trial run velocity(Jog speed) P47.25 and Acceleration(declaration) of trail running P47.29, click on 'Download' to save parameters to servo driver.
2. Tick "External enabling disabled" and click on "Servo Enable".
3. Click and hold "Forward" to start the motor. Current position will show motor cycles of revolution. Click on Position 1 to save current position as starting point. Click and hold "Reverse" to start the motor again. Click on Position 2 to save current position as ending point.
4. Set the waiting time between each cycle in P47.27 and no. of cycles in P47.28. Click on 'Run' and motor will run according to the parameters set.



5. After the calculation is done, inertia ratio will be calculated automatically and click on 'write' to enter the calculated value into P21.03.

6. Click on “Parameter List” to enter parameters management to check or modify P21.03. Then, click on “Save” to save parameters to driver.



Please take note:

1. *Trial run velocity and distance should be optimal to prevent any axis from bumping into objects.*
2. *It is recommended to move only in 1 direction for vertically mounted axis. Take precaution before moving the axis.*
3. *For applications with higher frictional drag, please set a minimal travel distance.*

P21.03	Label	Inertia ratio		Mode	F		
	Range	0~20000		Default	250	Unit	%
	Activation	Immediate	Attribute	RW		PNU	2021-03h

P21.03=(load inertia/motor rotational inertia)×100%

Set inertia ratio according to actual load inertia. When both are uniform, actual motor velocity loop responsiveness and gain settings will be consistent. If inertia ratio is greater than actual value, velocity loop gain settings will be higher and vice versa.
For motor with high inertia, P21.03 can be left unfilled but optimal setting of P21.03 could improve system performance.

5.3 Auto gain adjustment (Auto-tuning)

5.3.1 Single-parameter tuning function

The single-parameter tuning function enables the servo drive to automatically adjust parameters—including inertia identification and vibration suppression—by setting the rigidity level, to meet the requirements for speed and stability. Advanced functions such as command filtering and low-frequency suppression can also be configured.
Recommended application scenarios for this function: Situations with small variations in load inertia. The performance of this function may be affected in cases with large inertia variations or where inertia is difficult to identify (e.g., low operating speed or excessively small acceleration).
The single-parameter tuning function delivers better performance than one-click auto-tuning but is more complex to operate. It is recommended to use one-click auto-tuning first; if the results do not meet expectations, use single-parameter tuning for further adjustments. This function can be used in scenarios with large inertia ratios (e.g., inertia ratio greater than 30:1) where one-click auto-tuning fails to achieve the desired effect.

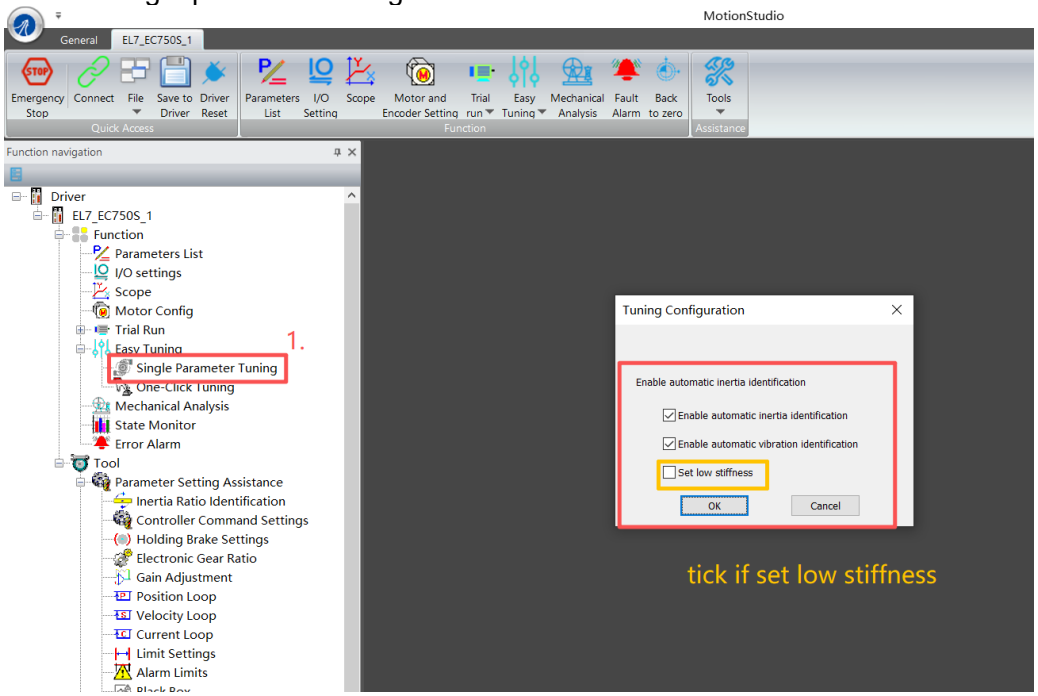
Conditions to implement	
Control Mode	Applicable to Position Mode (this function cannot be used in other modes)
Others	• The servo must be in the enable ON state (can be the internal enable for trial run) • Set appropriate parameters other than control such as limit position and torque limit to ensure the motor operates normally without faults • When the motor is controlled by trial run or an external controller, ensure collision-free operation

Under the following conditions, single-parameter tuning may not function correctly or may produce poor results.
In such cases, please adjust the load conditions and the operational model before attempting the adjustment again.

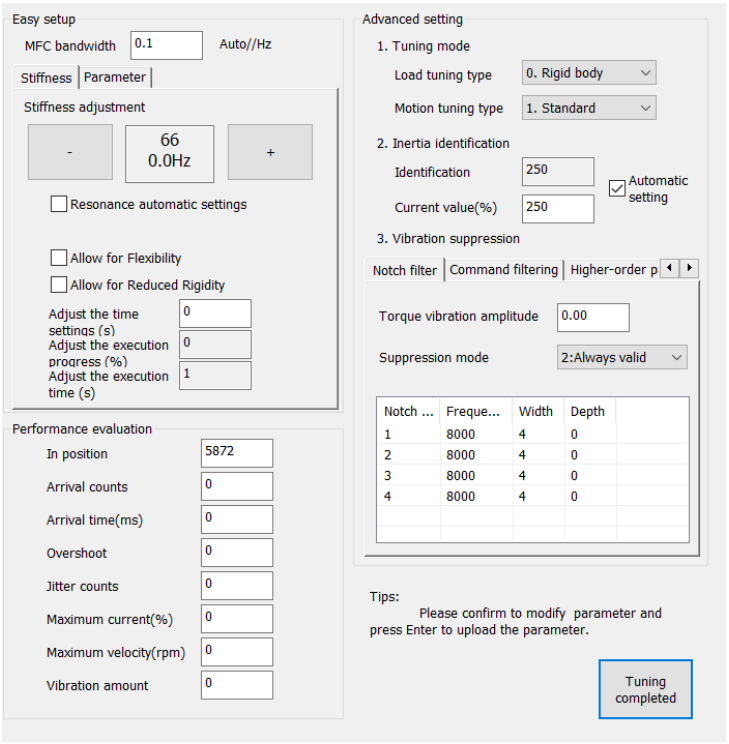
Affecting conditions	
Load Inertia	• External load < rotor inertia, or > 30× rotor inertia (excessive inertia ratio degrades function performance) • Inertia cannot be accurately identified if load inertia varies • Rapid changes in load torque
Load Condition	• Insufficient mechanical rigidity • Presence of non-linear characteristics such as backlash• Complex load mechanical structure
Motion Model	• Speed < 300r/min or continuous low-speed operation • Acceleration/deceleration time > 600ms (insufficient acceleration/deceleration) • Duration of speed ⩾300r/min with acceleration/deceleration time <600ms is less than 50ms

Operation Steps

1. Open the wizard and select the single-parameter tuning function. The following interface will appear. Automatic inertia identification and automatic vibration identification are enabled by default. If rigidity parameter **P21.02** is greater than 68 and you select the low-rigidity option, the initial rigidity will be set to 68 when entering the single-parameter tuning function.



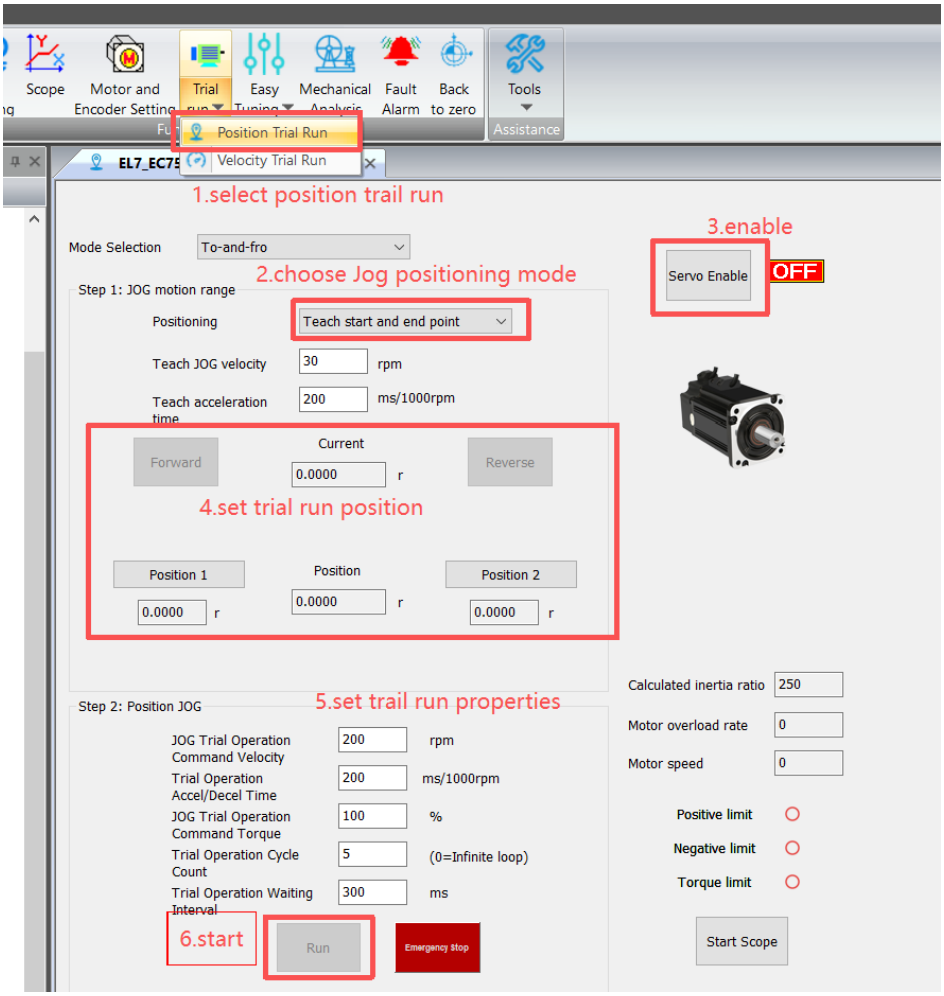
2. On the single-parameter tuning interface, the MFC bandwidth in basic settings is set to 0.1 for automatic adjustment of the model following bandwidth. You may also set other values manually. If no parameters in the advanced settings need to be adjusted, you can start the motor using the trial run function or by enabling the host computer to send motion commands.



Description

- Allow switch to flexible mode: During single-parameter auto-tuning, if the servo detects a flexible mechanical structure, large load inertia, or elastic deformation in the transmission (e.g., long lead screws, timing belts, chains, large-load cantilever mechanisms, etc.), it automatically switches to control parameters for flexible loads to prevent system resonance, squealing, jitter, or unstable positioning.
- Allow rigidity reduction: If the rigidity level is set too high, or significant vibration, overshoot, or mechanical shock occurs during operation, the drive automatically detects and moderately reduces position/velocity loop gains. It trades partial speed for smoother operation to prevent mechanical damage or positioning errors.

3. Single-parameter tuning requires motor operation to evaluate the tuning result. Use the trial run function to configure the motion path, speed, and acceleration to start the motor.



There are three methods for the drive's position trial run:

1) Teach start and end point: After enabling the servo, adjust the position using the forward/reverse buttons, then click the "Set current position as start and end point" button to complete the start and end point configuration.
2) Input start and end point: Select this mode, directly enter the positions in the start and end point input fields. The motor will move to the start point first, then perform reciprocating motion.
3) Input distance: Select this mode, enter the running distance in the position difference field. The motor will perform reciprocating motion of the specified distance starting

from the current position.

Note: The teach speed should not be too high to avoid collision.

After configuring the motion range, you can set the position JOG operation parameters:

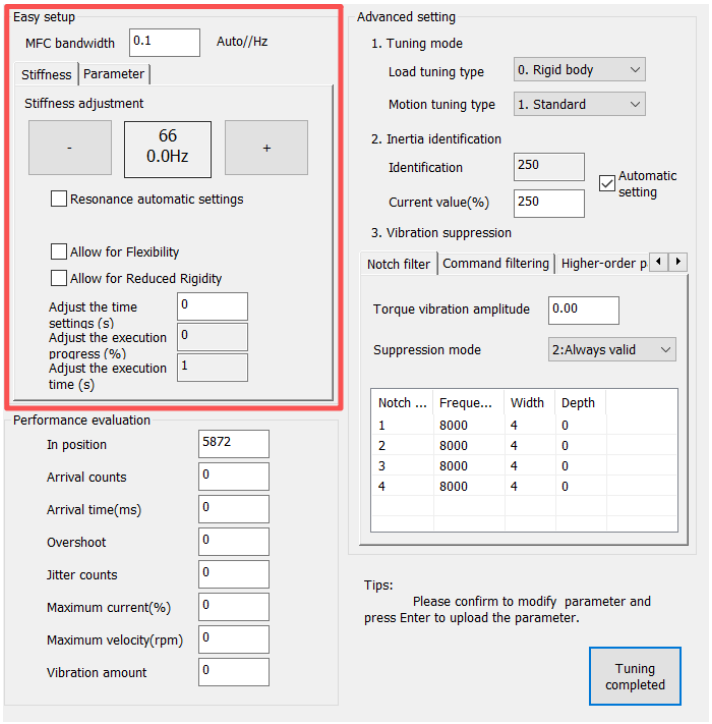
- JOG speed: Set the JOG speed. For parameter tuning, the JOG speed must be > 300 r/min.
- Acceleration/deceleration time: Set the acceleration/deceleration time. For parameter tuning, the acceleration/deceleration time must be less than 600 ms.
- Number of runs: When using single-parameter tuning, set an appropriate number of runs to facilitate the tuning process.

(Note: Single-parameter tuning can be performed using the trial run function, or by controlling the motor via the host computer.)

4. Automatic Parameter Setting

Single-Parameter Tuning: Basic Setup / Advanced Setup

1) **Easy Setup**: Achieves auto-tuning results by simply adjusting rigidity, with no other operations required. Since inertia identification is enabled by default, the inertia ratio will also be set automatically.



Basic Setup:
MFC Bandwidth: Sets the model following bandwidth. MFC (Model Following Control) is used in position loop control to improve command response, shorten positioning time, and reduce tracking error.

MFC Function Setting	Description
0.0	Disable the MFC model following control function
0.1	Automatically adjust the MFC tuning bandwidth
0.2~0.9	Invalid
1.0~2000.0	Manually set the MFC tuning bandwidth; recommended setting for belt applications: 3.0~10.0

Rigidity Adjustment: 50~81 rigidity levels. Press + to increase the rigidity level; press - to decrease the rigidity level.

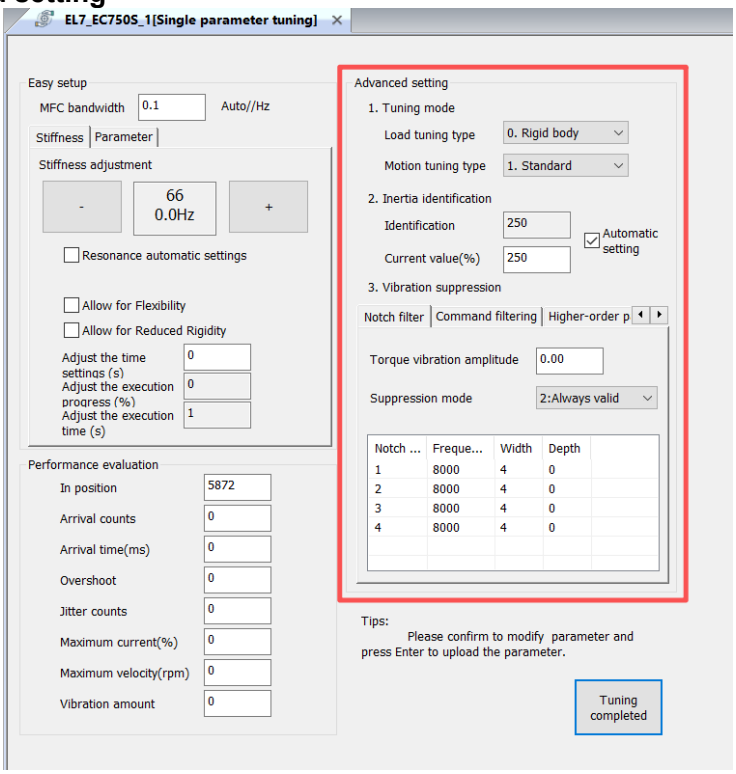
Setting Principles:

- A higher setting increases speed response but also makes the system more prone to vibration.
- Set according to mechanical structure strength: increase rigidity as structural strength improves. If the vibration count in servo performance evaluation exceeds 10, reduce rigidity by 2 levels to prevent fastener loosening caused by high-rigidity vibration during prolonged operation.
- For easily deformable structures (e.g., belts, long rods), reduce rigidity appropriately to avoid deformation, then adjust vibration suppression parameters based on performance requirements.
-

Automatic Resonance Setting:

When enabled, the function cyclically detects vibration under the current rigidity state. If no vibration is detected, settings will revert to default values. When disabled, the system continuously detects vibration and does not revert to default values.

2) Advanced setting

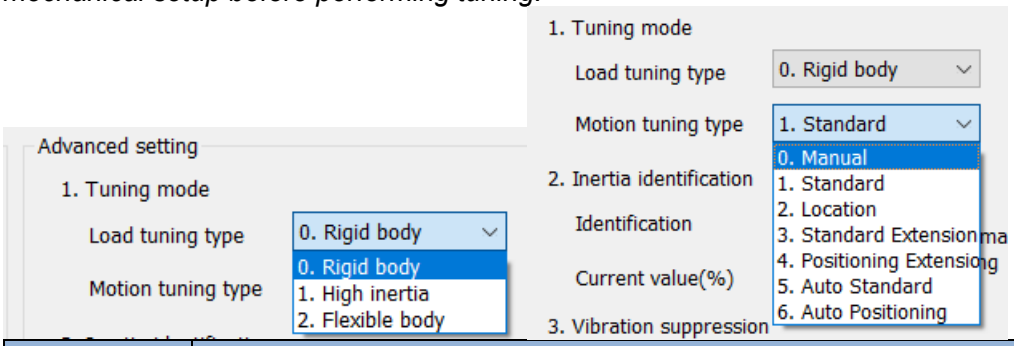


<1> Tuning Mode

Load tuning type: Default setting is Rigid (Standard). The system will automatically switch to adapt to different transmission methods if vibration occurs during operation.

- 0 Rigid: Rigid type, corresponding to ball screw transmission with low flexibility.
- 1 High inertia: High inertia type, corresponding to loads with inertia exceeding 30~40 times the motor inertia.
- 2 Flexible: Flexible type, corresponding to belt transmission with high flexibility.

Note: For optimal tuning results, set the correct load tuning type according to your actual mechanical setup before performing tuning.



Value	Description
0: Manual	P21.02 (real-time automatic rigidity adjustment setting) is invalid. Manual gain adjustment is required, and individual gain values can be adjusted as needed.
1: Standard	P21.02 (real-time automatic rigidity adjustment setting) is valid. Changing the rigidity value enables fast gain adjustment, with different rigidity values corresponding to different gain combinations. This mode does not use gain switching and is suitable for stability-prioritized applications.

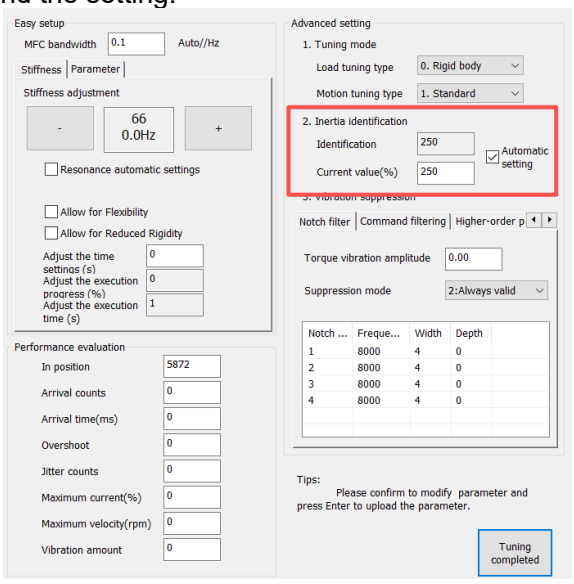
2: Positioning	P21.02 (real-time automatic rigidity adjustment setting) is valid. Changing the rigidity value enables fast gain adjustment, with different rigidity values corresponding to different gain combinations. This mode uses gain switching and is suitable for fast-positioning applications. [Not recommended for vertically mounted gravity load axes; if used, compensate for gravity load with P21.25 (torque command addition)]
3: Standard Extended	Functionally similar to mode 1 (Standard), with different internal software gains used at the same rigidity level.
4: Positioning Extended	Functionally similar to mode 2 (Positioning), with different internal software gains used at the same rigidity level.
5: Auto Standard	Based on mode 1 (Standard), adds inertia identification and automatic notch filter tuning; automatically reverts to Standard mode after tuning completion (0x5 → 0x1).
6: Auto Positioning	Based on mode 2 (Positioning), adds inertia identification and automatic notch filter tuning; automatically reverts to Positioning mode after tuning completion (0x6 → 0x2).

<2> Inertia Identification

The inertia identification function is enabled by default.

- Identified Value %: The system continuously performs identification; the value flashes yellow upon each successful identification.
- Current Value %: If Auto Set is checked, this value is synchronized with the identified value; if unchecked, it is not synchronized, and you can manually set the current inertia ratio and press Enter to send the setting.

When Auto Set is checked, the actual inertia identification value is automatically written to parameter P21.03.
If Auto Set is unchecked, you can manually input the inertia ratio in the Current Value field and press Enter to send the setting.



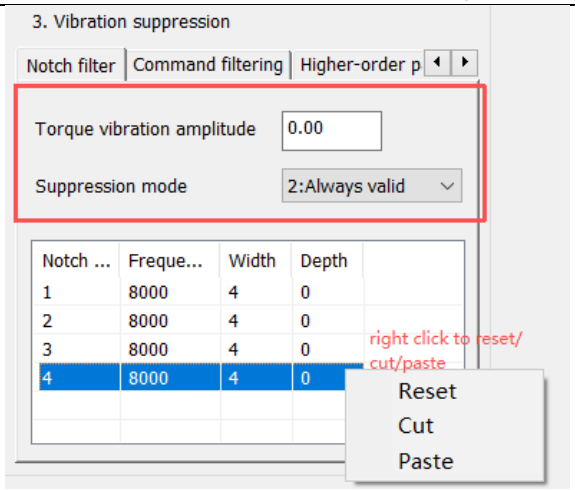
<3> Vibration Suppression:

■ Notch Filter

Torque Vibration Detection Amplitude: 0 = most sensitive, 100% = no vibration detection. Adjust this value based on on-site conditions to determine vibration presence.

Suppression Mode:

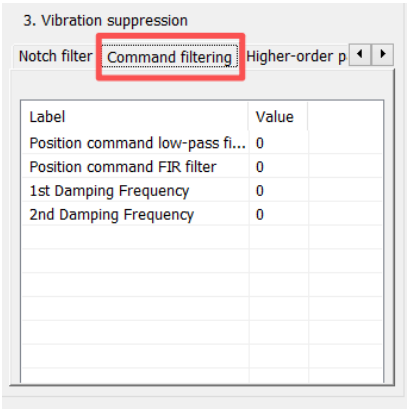
Value	Description
0	Adaptive filter disabled; parameters associated with the 3rd notch filter remain unchanged.
1	Adaptive filter: 1 filter enabled (single use). 1 adaptive filter becomes active, and parameters of the 3rd notch filter are updated based on adaptation results. After update, P22.00 automatically returns to 0, stopping the adaptive process.
2	Adaptive filter: 1 filter enabled (continuous use). 1 adaptive filter remains active, and parameters of the 3rd notch filter are continuously updated based on adaptation results.
3	Adaptive filter: 2 filters enabled (continuous use). 2 adaptive filters remain active, and parameters of the 3rd and 4th notch filters are continuously updated based on adaptation results.
4	Clear filter settings.



- Notch Filters: Adaptive notch filters, including the 1st, 2nd, 3rd, and 4th notch filters.
- Frequency: Notch filter frequency, range: 50~8000.
- Width: Filter width, range: 0~20.
- Depth: Filter depth, range: 0~99.

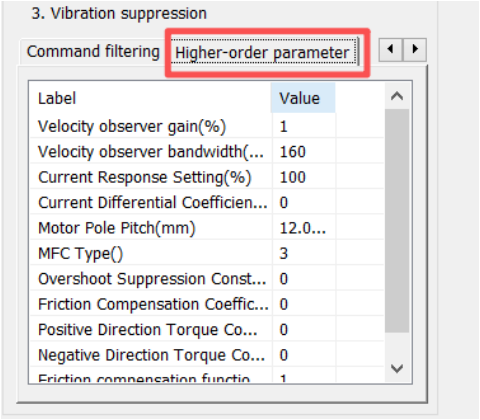
The notch filter frequency flashes yellow when it changes.

■ Command Filter (Parameters require manual input and cannot be automatically identified)



- Position Command Low-Pass Filter: Range: 0.0~300.0, unit: ms. Setting this parameter too large may prolong the settling time.
- Position Command FIR Filter: Range: 0.0~250.0, unit: ms. Setting this parameter too large may prolong the settling time.
- 1st Damping Frequency: Range: 0.0~200.0, unit: Hz. Sets the damping frequency to suppress end-point oscillation.
- 2nd Damping Frequency: Range: 0.0~200.0, unit: Hz. Sets the damping frequency to suppress end-point oscillation.

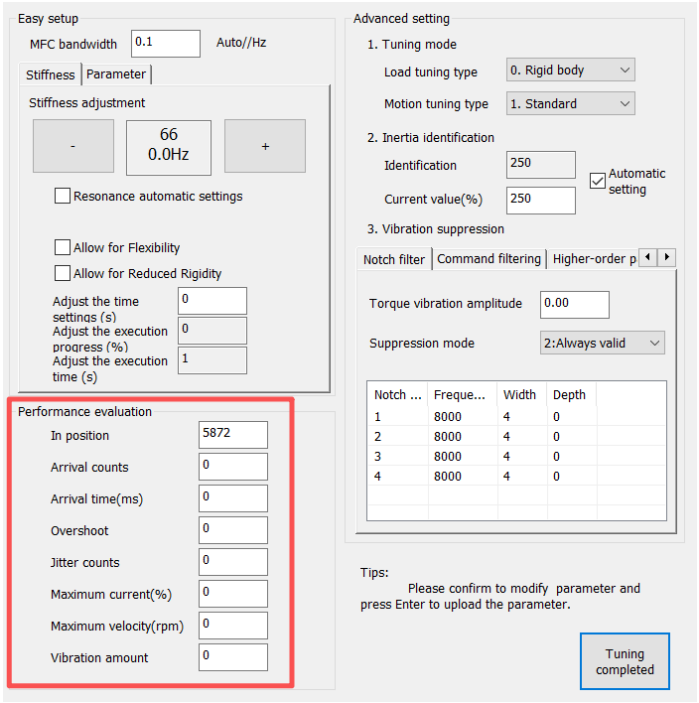
■ Advanced Parameters

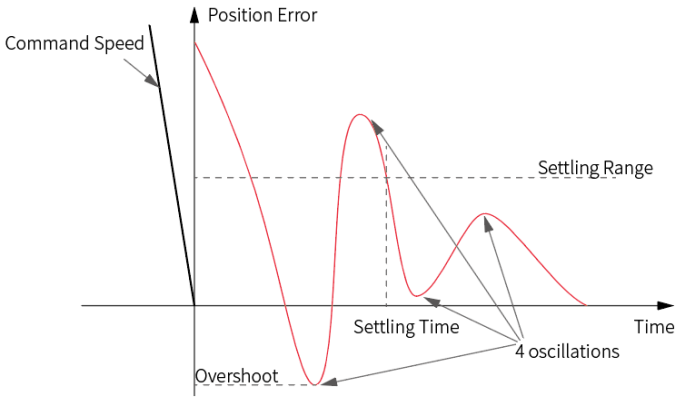


- Observer Gain: Default stable gain. Set to 1 to disable the observer.
- Observer Filter: Default stable filter. Set to 1 to disable the observer.
- Current Response: The ratio of effective values for parameters related to the drive's current loop. Range: 50~100, unit: %.

5. Performance Evaluation

Check overshoot and jitter count:

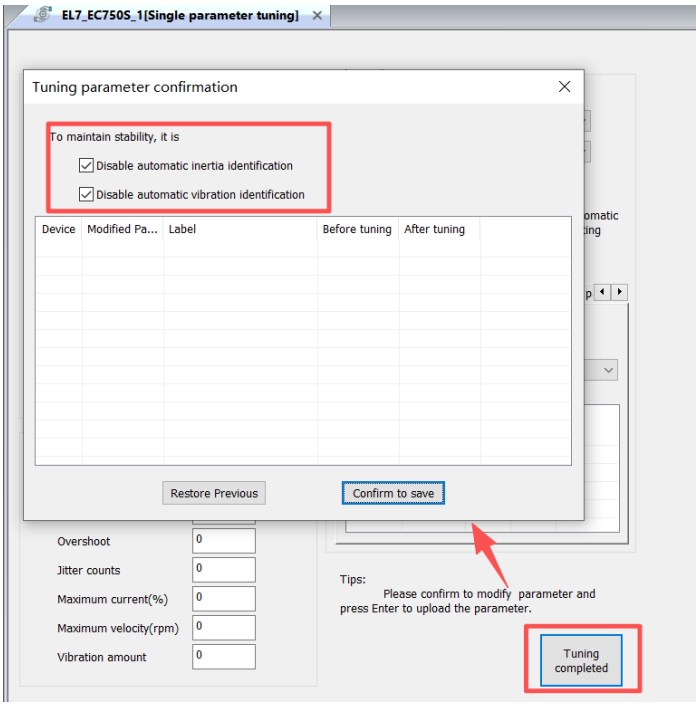




- In-position range: The allowable speed deviation between the target speed and the actual speed.
- In-position count: The number of times the target value is reached during trial run.
- Overshoot: The overshoot between the set target value and the measured actual value. Displayed as white if ⩽10%, yellow if >10% but <100%, and red if ⩾100%.
- Vibration count: The number of detected vibrations. Displayed as yellow when count = 1, red when count > 1, and white by default.
- Maximum current: Percentage of the maximum current.

User can continuously increase rigidity and gain using the basic or advanced settings described earlier, while observing the waveform to achieve the ideal response.

6. Single-parameter tuning complete



- Disable automatic inertia identification: Turn off automatic inertia identification after auto-tuning parameters.
- Disable automatic vibration identification: Turn off automatic vibration identification after auto-tuning parameters.
- Restore previous: Do not save the parameters obtained after auto-tuning.
- Confirm and save: Save the parameters obtained after auto-tuning.

5.3.2 One-click tuning function

The One-click tuning function enables the servo to automatically run and learn the optimal gain parameters after setting the corresponding motion path and response level. The parameters can be saved once the learning is complete. Exporting the parameters to a configuration file facilitates replication for the same model.
Recommended application scenario for this function: applications with small variations in load inertia.

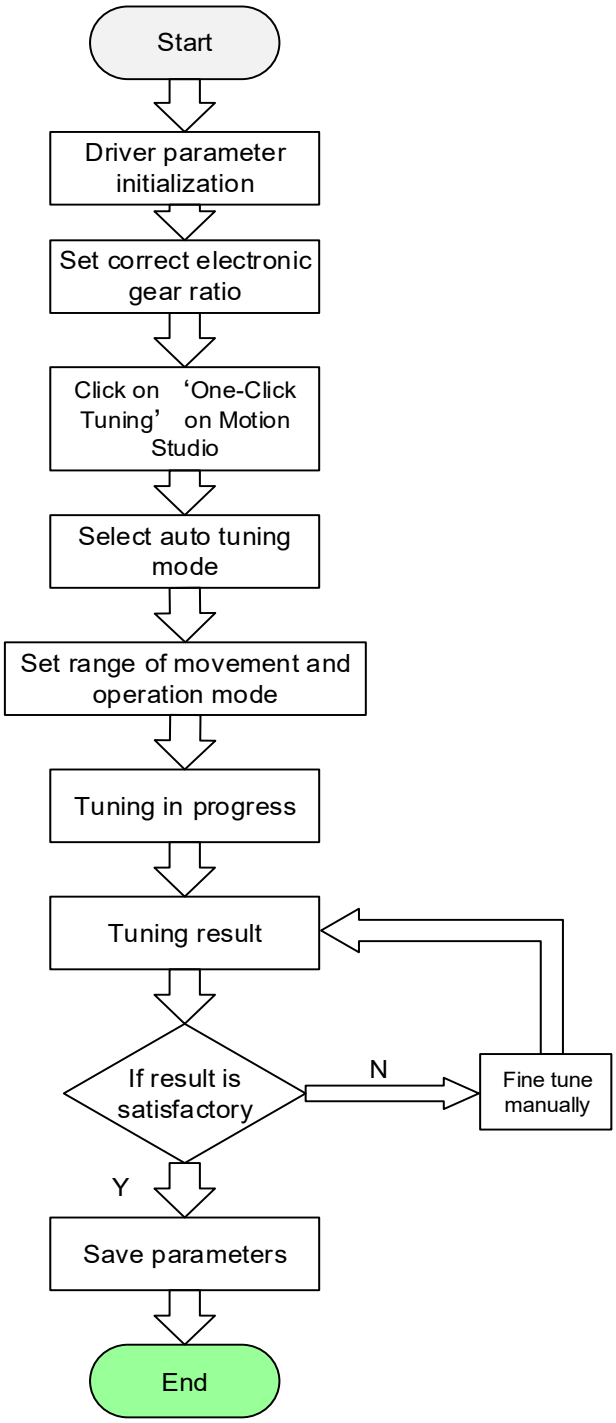
Conditions to implement	
Control Mode	Applicable to Position mode and PROFINET mode (this function cannot be used in other modes).
Other Requirements	• Ensure there is no external enable signal or external control command driving the motor; configure the motion range, speed, and acceleration/deceleration time using the built-in motion settings of One-click tuning. • Disable external enable, ensure the external motion path is unobstructed, and confirm the motor can operate normally without faults.

Under the following conditions, the One-click tuning function may not operate properly or yield poor results.
In such cases, please adjust the load conditions and motion profile, then perform the tuning again.

Affecting conditions	
Load Inertia	• External load inertia is less than the rotor inertia, or more than 30 times the rotor inertia (an excessively large inertia ratio affects the function's performance); • Significant variations in load inertia during operation; • For inertia ratios exceeding 30× in heavy-load applications, confirm the travel range and safety before using One-click tuning.
Load	• Loose mechanical connections in the load; • Presence of non-linear characteristics such as backlash; • Complex mechanical structure of the load.
Motion Profile	• The travel distance for One-click tuning is too short or too long. Excessively long travel may lead to overly long tuning time or failure; • The tuning travel must be greater than 0.5 revolutions.

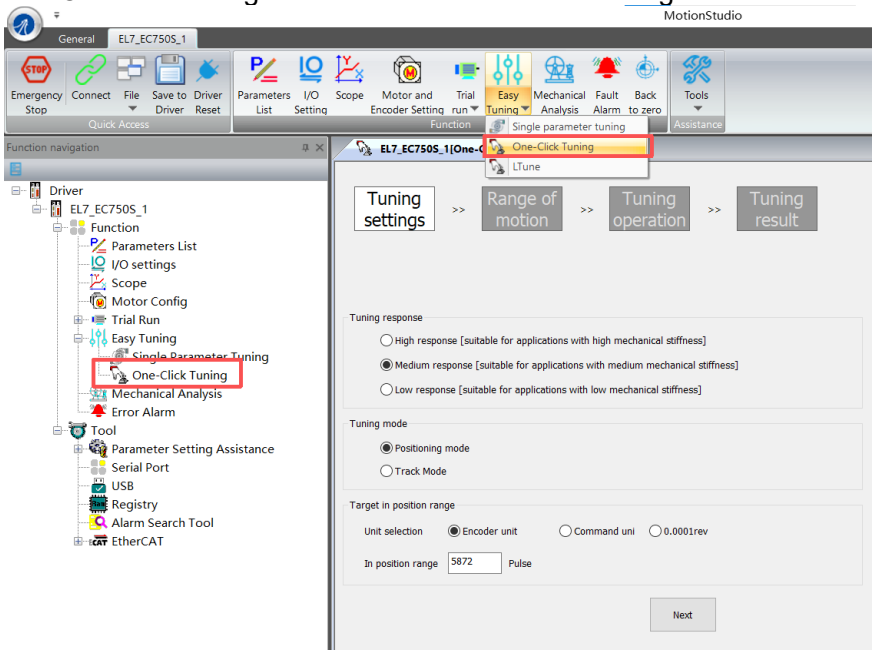
- For vertical axes, implement anti-fall measures before executing the tuning operation.
- For belt-driven applications, set an appropriate inertia ratio in advance to avoid oscillation caused by an excessively low initial inertia ratio at the start of tuning.

Operation Steps

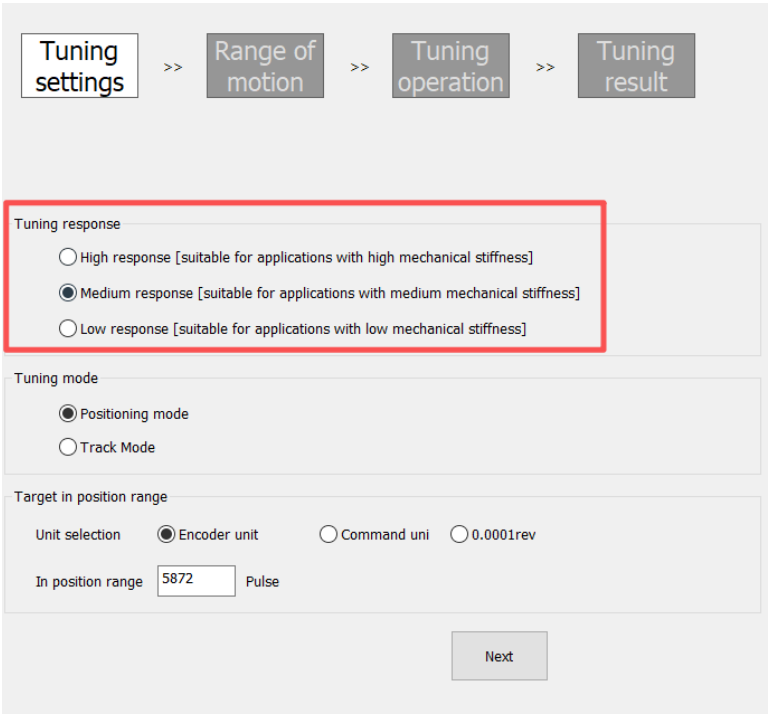


Debugging Tool: Motion Studio V3.0

1. Click the One-click tuning function in the Parameter Setting Assistant of the software.



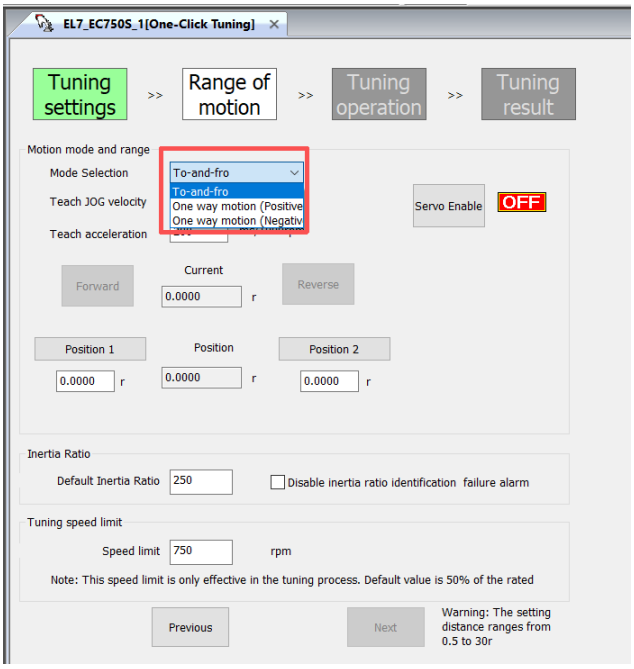
2. Click to enter the One-click tuning function interface. The first screen is the tuning adjustment page, which is used to set the execution criteria for the auto-tuning process.



3. Click Next to enter the motion range setting interface, where you can configure the travel range for the One-click tuning function.

1) There are three operation modes; select the appropriate one based on the allowable motion direction of the actual machine:

- To-and-fro: The motor moves back and forth between the start and end positions.
- One way motion (Positive): The motor uses the absolute value of the position difference between the start and end points as the travel distance for each movement, and maintains forward rotation.
- One way motion (Negative): The motor uses the absolute value of the position difference between the start and end points as the travel distance for each movement, and maintains reverse rotation.



2) There are two methods to set the start and end point range:

■ After enabling the servo, adjust the position using the forward/reverse buttons, then click the "Set current position as start and end point" button to complete the setting.

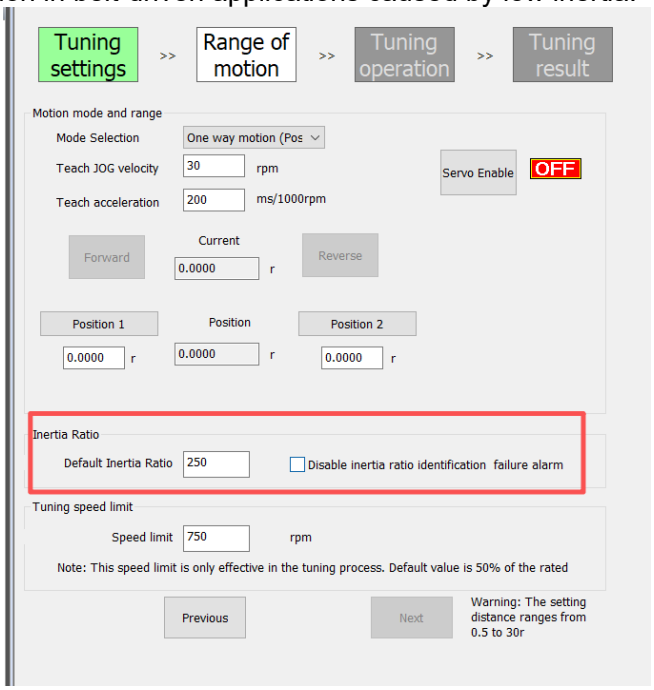
Note：

When setting the motion range, set the JOG speed between 0~200 r/min. Do not set the acceleration time too short to avoid collision. After configuring speed parameters, disable external enable first. Before enabling the servo, confirm there are no command inputs to prevent unintended movement when enabling, then click "Servo Enable".

■ Directly input the start and end point positions. Press Enter after entering the position values to confirm the changes. (Note: During reciprocating operation with directly input start/end positions, the motor will first move to the set start position before performing reciprocating motion. Therefore, verify collision risks when manually entering positions.)

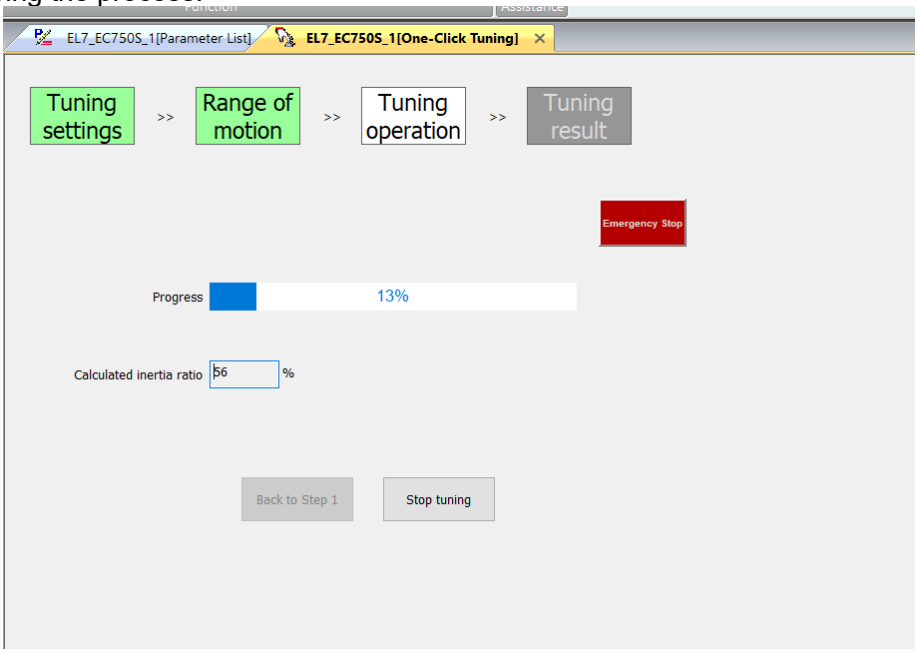
The difference between the start and end points must be greater than 0.5 revolutions. The closer the start/end positions are to the actual application stroke difference, the more adaptable the tuned parameters will be, though tuning time may increase accordingly.

3) After setting the motion range, configure the inertia ratio:
The inertia ratio setting allows you to suppress the "inertia identification failure" alarm, preventing tuning failure caused by failed inertia detection.
User can manually input the correct inertia ratio or preset an appropriate value to avoid equipment oscillation in belt-driven applications caused by low inertia.



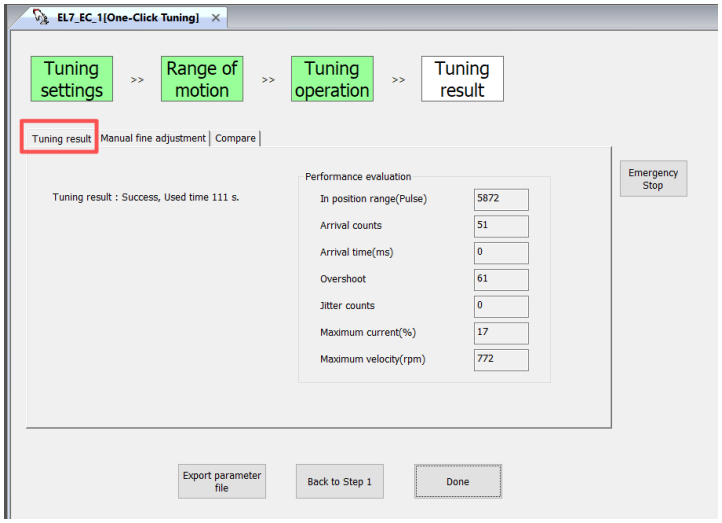
- Tuning speed limit: Limits the operating speed during tuning; the speed must not be lower than 400 r/min.

4. Click Start Tuning and confirm motion safety to enter the tuning operation interface. Tuning will start, and progress display and an emergency stop button will be provided during the process.

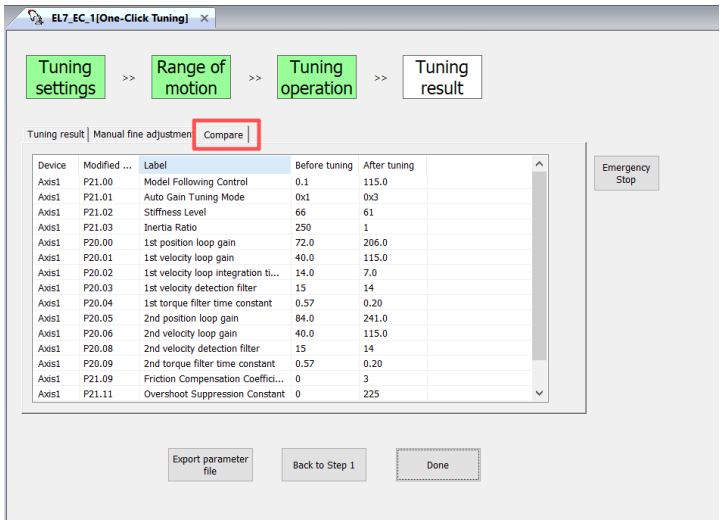


5. After tuning is completed, the system will jump to the tuning result interface, which displays the tuning results and the parameter comparison before and after tuning.

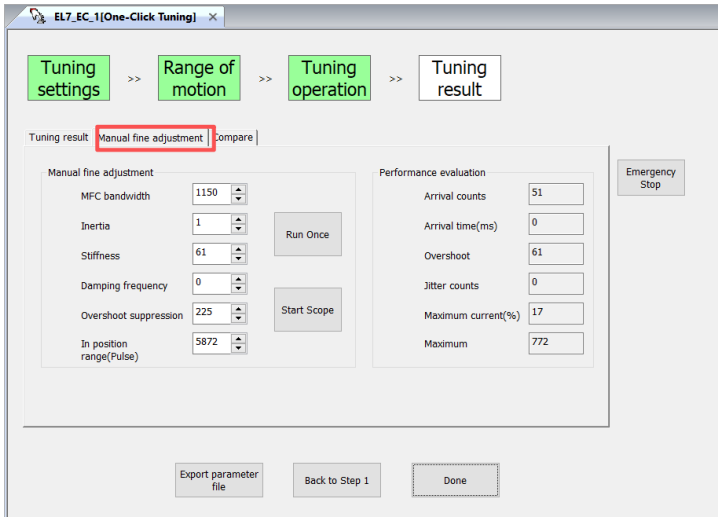
1) Tuning Result:



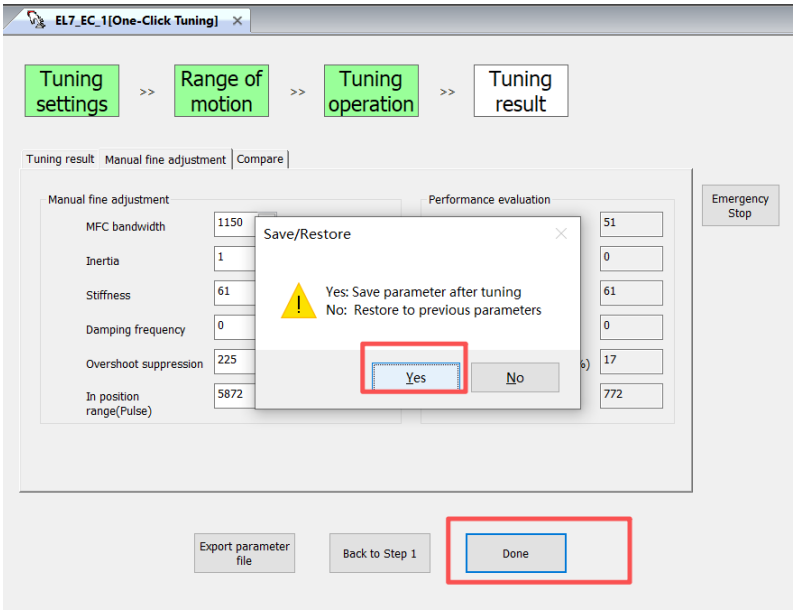
2) Parameter Comparison:



3) Manual fine adjustment:



After fine-tuning the parameters, run the test again. You can then check the performance evaluation or use the oscilloscope to verify if the results meet the actual requirements.



If user satisfied with the tuning result, click "Done". A prompt will appear asking whether to save the parameters.

- For vertical axis applications, implement anti-fall measures before performing any movements.
- For belt-driven applications, set a moderate inertia ratio in advance to prevent vibration caused by an excessively low inertia ratio at the start of auto-tuning.
- For ball screw applications, if the tuning time is too long, shorten the travel distance appropriately.

Common Tuning Failures

Fault	Cause	Solution
Inertia identification failure	Loose mechanical connection of the load	Troubleshoot mechanical faults
	Insufficient travel distance leading to inertia identification failure	Increase the travel distance appropriately
	Load is belt-driven	Pre-set a suitable inertia ratio for belt-driven applications to avoid identification failure caused by vibration due to low inertia

- If the tuning result is not as expected, perform more advanced operations via single-parameter tuning to adjust the optimal gains.

5.3.3 Ltune Intelligent Tuning-Free Function

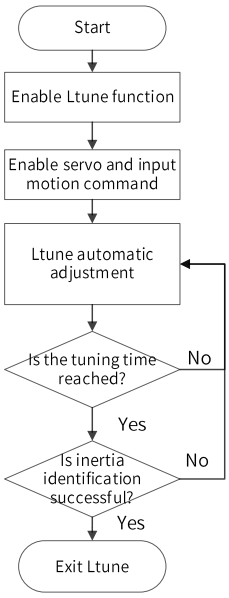
The Ltune intelligent tuning-free function automatically adjusts core gain parameters such as rigidity, inertia ratio, and notch filter suppression by identifying load conditions and dynamically recognizing mechanical inertia. It balances response speed and operational stability, enabling one-click control of the drive with high-speed response, low vibration, and low noise.

The Ltune function is enabled by default at factory (i.e., P21.01=0x5). After servo enable, as long as the axis starts moving, gain adjustment will be automatically performed in the background regardless of the command type. This process lasts for 60 seconds by default before being disabled, and the duration can be flexibly set via parameter P21.20 (Ltune Close Time).

Conditions to implement	
Control Mode	All control modes supported by the servo
Applicable Scenarios	Online simple adjustment within 100 times inertia
Prerequisites	• Command-based operation with a duration greater than or equal to the setting of P21.20; • Correct inertia ratio identification; • Appropriately set parameters other than gains (such as deviation counter reset, command input disable signals, torque limit, etc.) to ensure the motor can operate normally without obstruction.

Note:

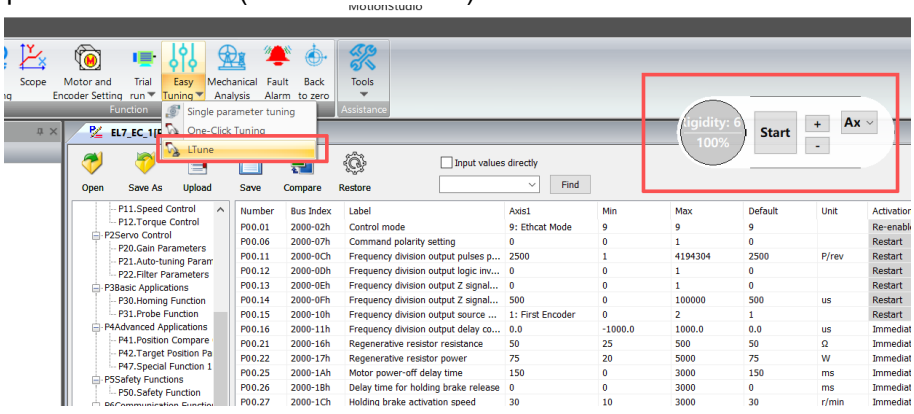
- During the activation of the Ltune function, external interference may cause abnormalities in automatic adjustment. If stable operation cannot be guaranteed after power-up, it is recommended to disable the Ltune function.
- When the load inertia or load torque changes rapidly, normal identification may fail. In this case, adjust the load conditions and motion model, or switch to manual gain adjustment.



Operation Steps
Debugging Tool: Motion Studio V3.0

■ Method 1: Enable via the debug software interface

1. Open the debug software interface, and enter "Easy tuning" → "Ltune".
2. Click "Start" to enable the Ltune function. After receiving motion commands, the system will automatically adjust parameters such as gains, inertia ratio, and notch filters until tuning is completed. The floating control interface displays the tuning progress in real time.
3. The default tuning time is 60s, which can be adjusted according to actual conditions via parameter P21.20 (Ltune Close Time).



■ Method 2: Parameter configuration

Enable the Ltune function by setting the motion tuning mode of parameter P21.01 (Real-time Automatic Adjustment Mode) to 5/6:

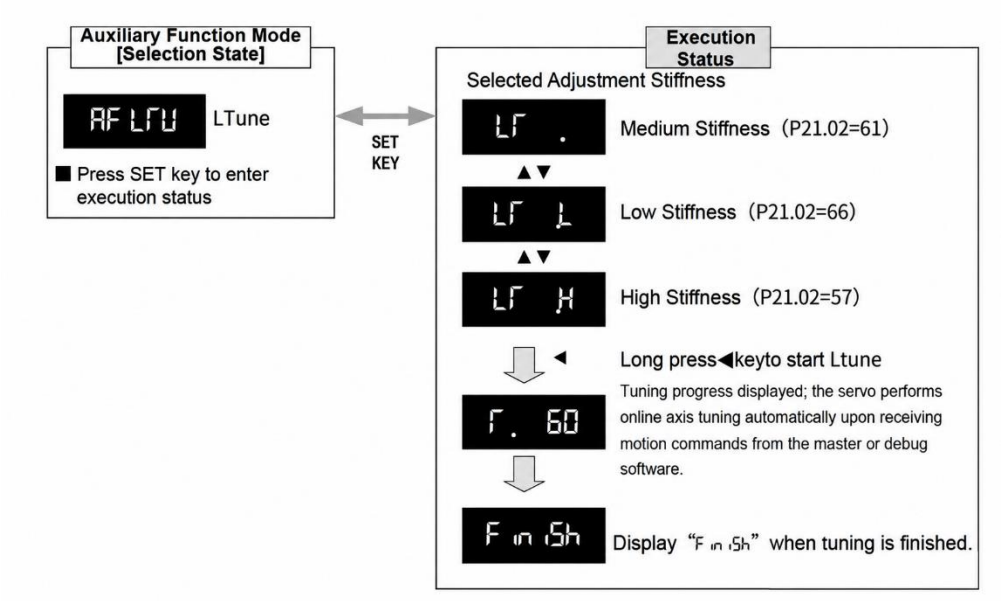
P21.01=0x__5: Standard + Inertia Identification + Notch Filter Auto-tuning. Based on the 1-Standard mode, Ltune is enabled, and the mode will automatically switch to the standard mode (0x__5 → 0x__1) after tuning is completed.

P21.01=0x__6: Positioning + Inertia Identification + Notch Filter Auto-tuning. Based on the 2-Positioning mode, Ltune is enabled, and the mode will automatically switch to the standard mode (0x__6 → 0x__2) after tuning is completed.

■ Method 3: Panel Enable

To activate the LTune intelligent zero-debugging function via the panel, the panel supports three stiffness settings when enabling LTune: P21.02=57, 61, 66. Once LTune is enabled, the servo will automatically perform online tuning of the axis upon receiving motion commands from the master station or the debugging software.

The procedure is as follows:



5.4 Auto gain adjustment (Rigidity Level Selection)

5.4.1 Overview

After setting an appropriate inertia ratio, estimate the mechanical load characteristics in real time, adjust the rigidity parameter value P21.02 automatically in real time, and set the corresponding basic gain values for rigidity based on the results.

Real-time automatic adjustment is applicable to all control modes.

Conditions to implement	
Control Mode	The valid real-time automatic adjustment mode varies with the control mode. For details, refer to the description of P21.01 Real-time Automatic Adjustment Setting.
Others	• Servo must be enabled. • Appropriately set parameters other than control-related functions (such as deviation counter reset, command input disable signals, torque limit settings) to ensure the motor can operate normally without obstruction.

Precautions:
When the real-time automatic adjustment function is active, external interference and other factors may cause anomalies in the estimated values. Therefore, if stable operation after power-on cannot be guaranteed, it is recommended to disable real-time automatic adjustment.

Real-time automatic gain adjustment may not function properly under the following conditions. In such cases, adjust the load conditions, motion model, or switch to manual gain adjustment.

Conditions to implement	
Load Inertia	When the ratio to the rotor inertia is too small or too large (less than 3 times or more than 30 times), or when the load inertia changes.
Load	When the mechanical rigidity is extremely low.When there are nonlinear characteristics such as backlash.
Motion Model	• When the speed is less than 300 r/min and continuously operated at low speed. • When the acceleration/deceleration is slow (below 2000 r/min within 1 second). • When the acceleration/deceleration torque is less than the load torque or viscous friction torque. • When the speed is above 300 r/min and the acceleration/deceleration reaches above 2000 r/min within 1 second, but the duration is less than 50 ms.

5.4.2 Operation Steps

1) The motor is in the stopped state (servo enable is off). The inertia ratio must be set correctly, otherwise the tuning effect will be affected.
2) Set bit0 (motion tuning mode) of P21.01 (Real-time Automatic Adjustment) to non-manual mode, then configure P21.02 (Real-time Automatic Adjustment Rigidity).
3) Enable the servo, operate the mechanism under normal conditions, and start estimating the load characteristics. Associated control parameters will be set automatically. [Refer to the table below for details]
4) Improve the motor's responsiveness by increasing the setting value of P21.02 (Real-time Automatic Adjustment Rigidity). Observe the positioning time and whether obvious mechanical vibration occurs; set the rigidity value to the maximum possible while avoiding vibration.
5) Save the results and write them to EEPROM.

Notes:

- After setting the P21.01 (Real-time Automatic Adjustment) parameter, it must be written to the EEPROM and the power cycled to take effect. Changes to the setting value of P21.02 (Machine Rigidity Setting) take effect immediately after being sent; stop the motor when modifying parameter values.
- After power-up, when the servo is enabled for the first time or when increasing P21.02 (Machine Rigidity Setting), abnormal noise or vibration may occur before the load characteristic estimation stabilizes. If it stabilizes quickly, this is not abnormal. If abnormal noise persists after 3 or more consecutive vibrations/movements, reduce the setting value of P21.02 (Machine Rigidity Setting).

The Servo Drive provides two automatic gain adjustment modes:

- Standard mode (P21.01=0x_ _1/0x_ _3/0x_ _5): The basic mode, which emphasises stability, does not use gain switching. The standard mode in real-time automatic gain adjustment is based on P21.02 'Machine Stiffness Setting', which updates the following basic gain setting parameters.

Parameters	Label	Remarks
P20.00	1st position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
P20.01	1st velocity loop gain	
P20.02	1st velocity integral time constant	
P20.04	1st torque filter time constant	

Parameter	Label	Parameter	Remarks
P20.10	Velocity feedforward gain constant	300（0.1%）	Parameters that do not change according to stiffness
P20.11	Velocity feedforward filter time constant	0.50ms	
P20.12	Torque feedforward gain	0	
P20.13	Torque feedforward filter time constant	0	

- Positioning mode (P21.01=0x_ _2/0x_ _4/0x_ _6): A mode that places emphasis on positioning, e.g. for use on a screw drive with low friction, can be used with gain switching. The position loop gain of the second gain parameter should be about one stiffness level higher than the first gain parameter.

The positioning mode in real-time automatic gain adjustment is based on P21.02 'Machine stiffness setting', and the following basic gain setting parameters are updated.

Parameters	Label	Remarks
P20.00	1st position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
P20.01	1st velocity loop gain	
P20.02	1st velocity integral time constant	
P20.04	1st torque filter time constant	
P20.05	2nd position loop gain	
P20.06	2nd velocity loop gain	
P20.09	2nd torque filter time constant	

Parameter	Label	Value
P20.07	Second velocity loop integration constant	1000ms
P20.10	Velocity feedforward gain constant	30%
P20.11	Velocity feedforward filter time constant	0.50ms
P20.12	Torque feedforward gain	0
P20.13	Torque feedforward filter time constant	0
P20.15	Position control gain switching mode	0
P20.17	Position control switching level	50
P20.18	Position control switching hysteresis	33
P20.19	Position gain switching time	3.3ms

When the real-time automatic adjustment mode is set to positioning mode, the gain switching function is automatically enabled, but the gain switching mode cannot be modified.

If user need to change the switching mode, please set the automatic adjustment mode to manual mode.

■ Standard mode + large inertia free adjustment (P21.01=0x_11/0x_13/0x_15)

In addition to the existing standard mode, the large inertia adjustment-free function has been added so that inertia ratio setting is not required before stiffness setting, and the following basic gain setting parameters are updated according to P21.02 'Machine Stiffness Setting'.

Parameters	Label	Remarks
P20.00	1st position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
P20.01	1st velocity loop gain	
P20.02	1st velocity integral time constant	
P20.04	1st torque filter time constant	

Parameter	Label	Parameter	Remarks
P20.10	Velocity feedforward gain constant	300（0.1%）	Parameters that do not change according to stiffness
P20.11	Velocity feedforward filter time constant	0.50ms	
P20.12	Torque feedforward gain	0	
P20.13	Torque feedforward filter time constant	0	

■ Positioning mode + large inertia free adjustment (P21.01=0x_21/0x_24/0x_26)

Based on the original standard mode, the large inertia adjustment-free function has been added. The inertia ratio parameter can be set at 30 times the inertia or more without adjustment.

Before setting the stiffness, it is not necessary to set the inertia ratio, and the following basic gain setting parameters are updated according to P P21.02 'Rigidity Setting'.

Parameters	Label	Remarks
P20.00	1st position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
P20.01	1st velocity loop gain	
P20.02	1st velocity integral time constant	
P20.04	1st torque filter time constant	
P20.05	2nd position loop gain	
P20.06	2nd velocity loop gain	
P20.09	2nd torque filter time constant	

No.	Parameter	Label	Value
0	P20.07	Second velocity loop integration constant	1000ms
1	P20.10	Velocity feedforward gain constant	30%
2	P20.11	Velocity feedforward filter time constant	0.50ms
3	P20.12	Torque feedforward gain	0
4	P20.13	Torque feedforward filter time constant	0
5	P20.15	Position control gain switching mode	0
6	P20.17	Position control switching level	50
7	P20.18	Position control switching hysteresis	33
8	P20.19	Position gain switching time	33ms

Load calibration type

Used to select the type of load, according to the size of the load inertia ratio and the characteristics of the mechanical structure

0x00_: **Stiff body**

This mode is selected when the load is a rigid body with good rigidity and small load inertia. The gain strategy gives priority to ensuring the system responsiveness, and the typical structures are direct-connected high-precision speed reducer, screw, rack and gear and other structures.

0x01_: **Large inertia**

Select this mode when the load inertia is large (more than 10 times), and the gains take into account the smoothness and responsiveness of the equipment. For large inertia loads, it is recommended to set the rigidity level not greater than 15.

0x02_: **Flexible**

Select this mode when the load is a flexible structure with low rigidity and high inertia, and the exact inertia ratio needs to be set for this type. The gain strategy gives priority to ensure smooth operation. Typical structures are long belts and chains.

P21.01	Label	Real-time auto adjustment mode					
	Range	0x0~0xFFF		Default	0x01	Unit	
	Activation	Immediate	Attribute	RW		PNU	13301

Data bits	Category	Settings	Application
0x00_	Motion setting mode	Used to set motion setting mode, which can be selected according to the motion characteristics or setting requirements. Generally, it is recommended to select mode 1 with good generality when there is no special requirement, mode 2 when rapid positioning is needed If mode 1 and mode 2 cannot meet the requirements, please choose mode 0.	
		0:Manual	P21.02 invalid. Gain value must be adjusted manually and accordingly.
		1:Standard	P21.02 valid. Quick gain adjusting can be achieved by changing P00.03 stiffness value. Gain switching is not used in this mode, suitable for applications with requirements for stability.

Set up the mode of the real time auto gain adjusting.

		2:Positioning	P21.02 valid. Quick gain adjusting can be achieved by changing P00.03 stiffness value. This mode is suitable for applications requiring quick positioning. Not recommended for load mounted vertical to ground, or please compensate for the load using P21.25
		3: Standard Expansion	Consistent with the 1-standard mode; the difference lies in that the gain used in the same rigid software is different.
		4: Positioning Expansion	Consistent with the 2-positioning mode; the difference lies in that the gain used in the same rigid software is different.
		5: Standard + Inertia Identification & Notch Auto-Setting	On the basis of the 1-standard mode, add inertia identification and notch auto-setting; after the setting is completed, automatically return to the standard mode 0x5 → 0x1.
		6: Positioning + Inertia Identification & Notch Auto-Setting	On the basis of the 2-positioning mode, add inertia identification and notch auto-setting; after the setting is completed, automatically return to the positioning mode 0x6 → 0x2.
0x0_0	Load type setting	Used to select the load type, choose according to load-inertia ratio and mechanical structure.	
		0: Rigid structure	This mode prioritizes system responsiveness. Use this mode when there is a relatively rigid structure with low load inertia. Typical application including directly connected high-precision gearbox, lead screw, gears, etc.
		1:High inertia	For applications with higher load inertia (10 times or above), gain settings take into account both machine stability and responsiveness. Not recommended to set stiffness above 15 for high load inertia.
		2: Flexible structure	This mode prioritizes system stability. Use this mode when there is low rigidity structure with high load inertia. Typical applications included belts and chains.
0x_00	*Reserved*		

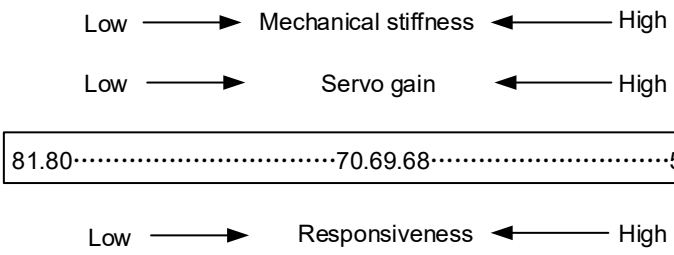
The setting type combination is a hexadecimal standard, as follows:

Setting type combination	Application type
0X000	Rigid structure + Manual
0X001	Rigid structure +Standard
0X002	Rigid structure +Positioning
0X010	High inertia + Manual
0X011	High inertia + Standard
0X012	High inertia + Positioning
0X020	Flexible structure + Manual
0X021	Flexible structure +Standard
0X022	Flexible structure +Positioning

P21.02	Label	Real time Auto stiffness adjustinge				
	Range	50~81	Default	70	Unit	

	Activation	Immediate	Attribute	RW	PNU	13302

Valid when P21.02 = 1,



Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Please stop the motor before doing any changes to the stiffness settings.

When P21.01 = 0x010, please set stiffness level to around 65.

Basic gain parameter setting table (stiffness table)

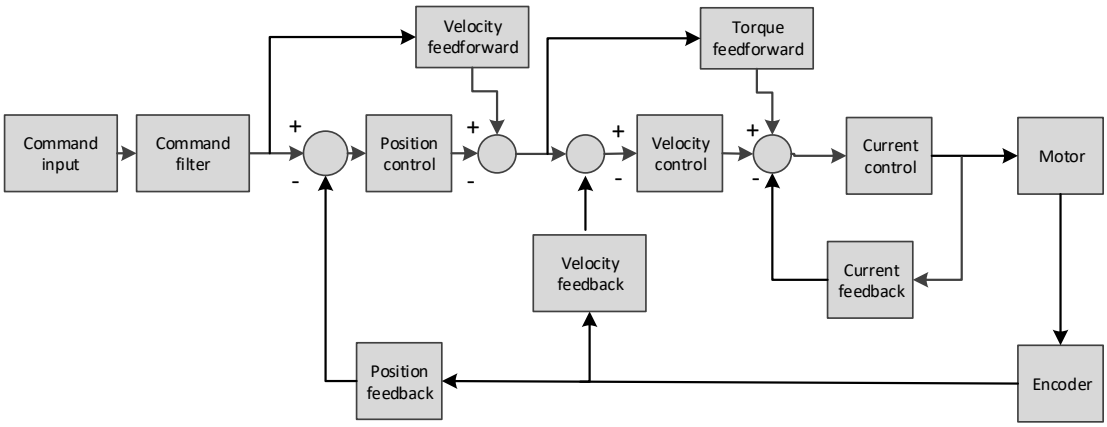
Stiffness	1st gain				2nd gain			
	P20.00	P20.01	P20.02	P20.04	P20.05	P20.06	P20.07	P20.09
	Position loop gain (0.1/s)	Velocity loop gain (Hz)	Velocity loop integral time constant （0.1ms）	Torque filter (0.01ms)	Position loop gain (0.1/s)	Velocity loop gain (Hz)	Velocity loop integral time constant （0.1ms）	Torque filter (0.01ms)
81	20	15	3700	1500	25	15	10000	1500
80	25	20	2800	1100	30	20	10000	1100
79	30	25	2200	900	40	25	10000	900
78	40	30	1900	800	45	30	10000	800
77	45	35	1600	600	55	35	10000	600
76	55	45	1200	500	70	45	10000	500
75	75	60	900	400	95	60	10000	400
74	95	75	700	300	120	75	10000	300
73	115	90	600	300	140	90	10000	300
72	140	110	500	200	175	110	10000	200
71	175	140	400	200	220	140	10000	200
70	320	180	310	126	380	180	10000	126
69	390	220	250	103	460	220	10000	103
68	480	270	210	84	570	270	10000	84
67	630	350	160	65	730	350	10000	65
66	720	400	140	57	840	400	10000	57
65	900	500	120	45	1050	500	10000	45
64	1080	600	110	38	1260	600	10000	38
63	1350	750	90	30	1570	750	10000	30
62	1620	900	80	25	1880	900	10000	25
61	2060	1150	70	20	2410	1150	10000	20
60	2510	1400	60	16	2930	1400	10000	16
59	3050	1700	50	13	3560	1700	10000	13
58	3770	2100	40	11	4400	2100	10000	11
57	4490	2500	40	9	5240	2500	10000	9
56	5000	2800	35	8	5900	2800	10000	8
55	5600	3100	30	7	6500	3100	10000	7
54	6100	3400	30	7	7100	3400	10000	7
53	6600	3700	25	6	7700	3700	10000	6
52	7200	4000	25	6	8400	4000	10000	6
51	8100	4500	20	5	9400	4500	10000	5
50	9000	5000	20	5	10500	5000	10000	5

5.5Manual gain adjustment (Basic)

5.5.1 Overview

Due to limitation of load conditions, automatic gain adjustment might not achieve expected performance. Control can be improved through manual gain adjustment

The servo system is made up of 3 control loops. From outer to inner: position loop, velocity loop, current loop as shown in the diagram below.



Inner control loop demands higher responsiveness. In order to avoid system instability, please tune in accordance to this principle. Current loop gain usually satisfies the responsiveness demand without tuning. When gain adjustment is done under position control mode, in order to keep the system stabile, position and velocity loop gain have to be increased at the same time to make sure the responsiveness of the position loop is lower than velocity loop.

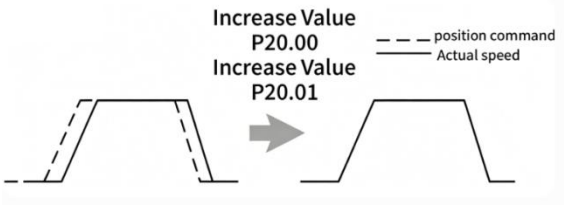
Steps to tuning (Position and velocity control)

For servo gain, if any one of the parameters is changed, please modify other gain related parameters accordingly. Make sure to the change at around 5% and follow the rules as below.

1) Increase responsiveness
   a) Reduce torque command filter time
   b) Increase velocity loop gain
   c) Decrease velocity loop integral time
   d) Increase position loop gain
2) Decrease responsiveness, prevent vibration and over shoot
   a) Reduce position loop gain
   b) Increase velocity loop integral time
   c) Reduce velocity loop gain
   d) Increase torque filter time

P20.00	Label	1st Position Loop Gain					
	Range	0~3000.0		Default	48.0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13200

Parameter function: Determines the maximum frequency of position commands that the position loop can follow and change. Maximum frequency of position loop following = P20.00

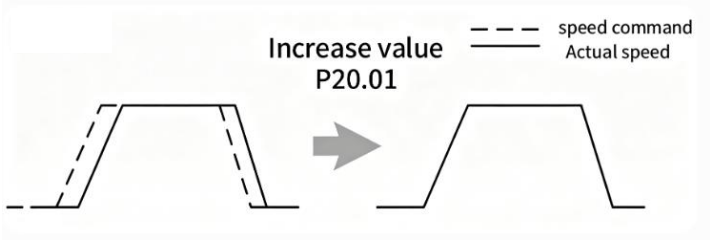


Adjustment method:

When the inertia ratio is set correctly, adjust according to the positioning time. Increase this parameter to speed up the positioning time. When noise is generated, reduce the gain appropriately.

Under the condition of ensuring that the mechanical system does not generate resonance or noise, increase the position loop gain to reduce the position tracking error and shorten the positioning time. However, excessive position loop gain may also cause mechanical system vibration or positioning overshoot.

P20.01	Label	1st velocity loop gain					
	Range	0.1~3276.7		Default	27	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13201



Function of the parameter: Determines the maximum frequency of the speed command that the speed loop can follow. When the inertia ratio P20.04 is set correctly, the maximum frequency that the speed loop can follow = P20.01.

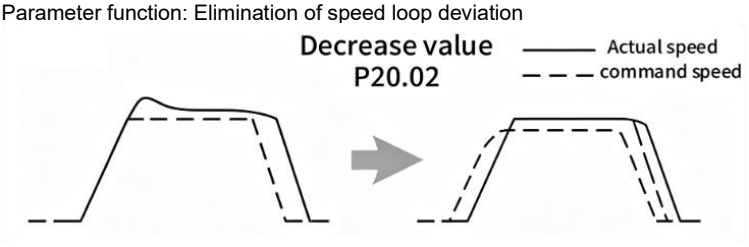
Adjustment method:

Within the range of no noise and no vibration, increase this parameter to speed up the positioning time and bring better speed stability and following; if noise occurs, reduce the parameter setting;

If mechanical vibration occurs, use the mechanical resonance suppression function.

P20.02	Label	1st Integral Time Constant of Velocity Loop					
	Range	1~1000.0		Default	21.0	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	13202

Parameter function: Elimination of speed loop deviation



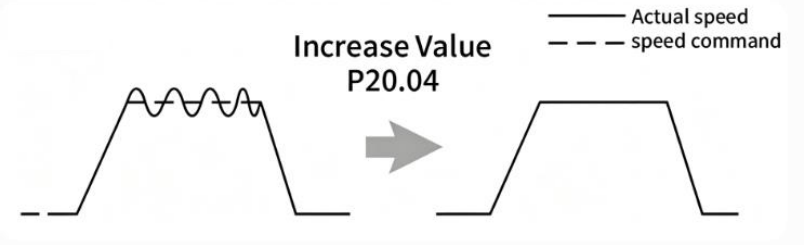
Adjustment method: It is recommended to take the value according to the following relationship:

Velocity loop integration time constant (ms) = 4000 / (2*pi*velocity loop gain (Hz))

Reducing the setting value of this parameter can strengthen the integrating effect and speed up the positioning time, but the setting value is too small to easily cause mechanical vibration, and the setting value is too large, which will lead to the speed ring deviation can never be zeroed.

Under the condition that the mechanical system does not generate resonance or noise, reducing the speed loop integration time constant can increase the system rigidity and reduce the steady state error. If the load inertia ratio is very large or there is a resonance factor in the mechanical system, the speed loop integration time constant must be increased to reduce the function of the integral, otherwise the mechanical system is prone to resonance.

P20.04	Label	1st torque filter time constant Time Constant					
	Range	0.00~25.00		Default	0.84	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	13204



Parameter function: Eliminate high-frequency noise, suppress mechanical resonance

Adjustment method:

The smaller the setting value is, the better the system responsiveness can be controlled, but it is limited by mechanical conditions; the larger the setting value is, the better the high frequency resonance can be suppressed, but setting the value too large will cause the response bandwidth and phase margin to be reduced, resulting in system vibration.

It should be ensured that the cut-off frequency of the torque filter is higher than 4 times of the highest following frequency of the speed loop:

1000000/(2π×P20.04)≥P20.01×4

For example, with a velocity loop gain P20.01 of 180 (0.1 Hz), the

Torque filter time constant should satisfy: P20.01≤221 (0.01ms), so the default value satisfies this condition.

Caution:

a. When vibration occurs by increasing the speed loop gain P20.01, the vibration can be suppressed by adjusting the P20.04 torque filter:

b. Setting the value too large will result in reduced response of the current loop;

c. Vibration suppression at stopping is required, try increasing the speed loop gain and decreasing P20.04;

d. If the motor stops with excessive vibration, try reducing the P01.04 setting.

e. However, because the response of the torque loop must be much larger than the response of the speed loop, the torque command filtering time must not be too large, or it will cause the control system to become unstable.

5.5.2 Parameter adjustment under different control modes

Parameter adjustment under different control modes must follow the sequence:
"Inertia Identification" → "Automatic Gain Adjustment" → "Manual Gain Adjustment"

Parameter Adjustment in Position Mode

1) Set the load inertia ratio P21.03 through inertia identification.
2) Gain parameters in position control mode:

Parameters	Label
P20.00	1st position loop gain
P20.01	1st velocity loop gain
P20.02	1st velocity integral time constant
P20.04	1st torque filter time constant
P20.05	2nd position loop gain
P20.06	2nd velocity loop gain
P20.07	2nd velocity loop filter time constant
P20.09	2nd torque filter time constant
P20.10	Velocity feedforward gain constant
P20.11	Velocity feedforward filter time constant
P20.12	Torque feedforward gain
P20.13	Torque feedforward filter time constant
P20.15	Position control gain switching mode
P20.17	Position control switching level
P20.18	Position Control Switching Hysteresis
P20.19	Position Gain Switching Time

3) Obtain the initial values of the 1st and 2nd gains via automatic gain adjustment parameters:

Parameters	Label
P20.00	1st position loop gain
P20.01	1st velocity loop gain
P20.02	1st velocity integral time constant
P20.04	1st torque filter time constant
P20.05	2nd position loop gain
P20.06	2nd velocity loop gain
P20.07	2nd velocity loop filter time constant
P20.09	2nd torque filter time constant

4) In manual adjustment mode, fine-tune the following parameters:

Parameters	Label
P20.00	1st position loop gain
P20.01	1st velocity loop gain
P20.02	1st velocity integral time constant
P20.04	1st torque filter time constant
P20.10	Velocity feedforward gain constant
P20.11	Velocity feedforward filter time constant

Parameter Adjustment in velocity Mode

The adjustment of speed control is generally the same as the previous "Parameter Adjustment in Position Mode". Adjust according to the specified steps, except for parameters related to position loop gain setting (P10.00/P20.05) and speed feedforward gain (P20.10).

Parameter Adjustment in torque Mode

Parameter adjustment in torque control mode must be distinguished based on the following scenarios:

- When the actual speed reaches the speed limit value: The adjustment method is the same as "Parameter Adjustment in Speed Mode". At this point, the motor switches from torque control to speed control, using the speed limit value as the command.
- When the actual speed does not reach the speed limit value: The adjustment method is the same as "Parameter Adjustment in Speed Mode", except for parameters related to position loop gain, speed loop gain, and feedforward gain.

When controlling solely based on torque commands without using speed limit:

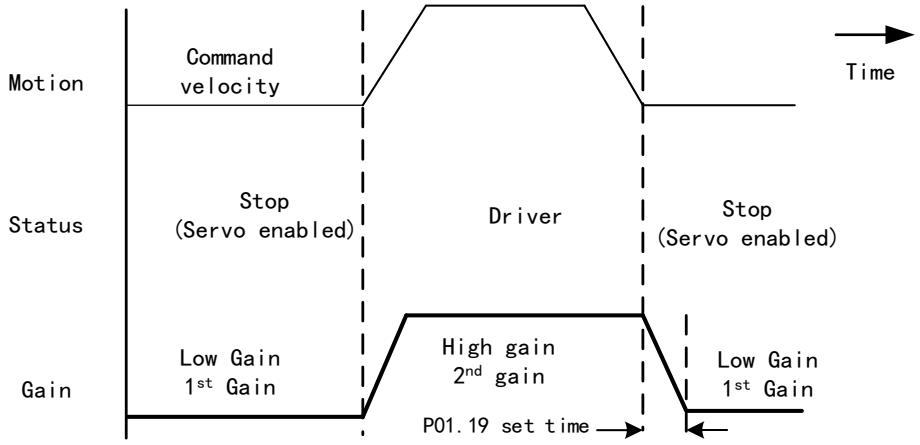
Set the torque filter and notch filter to disabled, set the speed limit value to the maximum speed, and increase the speed loop gain as much as possible.

5.5.3 Gain switching

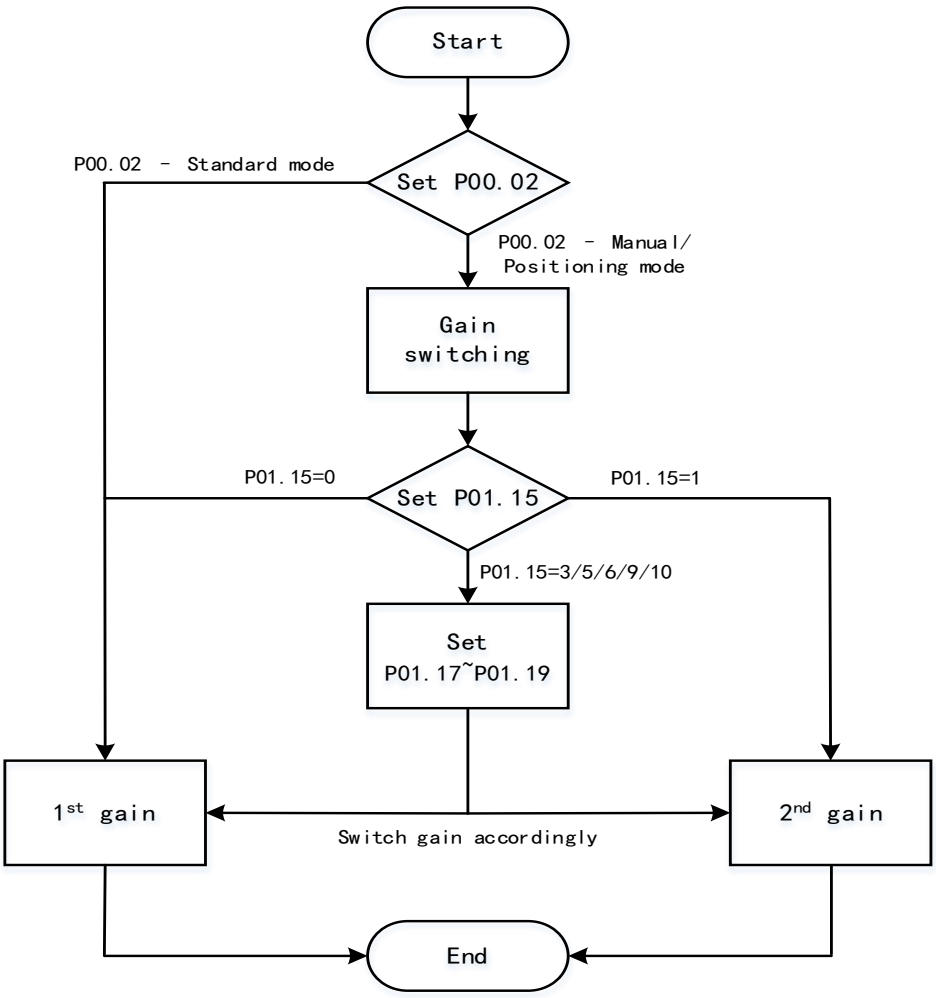
Gain switching function can be triggered internally in servo driver. Only valid under position or velocity control mode. Following effects can be realized by gain switching:

1. Switch to lower gain when motor stops to suppress vibration
2. Switch to higher gain when motor is moving at a low velocity to shorten positioning time
3. Switch to higher gain when motor is moving at a high velocity to improve command following behavior.

Diagram below shows gain switching when motor stops.

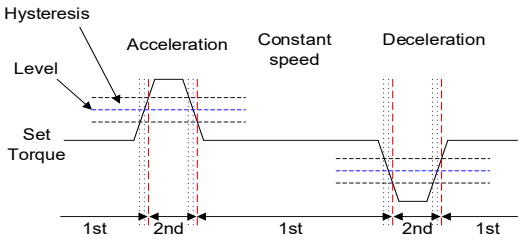


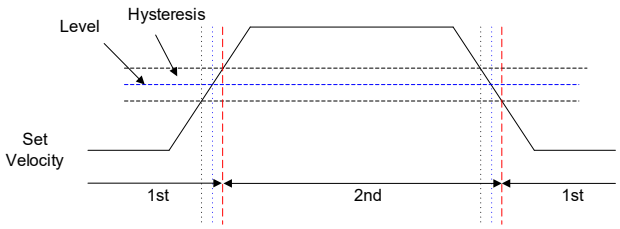
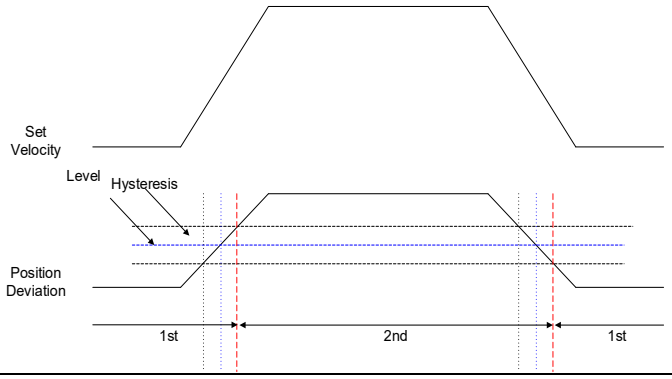
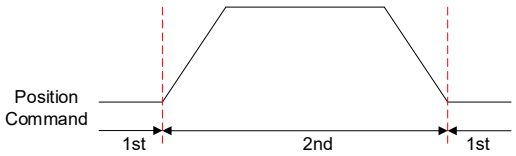
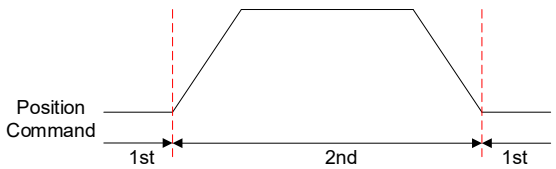
1st gain (P01.00-P01.04) and 2nd gain (P01.05-P01.09) switching can be realized through manual and positioning mode. Switching condition is set through P01.15. Gain switching is invalid under standard mode.

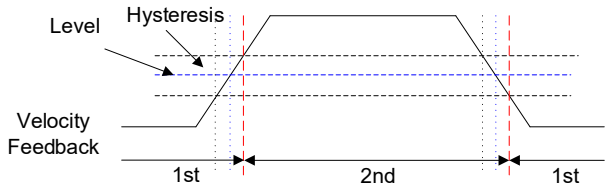
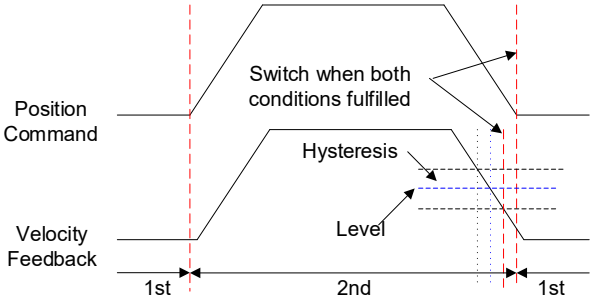


Related parameters on gain switching

P20.15	Label	Position control gain switching mode					
	Range	0.0~12		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13215

Set Value	Condition	Gain switching condition
0	1st gain fixed	Fixed on using 1st gain(P20.00-P20.04)
1	2nd gain fixed	Fixed on using 2nd gain (P20.05-P20.09)
2	Reserved	
3	High set torque	Switch to 2nd gain when set torque command absolute value larger than (level + hysteresis)[%] Switch to 1st gain when set torque command absolute value smaller than (level + hysteresis)[%] 

4	Reserved	Reserved
5	High set velocity	 Valid for position and velocity control. Switch to 2nd gain when set velocity command absolute value larger than (level + hysteresis)[r/min] Switch to 1st gain when set velocity command absolute value smaller than (level-hysteresis)[r/min]
6	Large position deviation	Valid for position control. Switch to 2nd gain when position deviation absolute value larger than (level + hysteresis)[pulse] Switch to 1st gain when position deviation absolute value smaller than (level-hysteresis)[pulse] 
7	Pending position command	Valid for position control. Switch to 2nd gain if position command ≠ 0 Switch to 1st gain if position command remains = 0 throughout the duration of delay time. 
8	Not yet in position	Valid for position control. Switch to 2nd gain if position command is not completed. Switch to 1st gain if position command remains uncompleted throughout the duration of delay time. 
9	High actual velocity	Valid for position control.

		 Switch to 2nd gain when actual velocity absolute value larger than (level + hysteresis)[r/min] Switch to 1st gain when actual velocity absolute value remains smaller throughout the duration of delay time than (level-hysteresis)[r/min]
10	Pending position command +actual velocity	 Valid for position control. Switch to 2nd gain if position command ≠ 0 Switch to 1st gain if positional command = 0 throughout the duration of delay time and absolute value of actual velocity remains smaller than (level - hysteresis) (r/min)

For position control mode, set P20.15=3,5,6,9,10;

For velocity control mode, set P20.15=3,5,9;

*** Above 'level' and 'hysteresis' are in correspondence to P20.17 Position control gain switching level and P20.18 Hysteresis at position control switching.*

P20.16	Label	Position Control Switching Delay					
	Range	0.0~1000.0		Default	0.0	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	13216

When P20.15 is set to 2, 3, or 10, it represents the time from the detection trigger to the actual gain switchover when switching from the 1st gain to the 2nd gain.

P20.17	Label	Position control gain switching level					
	Range	0~20000		Default	50	Unit	
	Activation	Immediate	Attribute	RW		PNU	13217

Set threshold value for gain switching to occur.
Unit is mode dependent.

Switching condition	Unit
Position	Encoder pulse count
Velocity	RPM
Torque	%

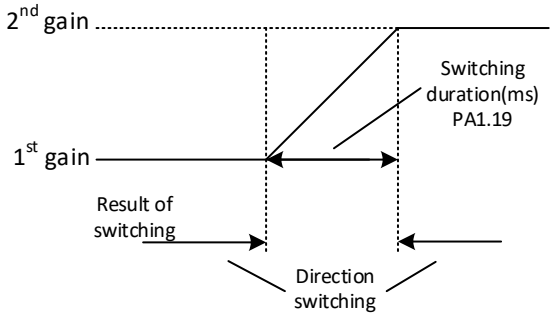
Please set level ≥ hysteresis

P20.18	Label	Hysteresis at position control switching					
	Range	0~20000		Default	33	Unit	
	Activation	Immediate	Attribute	RW		PNU	13218

To eliminate the instability of gain switching. Used in combination with P20.17 If level< hysteresis, drive will set internally hysteresis = level.

P20.19	Label	Position gain switching time					
	Range	0~1000.0		Default	3.3	Unit	Ms
	Activation	Immediate	Attribute	RW		PNU	13219

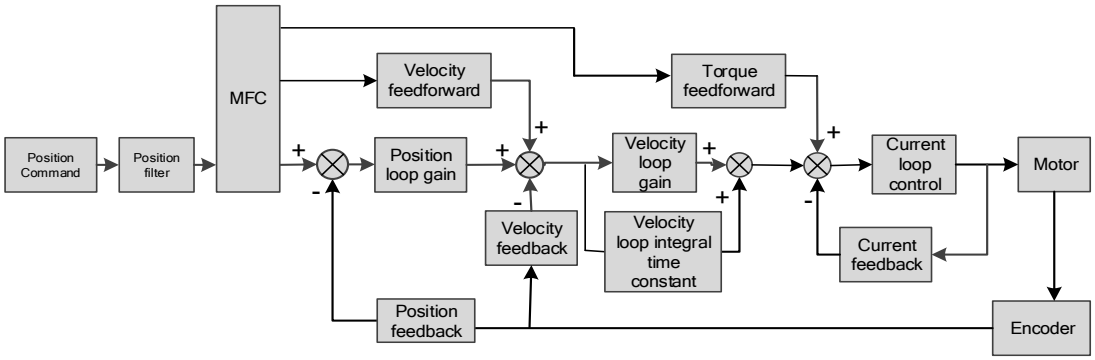
During position control, if 1st and 2nd gain difference is too large, to ease torque changes and vibration due to rapid changes in position loop gain, set suitable P01.19 value
For example: 1st (P20.00) <-> 2nd (P20.05)



5.6 Manual gain adjustment (Application)

5.6.1 Model following control

Model following control is a type of closed loop control system. First, an ideal model is constructed and acts as a reference for actual model in a closed loop control. Model following control can be treated as a control mode with 2 flexibilities: Reference model can be used to improve command responsiveness and closed loop control used to increase responsiveness of the system towards interference. They don't affect each other.
Model following control can be used in position loop control to increase responsiveness to commands, reduce positioning time and following error. This function is only available in position control mode.



1. Automatic adjustment
   B、 Set model following bandwidth P21.00 = 1 for automatic adjustment. Now, P21.00 = P20.01, model following bandwidth is adjusted automatically according to different velocity loop gain.
2. Manual adjustment
   C、 Please used manual adjustment if
   - Automatic adjustment is not satisfactory.
   - Responsiveness needs further improvement in comparison with automatic adjustment.
   - There is a need to set servo gain or model following control parameters manually.

Step	Content
1	Set up vibration suppression.
2	Set up the right inertia ratio.
3	Manually adjust gain.
4	Increase P21.00 provided that there is no overshoot and vibration. Usually P21.00 ≥ P20.01 is recommended.

Model following bandwidth determines the responsiveness of the servo system. Increase the value set will increase responsiveness and reduce positioning time. Overshoot can be prevented if it is set at a lower value but responsiveness will be lowered. Model following bandwidth shouldn't be too large for mechanical structure with lower stiffness, excessive position deviation alarm might occur under high velocity.

Related Parameters：

P21.00	Label	Model-following bandwidth(MFC)					
	Range	0~2000.0		Default	0.1	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13300

Model-following bandwidth, also known as model-following control (MFC), is used to control the position loop to improve the responsiveness to commands, speed up positioning time and reduce following error. The effect is obvious especially in low and medium mechanical stiffness. Use mainly for MFC or ZTC tuning.

Value	Description
0	Disable the function.
0.1	Enable the function to set bandwidth automatically
0.2~0.9	Reserved
1~2000.0	Manually set the bandwidth; belt application recommend 3.0~10.0

P21.04	Label	MFC Curve Damping Correction Coefficient					
	Range	-100.00~100.00		Default	0.00	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13304
Used to improve positioning smoothness and positioning time.							
P21.05	Label	Forward/Reverse Torque Comp Gain Difference Percentage					
	Range	-20.00~20.00		Default	0.00	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13305
Used to set the difference ratio of torque compensation gains between the forward rotation and reverse rotation of the servo motor, with the forward torque being P21.05×100% of the reverse torque.							

P21.06	Label	MFC Type					
	Range	0~5		Default	3	Unit	
	Activation	Immediate	Attribute	RW		PNU	13306

Set value	Description
【0】	Model following control
1	Zero tracking control
2	3 inertia (future upgrade)
3	Path following (future upgrade)
4	Traditional Feedforward
5	Vibration Suppression Type

P21.07	Label	Velocity feedforward compensation coefficient					
	Range	-10000~ 10000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	13307

This parameter is used for feedforward compensation of speed to reduce system tracking errors and improve dynamic response speed. As an open-loop control technology, it predicts load changes or command changes to adjust control output in advance, making the system more stable and accurate.

P21.08	Label	Torque feedforward compensation coefficient					
	Range	-10000~ 10000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	13308

This parameter enables feedforward compensation for torque control when set, enhancing the system's ability to predict and compensate for load changes (such as external torque disturbances). This improves the system's response speed and reduces tracking errors. As an open-loop control strategy, feedforward compensation, when combined with feedback control, significantly improves overall system stability.

P21.09	Label	Dynamic friction compensation coefficient					
	Range	0~1000		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13309

To set ratio of rated torque/rated rotational speed, to compensate for dynamic friction during motion and have better control over acceleration/deceleration.

$$\text{Dynamic friction coefficient} = \left| \frac{\text{Torque(Rotational speed 1)} - \text{Torque(Rotational speed 2)}}{\text{Rotational speed 1} - \text{Rotational speed 2}} * \text{rated rotational speed} \right|$$

When there is an excess position deviation during acceleration/deceleration, please adjust friction coefficient to reduce the deviation to 0.

P21.10	Label	Overtravel time coefficient					
	Range	0~10000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	13310
	By setting this time constant, the system's overshoot suppression capability can be adjusted. The settling time refers to the time it takes for the system (such as position, speed, etc.) to return to and stabilize within a specified range after a target value disturbance. This parameter adjusts the damping characteristic of the control algorithm, reducing overshoot and making the system run more smoothly.						

P21.11	Label	Overtravel suppression gain					
	Range	0~1000		Default	0	Unit	-
	Activation	Immediate	Attribute	RW		PNU	13311
	Suppression improves with larger set value but might affect the performance of MFC. Please use with caution for any value above 100.						

P22.17	Label	MFC vibration damping frequency 1					
	Range	0.0~2000.0		Default	0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13417
	Set the MFC vibration damping frequency; set P21.06 – MFC type to Mode 5 to enable it.						

P22.18	Label	MFC Vibration Damping 1					
	Range	0~1000		Default	1	Unit	
	Activation	Immediate	Attribute	RW		PNU	13418
	Set the MFC vibration damping; set P21.06 – MFC type to Mode 5 to enable it.						

P22.19	Label	MFC vibration damping frequency 2					
	Range	0.0~2000.0		Default	0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13419
	Set the MFC vibration damping frequency; set P21.06 – MFC type to Mode 5 to enable it.						

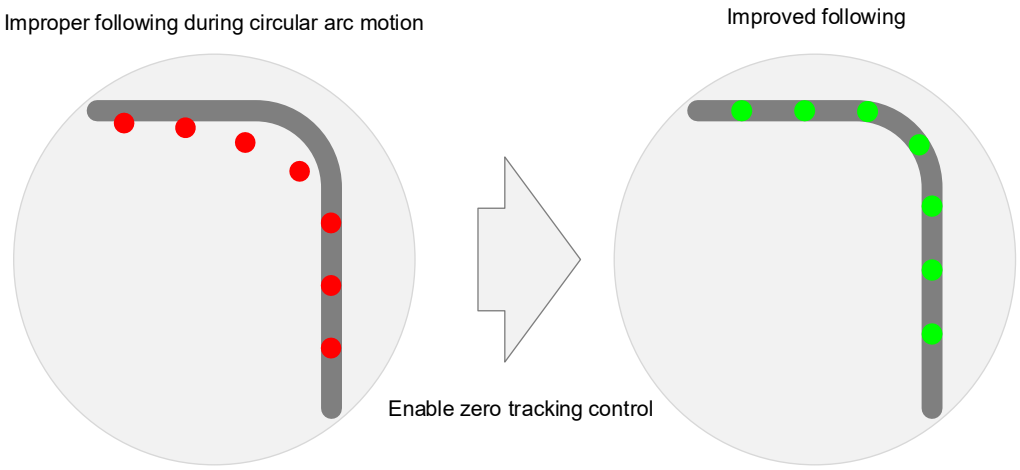
P22.20	Label	MFC Vibration Damping 2					
	Range	0~1000		Default	1	Unit	
	Activation	Immediate	Attribute	RW		PNU	13420
	Set the MFC vibration damping; set P21.06 – MFC type to Mode 5 to enable it.						

5.6.2 Zero tracking control

Zero tracking control (ZTC) is able to realize a zero position deviation during acceleration/deceleration. This function increase multi axis precision and master-slave following.

Recommended application:

1. Multi axis



2. Master-slave following

Used when driving axis sends frequency divider signal to lead following axis to improve the following control.

ZTC only available under position control mode.
ZTC can only be enabled when P00.00 is valid.
Model following control (MFC) and Zero Tracking Control (ZTC) cannot be used together at the same time.

Zero tracking control can achieve better performance with the following limiting factors.

Limiting factors	
Control Mode	Applicable to position loop (this function is not available in other modes).
Other	The Zero tracking control function cannot coexist with standard MFC (Model Following Control).

Affecting conditions	
Command Electronic Gear Ratio	The command electronic gear ratio must be small; otherwise, current noise will be high.
Mechanical Structure	The mechanical rigidity must be good; otherwise, vibration will be significant.
Motion Profile	The command jerk must be continuous and as small as possible. Otherwise, sudden error changes will occur during acceleration variation. Positioning operation may involve overshoot and undershoot; S-curve commands will improve performance.

Related parameters

Parameter	Label	Description
P21.06	Model following control	0：Model following control - Default 1：Zero tracking control
P21.09	Dynamic friction compensation coefficient	Range: 0-1000, unit: 0.1% Unit：Changes in torque with the effect of friction on rotational speed. Only valid when MFC is activated
P21.00	Model following bandwidth	If P00.00 = 0, MFC and ZTC is deactivated. When P02.50 = 1 (Zero tracking control), higher bandwidth will improve following performance but noise will be higher.
Set the following parameters to default		
P21.07	Velocity feedforward compensation coefficient	Default value = 0 for zero tracking control.
P21.08	Torque feedforward compensation coefficient	
P21.10	Overtravel time constant	
P21.11	Overtravel suppression gain	

Operation steps

1) Disable the position command low-pass filter, position command FIR filter (P10.14 and P10.15), and vibration suppression (P22.13 and P22.15).

2) Normally tune the servo drive parameters to achieve the optimal performance at this stage (trajectory deviation may exist, but rigidity has reached the mechanical limit).

3) Set P21.06 to 1 to enable the Super Track function.

4) Verify if the trajectory following performance meets requirements. If satisfied, the process is complete.

5) Dynamic Friction Coefficien: This function compensates for the dynamic friction encountered by the equipment during motion, eliminating steady-state tracking errors in acceleration/deceleration phases and achieving more precise torque control. (Only valid when P21.00 Model Following Bandwidth (MFC) is enabled.)

$$\text{Dynamic Friction Coefficient} = \left| \frac{\text{Steady-state torque at speed 1} - \text{Steady-state torque at speed 2}}{\text{Speed 1} - \text{Speed 2}} \right| \times \text{Rated speed}$$

Specific Operating Steps:

a) Select two speed points: While the equipment performs acceleration/deceleration motion, observe and record two speed values (Speed 1 and Speed 2) at which constant position errors occur.
b) Read steady-state torque: Use the built-in monitoring function of the servo tuning software to read the steady-state output torque values when the equipment runs at these two speeds.
c) Substitute into the formula for calculation: Plug the obtained speed values (Speed 1, Speed 2) and corresponding steady-state torques into the formula above to calculate the value of the "Dynamic Friction Coefficient" parameter to be set.
d) Parameter input and verification: Input the calculated value into the corresponding parameter of the drive, run the equipment again, and observe whether the tracking errors in acceleration/deceleration phases are eliminated.

6) If the error during acceleration/deceleration start/stop is large, increase the model following bandwidth (P21.00) and gain. This will reduce the error during acceleration/deceleration start/stop, but the current noise will increase.

Notes:

- The Super Track function is only applicable to the position loop.
- The Super Track function is only valid after the P21.00 Model Following Bandwidth (MFC) is enabled.

5.6.3 Feedforward gain

In position control, the speed control command required for an action is calculated from the internal position command, and the speed feedforward is calculated by adding the speed command calculated by comparing it with the position feedback, which reduces the position deviation and improves the responsiveness compared with the feedback control alone.

In addition, the response of the speed control system can be improved by calculating the torque command required for the movement from the speed control command and adding the torque feedforward calculated from the torque command by comparing it with the speed feedback.

Servo drives use two types of feedforward functions: speed feedforward and torque feedforward.

Velocity feedforward can be applied to the position control mode. Using the velocity feedforward function improves the velocity command response and reduces the position deviation at fixed speeds.

In position control mode, torque feedforward can be used to improve the torque command response and reduce the position deviation at fixed acceleration and deceleration;

Speed control mode, using torque feedforward, can improve the torque command response and reduce the speed deviation at fixed speed.

Velocity feedforward

Velocity feedforward can be used in position control mode. When the function is enabled, it can increase velocity responsiveness, reduce position deviation during constant velocity.

P20.10	**Label**	Velocity feed forward gain					
	Range	0.0~1.000		**Default**	0.3	**Unit**	1
	Activation	Immediate	**Attribute**	RW		**PNU**	13210
	According to the position command feedforward compensation amount calculated by the differentiation, the speed command calculated by the differentiation is multiplied by the setting value of this parameter, skipping the "position controller" and directly added to the speed command input. This parameter is often used to reduce the following error and stabilize the setting value during slow speed response. **Increasing the setting value**: It can enhance the front feedback compensation amount, further reduce the following error, and improve the response agility of the system. However, please note that if the setting value is too large, it may easily cause system overshoot or oscillation. It is recommended to set it in combination with the actual commissioning situation. **Decreasing the setting value**: The front feedback compensation effect is weakened, and the system stability is improved. But it may lead to an increase in the following error and a slower response speed. This setting is suitable for working conditions that require high stability of the dynamic response of the system.						

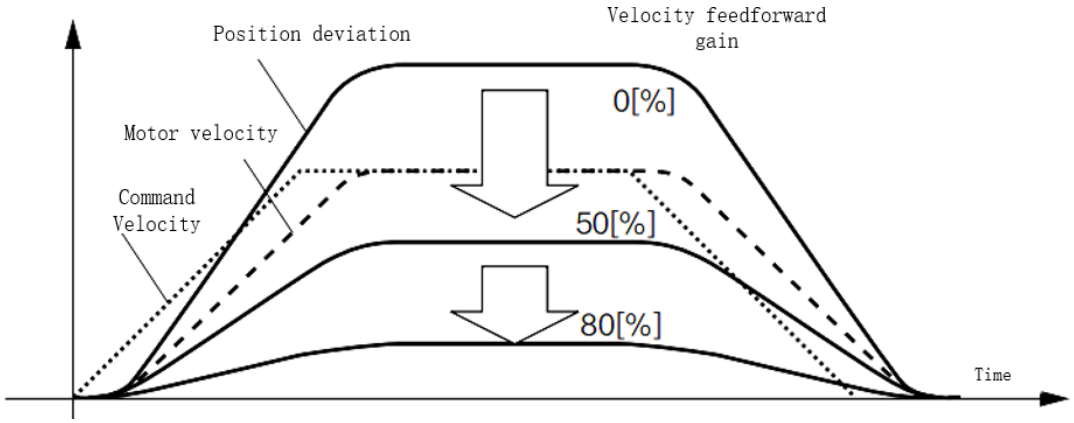
P20.11	Label	Velocity feed forward filter time constant					
	Range	0.0~64.00		Default	0.50	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	13211

Set velocity feed forward low pass filter to eliminate high or abnormal frequencies in velocity feed forward command. Often used when position command with low resolution or high electronic gear ration to smoothen velocity feed forward.

Position deviation under constant velocity can be lowered with higher velocity feed forward gain. Please to refer to the equation below.

$$\text{Position deviation[Uint]} = \frac{Set\ velocity[\frac{Uint}{s}]}{Position\ loop\ gain[Hz]} \ x\ \frac{100 - Velocity\ feed\ foward\ gain[\%]}{100}$$

Set P20.11 to around 50 (0.5ms), then tune P20.10 from 0 to bigger values until the velocity feedforward achieves better performance. Under constant velocity, the position deviation in a motion will decrease as the velocity feedforward gain increase.



Steps to tuning Velocity feedforward:

1. Increase P20.10 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
2. By reducing P20.11, velocity feedforward would be more effective and vice versa. P01.10 and P01.11 need to be tuned to a balance.
3. If mechanical noise exists under normal working conditions, please increase P20.11 or use position command filter (1 time delay/ FIR smoothing filter)

Torque feedforward

Position control mode:

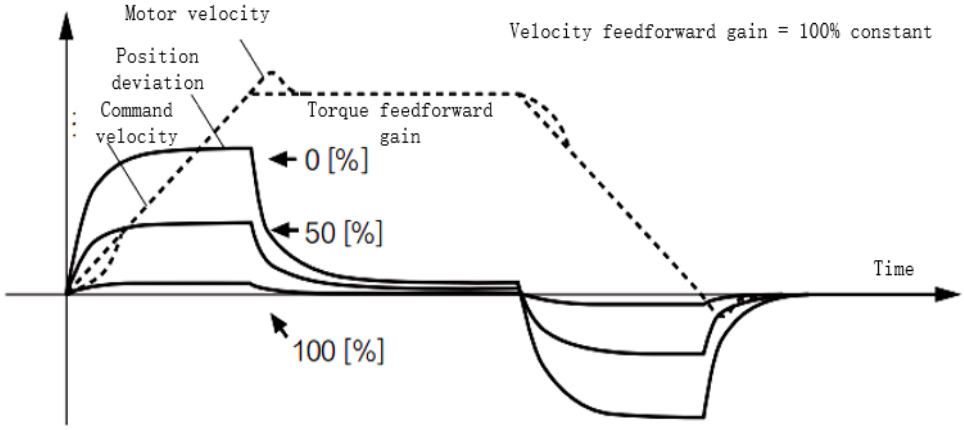
Torque feedforward can increase the responsiveness of torque command, decrease position deviation during constant acc-/deceleration.

Velocity control mode:

Torque feedforward can increase the responsiveness of torque command, decrease velocity deviation during constant velocity.

P20.12	Label	Torque feedforward gain					
	Range	0.0~1.0		Default	0	Unit	1
	Activation	Immediate	Attribute	RW		PNU	13212
	Before using torque feed forward, please set correct inertia ratio P20.04. By increasing torque feed forward gain, position deviation on constant acceleration/deceleration can be reduced to close to 0. Under ideal condition and trapezoidal speed profile, position deviation of the whole motion can be reduced to close to 0. In reality, perturbation torque will always exist, hence position deviation can never be 0.						
P20.13	Label	Torque feed forward filter time constant					
	Range	0.0~64.00		Default	0.00	Unit	ms
	Activation	Immediate	Attribute	RW		PNU	13213
	Low pass filter to eliminate abnormal or high frequencies in torque feed forward command. Usually used when encoder has lower resolution or precision. Noise reduces if torque feed forward filter time constant is set higher but position deviation will increase at acceleration varied points.						

Set P20.13 to around 50 (0.5ms), then tune P20.10 from 0 to bigger values until torque feedforward achieves better performance. Under constant acc-/deceleration, the position deviation in a motion will decrease as the velocity feedforward gain increase.



Steps to tuning Torque feedforward:

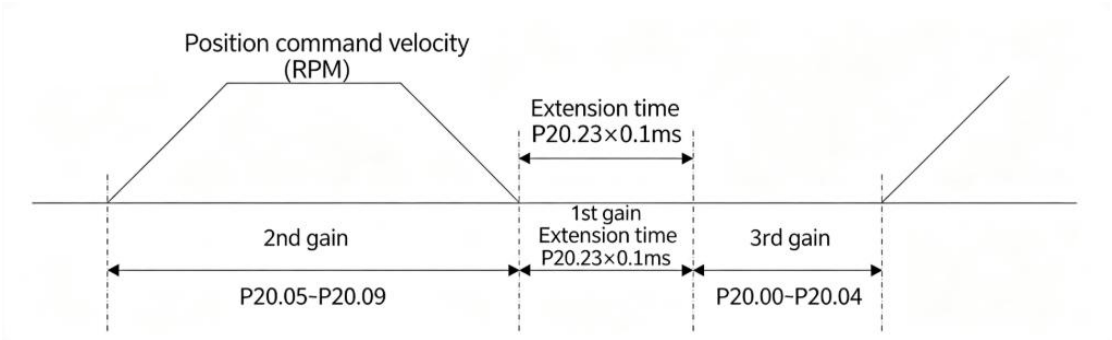
1. Increase P20.12 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
2. By reducing P20.13, torque feedforward would be more effective and vice versa. P01.12 and P01.13 need to be tuned to a balance and reduce noise.

5.6.4 3rd Gain Switching

Besides switching between 1st and 2nd gain, a 3rd gain switching is added to set gain at the moment of stopping to reduce positioning time.

Only available under position mode and P20.03 ≠ 0, set P20.24 for 3rd gain value. When 2nd gain switches to 1st gain, it has to go through 3rd gain, switching time is set in P20.19.

Diagram below shows when P01.15 = 7.

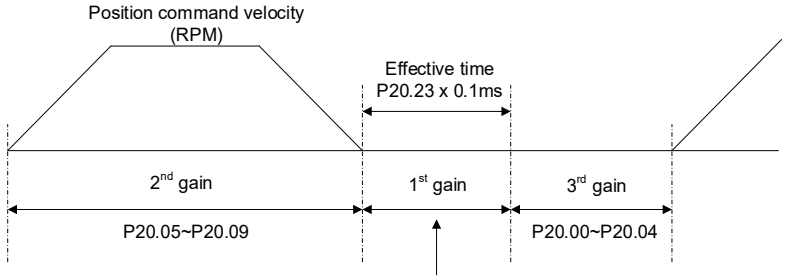


Related parameters:

P20.23	**Label**	3rd Position Gain Active Time					
	Range	0~10000		**Default**	0	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	13223
	Set the effective time of the 3rd gain. When not in use, please set P20.23=0 and P20.24=100.						

P20.24	**Label**	3rd Position Gain Multiplier					
	Range	0~1000		**Default**	100	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	13224

The 3rd gain becomes effective after the position command speed reaches zero and the time set by



P20.23 has elapsed.

3rd gain = 1st gain × P20.24 / 100.

The 3rd gain does not change the original speed loop integral time, speed filter, or torque filter values.

5.6.5 Friction compensation function

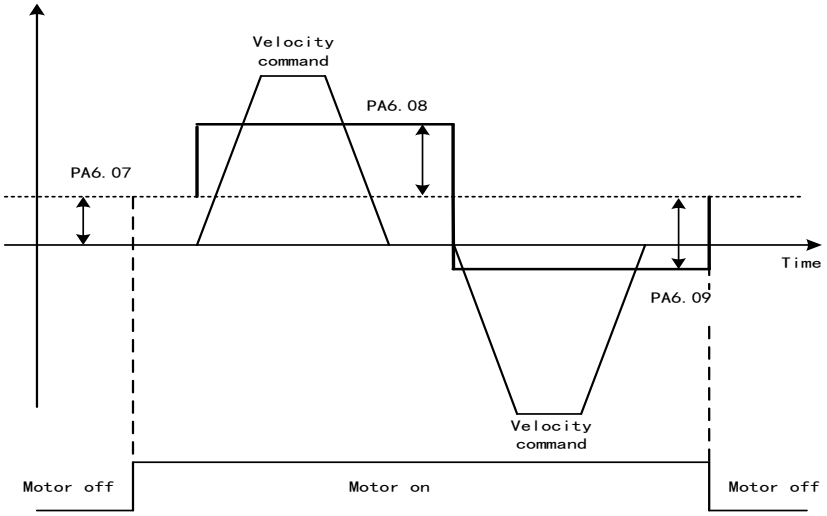
This function is to compensation for changes in load to reduce the effect of friction in motion. The compensation value is directional.

As a function to reduce the effect of friction on machinery, the friction torque compensation function operates under the following conditions:

■ The servo must be enabled.

■ The motor must be in normal rotation and without faults.

■ Conditions other than the control parameters are set appropriately, such as deviation counting zero command input prohibition, torque limitation, and so on.



■ Vertically loaded axis: A constant eccentric load torque is applied on the motor. By adjusting P21.25, positioning deviation due to different motional direction can be reduced.

■ Belt-driven axis: Due to large radial load with dynamic frictional torque. Positioning time delay and deviation can be reduced by adjusting P21.23 and P21.24.

Related Parameters：

P21.23	Label	Positive Torque Compensation Value					
	Range	-100~100		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13323
	Set to add feedforward torque superposition to the torque command, mainly for friction compensation in horizontal movement.It reduces the impact of friction in mechanical transmission on operation effects and provides positive and negative compensation values for torque in the same forward and reverse direction. Example: When the motor speed is at a constant speed, the monitored torque output value for forward operation is recorded as T1, and the torque output value for reverse operation is recorded as T2. If T2 = |T1-T2|/2, the friction torque is Tf = |T1-T2|/2. The magnitude of Tf is determined by the settings of P21.23 and P21.24. Note: Positive and negative compensation directions are determined based on the actual position command. The forward torque compensation value is set to positive (P21.23=+Tf), and the reverse direction friction compensation value is set to negative (P21.24=-Tf).					

P21.24	Label	Negative Torque Compensation Value					
	Range	-100~100		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13324
	Check 21.23						

P21.25	Label	Torque Command Additive Value					
	Range	-100~100		Default	0	Unit	%
	Activation	Immediate	Attribute	RW		PNU	13325
	Set the feedforward addition value of the vertical torque. It is applied to vertical load conditions to compensate for the torque caused by gravity. Example: When moving along the vertical direction, select any position within the stroke as the load point. When the load moves to that point, the motor is controlled to stop but not move. Record the torque value T output at that time as the torque command addition value (gravity compensation value).						

5.7 Vibration Suppression Function

5.7.1 Mechanical resonance suppression

Mechanical system has certain resonance frequencies. When servo gain is increased, resonance might occur at around mechanical resonant frequencies, preventing gain value from increasing. In such situation, notch filter can be used to suppress resonance to set higher gains or lower vibration.

To suppress mechanical resonance:

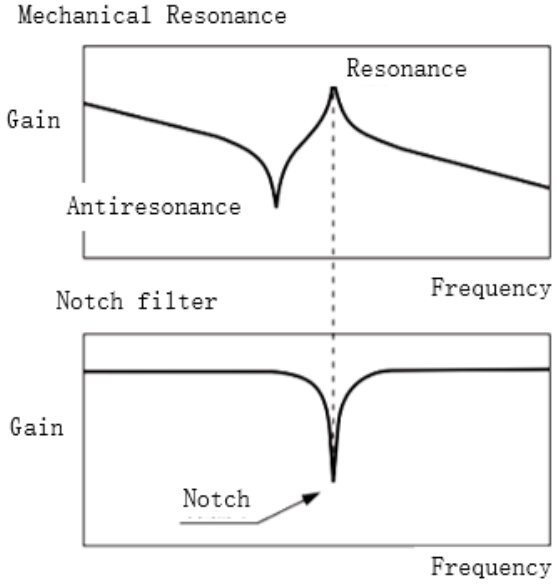
1. Torque command filter time constant

Set filter time constant to reduce gain at around resonant frequencies

Torque command filter blocked frequencies（Hz） fc=1/ [2π×P20.04(0.01ms)×0.00001）]

2. Notch filter

Notch filter suppress mechanical resonance by reducing gain at certain frequencies. When notch filter is correctly set, resonance can be suppressed and servo gain can be increased.



The servo drive has 4 groups of notch filters, each with 3 parameters: notch filter frequency, width level, and depth level. The first and second groups are manual notch filters, whose parameters are set manually by the user. The parameters of the third and fourth groups can be set manually or configured as adaptive notch filters. When P22.00=1 or 2, the third filter is an adaptive filter; when P22.00=3, both the third and fourth filters are adaptive filters, and all parameters of the adaptive filters can be automatically set by the drive.

Note:

1. When the ‘Frequency’ is the default value of 4000Hz, the trap is invalid.
2. If resonance occurs and a trapper is needed, please use the adaptive trap first.

If the Adaptive Trap is not effective, then try using the Manual Trap.

Operation steps

Adaptive Notch Filter Usage Steps:

1) Set P22.00 (Adaptive Filter Mode Setting) to 1, 2, or 3 to enable filter adaptation.
2) When P22.00=1 or 2, the parameters of the 3rd group notch filter (P22.07/P22.08/P22.09) are automatically updated during servo operation. If P22.00 is set to 1, P22.00 will automatically return to 0 after the update, stopping adaptation. When P22.00=3, the parameters of the 3rd and 4th group notch filters (P22.07~P22.12) are automatically updated during servo operation.
3) If resonance is suppressed, the adaptive filter is effective. If new resonance occurs, use a manual notch filter and set its frequency to the actual resonance frequency. If vibration cannot be eliminated for a long time, please disable the servo enable in time.

Manual notch filters can be used in two ways:

- Write the parameter values obtained from the adaptive filters (3rd and 4th filters) into the 1st and 2nd group notch filters, and re-enable P22.00 (Adaptive Notch Filter Mode Setting). New resonance points will be automatically updated to the adaptive filters.
- Obtain parameters via the "Mechanical Characteristic Analysis" function in Leadshine's tuning software, then download the obtained resonance frequency, notch width, and notch depth parameters to the corresponding notch filter parameters of the drive.

Manual Notch Filter Usage Steps:

4) Analyze the resonance frequency.
5) When using a manual notch filter, set its frequency to the actual resonance frequency.

Methods to obtain the resonance frequency:

- Obtain via the "Mechanical Analysis" function in Leadshine's Motion Studio.
- Set P22.00=1; the servo will automatically test the resonance frequency during operation and save the test result in the 3rd filter. Fill the parameters of the 3rd filter into the other manual filter parameters, then test the resonance frequency again.

6) Input the resonance frequency obtained in step 1 into the selected group's notch filter parameters, along with the width level and depth level of that group's notch filter.
7) If resonance is suppressed, the notch filter is effective. You can continue to adjust the gain. If new resonance occurs after increasing the gain, repeat the previous steps.
8) If vibration cannot be eliminated for a long time, please disable the servo enable in time.

Notch filter bandwidth：

The notch width level is used to indicate the ratio of the notch width to the notch centre frequency: **(fH-fL)/ fT**

fT: trap centre frequency, i.e. mechanical resonance frequency.

fH-fL: trap width, indicating the frequency bandwidth with amplitude

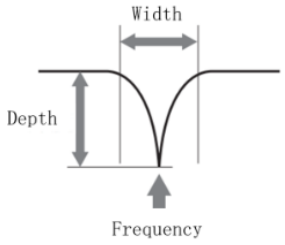
attenuation of -3dB relative to the trap centre frequency.

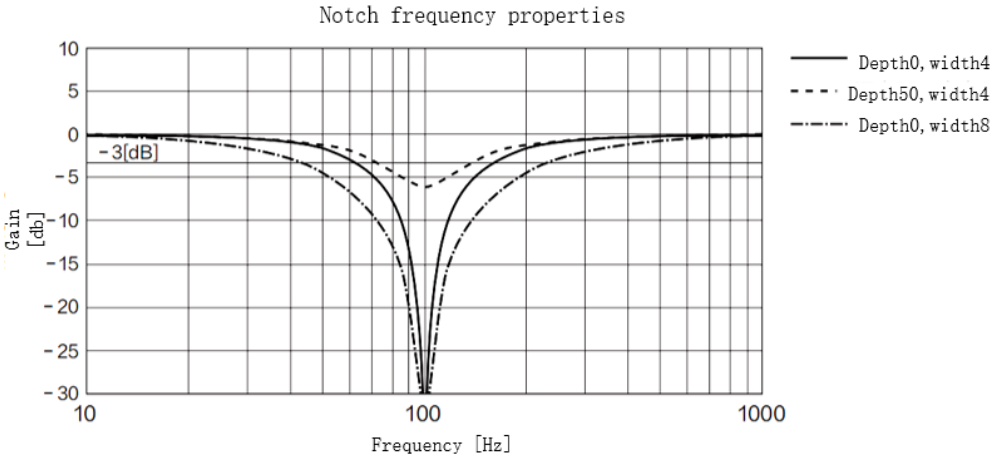
Generally, the default value of 2 can be kept.

Notch filter depth：

The ratio between input and output of center frequency.

When depth = 0, center frequency output is totally off and when depth = 100, Hence when notch filter depth is set at lower value, the depth is higher and better at suppressing mechanical resonance but it might cause system instability.





If the amplitude-frequency curve from mechanical properties analysis tool doesn’t show any obvious peak but vibration did occur, it might not be due to mechanical resonance, it may be that servo gain has reached its limit. This kind of vibration can’t be suppressed by using notch filter, only by reducing gain and torque command filter time.

Related Parameters：

P22.00	Label	Adaptive filtering mode settings					
	Range	0~4		Default	3	Unit	
	Activation	Immediate	Attribute	RW		PNU	13400

Set value	Description	
0	Adaptive filter: invalid	Parameters related to 3rd and 4th notch filter remain unchanged
1	Adaptive filter: 1 filter valid for once.	1 adaptive filter becomes valid. 3rd notch filter related parameters updated accordingly. P22.00 switches automatically to 0 once updated.
2	Adaptive filter: 1 filter remains valid	1 adaptive filter becomes valid. 3rd notch filter related parameters will keep updating accordingly.
3	Adaptive filter: 1&2 filter remains valid	1 & 2 adaptive filter becomes valid. 3rd & 4th notch filter related parameters will keep updating accordingly.
4	-	Filtering clearing.

P22.01	Label	1st notch frequency					
	Range	50~8000		Default	8000	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13401
	Set center frequency of 1st torque command notch filter. Set P22.01 to 8000 to deactivate notch filter						

P22.02	Label	1st notch bandwidth					
	Range	0~20		Default	4	Unit	
	Activation	Immediate	Attribute	RW		PNU	13402
	Set notch bandwidth for 1st resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P22.01 and P22.03, P22.02 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.						

P22.03	Label	1st notch depth					
	Range	0~99		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13403
	Set notch depth for 1st resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P22.01 and P22.02, P22.03 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings						

P22.04	Label	2nd notch frequency					
	Range	50~8000		Default	8000	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13404
	Set center frequency of 2nd torque command notch filter. Set P22.04 to 8000 to deactivate notch filter						

P22.05	Label	2nd notch bandwidth					
	Range	0~20		Default	4	Unit	
	Activation	Immediate	Attribute	RW		PNU	13405
	Set notch bandwidth for 2nd resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P22.04 and P22.06, P22.05 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.						

P22.06	Label	2nd notch depth					
	Range	0~99		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13406
	Set notch depth for 1st resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P22.04 and P22.05, P22.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings						

P22.07	Label	3rd notch frequency					
	Range	50~8000		Default	8000	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13407
	Set center frequency of 3rd torque command notch filter. Set P22.07 to 8000 to deactivate notch filter						

P22.08	Label	3rd notch bandwidth					
	Range	0~20		Default	4	Unit	
	Activation	Immediate	Attribute	RW		PNU	13408
	Set notch bandwidth for 3rd resonant notch filter. Same as above.						

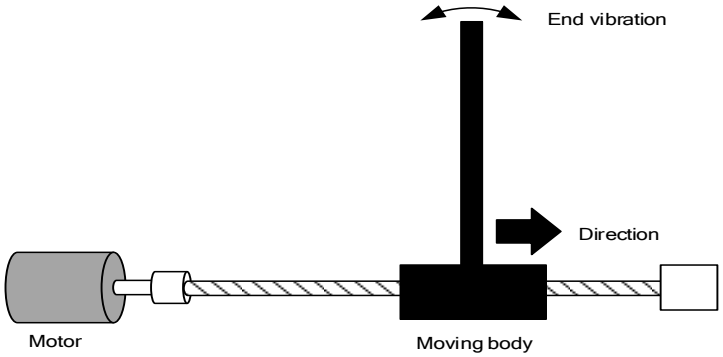
P22.09	Label	3rd notch depth					
	Range	0~99		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13409
	Set notch depth for 3rd resonant notch filter. Same as above.						

P22.10	Label	4th notch frequency					
	Range	50~8000		Default	8000	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13410
	Set center frequency of 4th torque command notch filter. Set P22.10 to 8000 to deactivate notch filter						

P22.11	Label	4th notch bandwidth					
	Range	0~20		Default	4	Unit	
	Activation	Immediate	Attribute	RW		PNU	13411
	Set notch bandwidth for 4th resonant notch filter. Same as above.						

P22.12	Label	4th notch depth					
	Range	0~99		Default	0	Unit	
	Activation	Immediate	Attribute	RW		PNU	13412
	Set notch depth for 4th resonant notch filter. Same as above.						

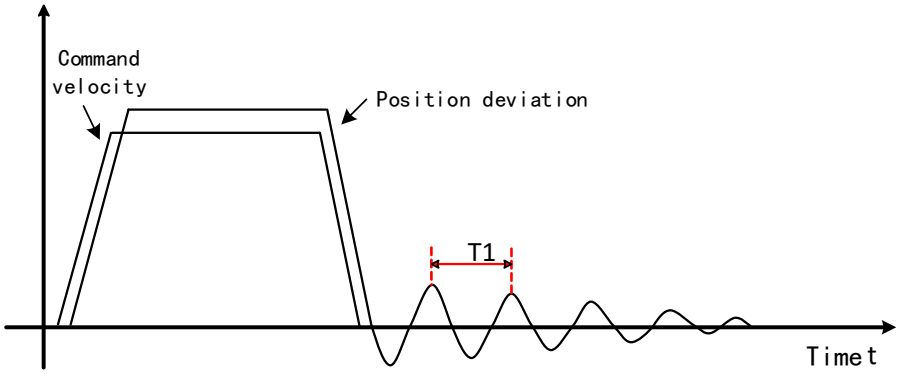
5.7.2 End vibration suppression



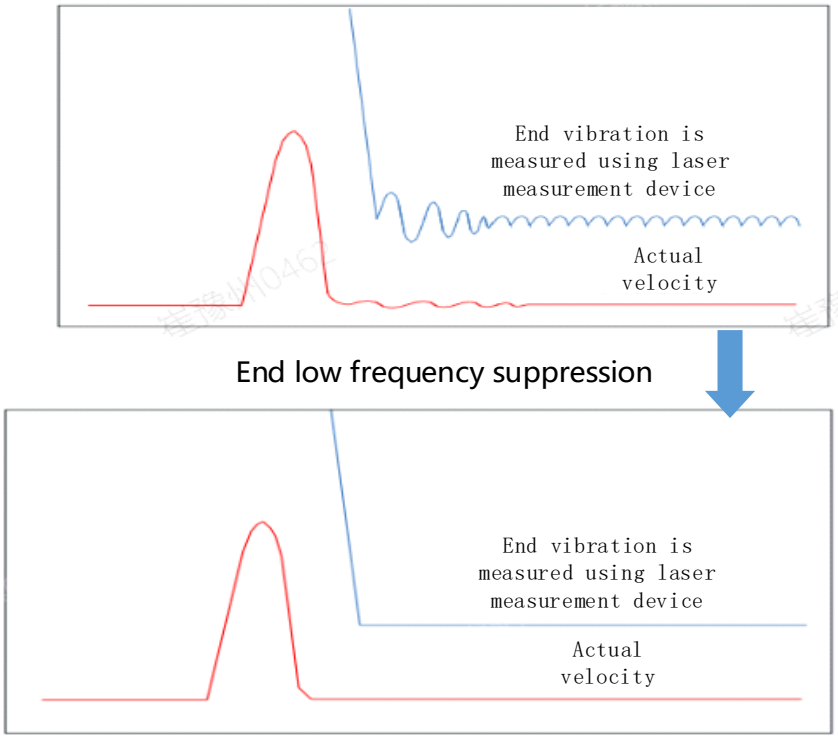
If the mechanical structure has an end that is long and heavy, it might cause end vibration at emergency stop and affect the positioning. Usually happens on long armed axis with loose end. The frequency is usually within 100Hz which is lower than mechanical resonant frequencies. It is called low-frequency resonance which can be prevented by applying low frequency suppression function.

To apply low frequency suppression

1. Trace current/ position deviation waveform when motion stops.
2. Measure the vibration cycle T1 of current waveform.
3. Convert T1 into low frequency resonance by F1 = 1/T1
4. Write F1 into P20.14
5. If some other low frequency resonance occurs, please repeat step 1-3 and write F2 into P20.16.



The result of suppressing low frequency resonance:



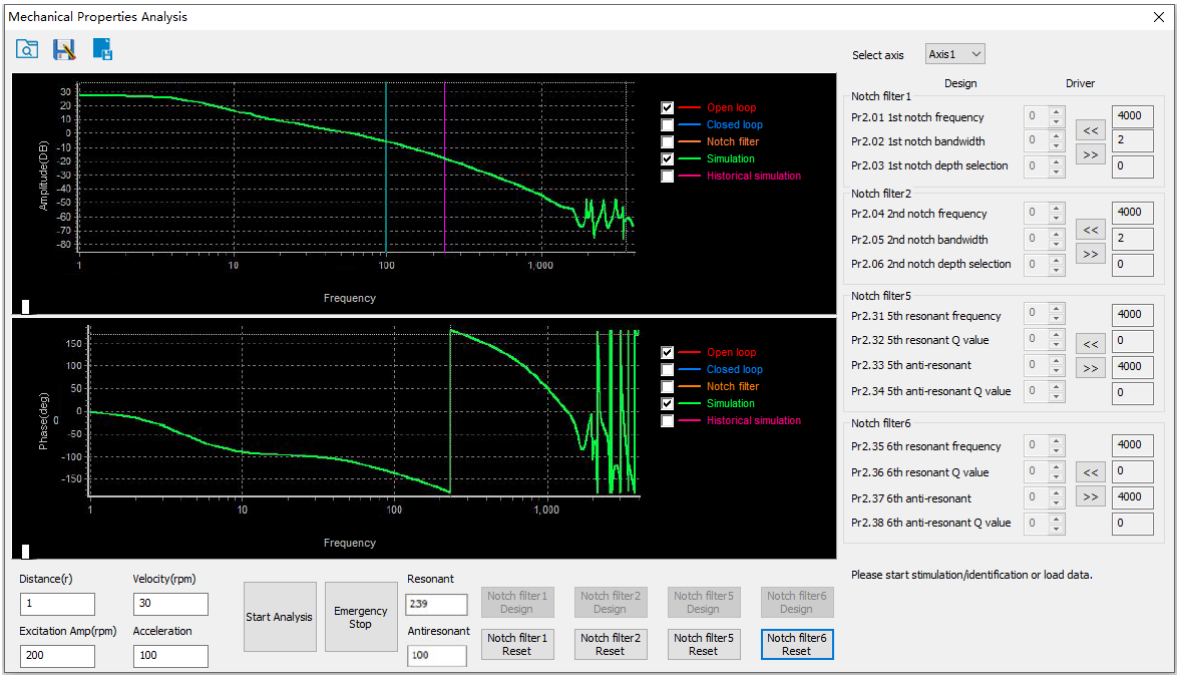
P22.13	Label	1st Vibration Suppression Frequency					
	Range	0~200		Default	0	Unit	Hz
	Activation	Immediate	Attribute	RW		PNU	13413
	Set the vibration suppression frequency to suppress end shaking. After measuring the vibration frequency of the load, set it in units of 0.1 [Hz]. 0.0: Turn off the vibration suppression function. 1.0~200.0: Set the vibration suppression frequency. Note: The suppression function targets end shaking. It is specifically used to suppress end shaking caused by high deceleration impacts during motor stops, which is particularly effective for shaking at frequencies around 100Hz. During use, set this parameter to the frequency of the shaking. (For vibration frequencies, you can try to use servo adjustment software to collect waveform analysis for acquisition).						

P22.15	Label	2nd Vibration Suppression Frequency					
	Range	0~200		Default	0	Unit	H
	Activation	Immediate	Attribute	RW		PNU	13415
	Check 22.13						

5.7.3 Mechanical properties analysis

Please use this function on the Leadshine drive debugging software Motion Studio.

The Mechanical Characteristic Analysis is mainly used to identify mechanical resonance points, which works together with the notch filter to effectively suppress mechanical resonance.



To avoid strong vibration, please first set lower excitation amplitude. However, if the set value is too low, data waveform will include some degree of distortion.

If vibration occurs during tests which can't be reduce through lowering electrical current excitation, it might be due to excessive gain. Please lower velocity gain and set notch filter as accordance from the mechanical properties analysis. Or might be due to inertia settings is too large, please use optimal inertia ratio value.

5.8 Multiturn absolute encoder

5.8.1 Parameters setting

Multiturn absolute encoder records the position and the revolution counts of the motor. When driver is powered-off, multiturn absolute encoder will backed up the data using battery and after powering on, the data will be used to calculated absolute mechanical position and there is no need for a mechanical homing process. Use widely in robotic arms and CNC machines.

Move machine to home and set P10.10 (Absolute Encoder Setting) on first-time use of absolute motor. First enabling multi-turn mode triggers Er153 (Battery Fault). Clear multi-turn position & reset alarm by setting P10.09=2 for home calibration. Homing is not required thereafter (except absolute alarms). Read position at motor stand-still to prevent data jump. For multi-turn absolute encoder motor, use encoder cable with battery holder or separate battery box.

P10.09	**Label**	Absolute Encoder Reset Enable					
	Range	0~2		**Default**	0	**Unit**	
	Activation	After reset	**Attribute**	RW		**PNU**	11609
Sets functions related to the absolute encoder. 0: Function disabled; 1: Clear encoder alarm; 2: Clear encoder alarm and multi-turn position.							
P10.10	**Label**	Absolute Encoder Setting					
	Range	0~3		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	11610
Sets the type and usage mode of the absolute encoder. The specific usage can be set as follows: 0: Incremental mode. The encoder is used as a bus incremental encoder, with no power-off position memory function. There is no restriction on the load travel range of the equipment. 1: Multi-turn linear mode. Enables the multi-turn absolute value function, with power-off position memory function. It is applicable to scenarios where the load travel range of the equipment is fixed and the encoder's multi-turn data will not overflow. 2: Multi-turn rotary mode. Enables the multi-turn absolute value function, with power-off position memory function. The actually fed back multi-turn data cycles back and forth between 0 and (P10.12+1); it is applicable to scenarios where the load travel range of the equipment is unrestricted. 3: Single-turn absolute value mode. This mode is mainly used in scenarios where the equipment load only needs to record the position within one revolution of the motor. The initial position fed back at each power-on is used to calculate the current position feedback based on the coordinate system after the last homing operation, with no need for re-homing.							

P10.11	Label	Absolute Multi-turn Mode Minimum Value					
	Range	0~2147483647		Default	0	Unit	pulse
	Activation	Immediate	Attribute	RW		PNU	11611
	Sets the minimum value of multi-turn data when the absolute encoder is in rotary mode. When P10.10=2 (multi-turn rotary mode), the number of pulses per single revolution is: P10.12 (range value of absolute value rotary mode) - P10.11 (minimum value of absolute value rotary mode).						

P10.12	Label	Absolute Multi-turn Mode Range Value				
	Range	0~2147483647	Default	0	Unit	Pulse
	Activation	Immediate			PNU	11612
	Sets the value range of multi-turn data when the absolute encoder is in rotary mode. When P10.10=2 (multi-turn rotary mode), the number of pulses per single revolution is: P10.12 (range value of absolute value rotary mode) - P10.11 (minimum value of absolute value rotary mode).					

5.8.2 Read absolute position

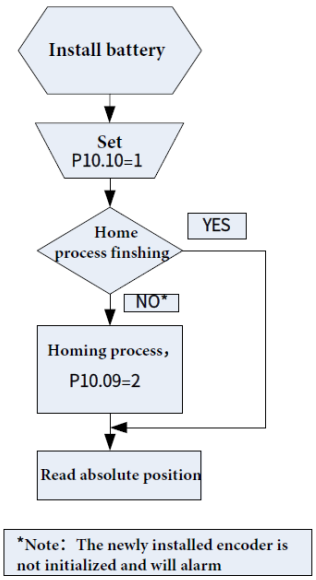
1、Steps：

1) First, select a motor with multiturn absolute encoder, install battery and confirm whether the driver version supports the specific motor;

2) Set P10.10 = 1. If it is the first time of installation, Er153 will occur because battery is newly installed and position data is invalid. Please home the axis and initialize the absolute position of the encoder to zero.

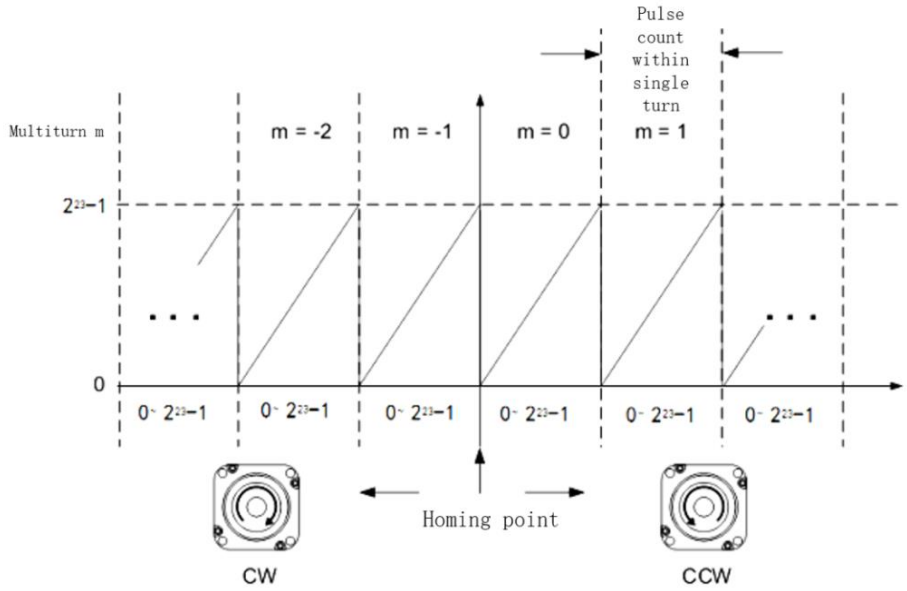
3) When absolute homing point is set and there is no fault with the battery, the alarm will be cleared

4) Finally, the user can read the absolute position. Position won't be lost even if the driver is powered off.



2、Read absolute position

For absolute-value counting: the turn count is negative when the motor rotates clockwise, and positive when rotating counter-clockwise. The turn-count range is 0-65536. Once the limit is reached, the value rolls over: counter-clockwise rotation past 65536 wraps to 0; clockwise rotation from 0 wraps to 65536.
Single-turn position also adopts roll-over counting, with the absolute-value range determined by encoder resolution. - 17-bit encoder: range 0 ~ 131071 - 23-bit encoder: range 0 ~ 8388607 Take the 23-bit encoder as an example:



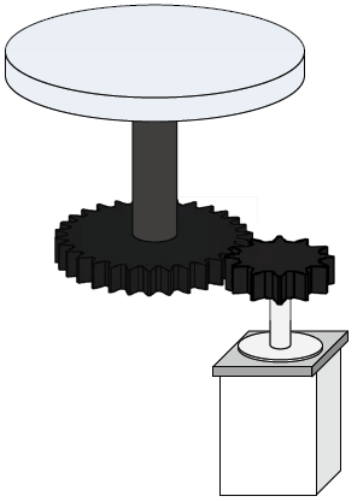
Read data from 485 address:H:0x0510, L:0X0511
Please read data only when the motor is fully stopped or it might cause calculation errors. Please repeat this step for at least twice to make sure the result is uniform.

■ Multiturn linear mode (P10.10 = 1)

Enable multi-turn absolute-value function for power-off position retention. Suitable for fixed-stroke loads without multi-turn data overflow. Absolute linear-mode encoder: multi-turn data 0-65536, cycled repeatedly.

■ Multiturn rotational mode (P10.10 = 2)

In multi-turn rotation mode, valid multi-turn-count range: (P10.11 / Pulses Per Revolution ~ P10.12 / Pulses Per Revolution). Multi-turn feedback cycles inside this range during continuous rotation, no overflow occurs. For unlimited-stroke rotating-type loads.



■ Single turn absolute mode(P10.10 = 3)

No external battery needed; motor turn count is lost on power-off. After power-on, 6064h ranges 0 ~ command pulses per revolution. The drive keeps the coordinate system from last homing for position feedback; no re-homing required.When electronic gear ratio = 1:1, 607Ch = 10000:

3、Clear multiturn position

Return machine to home before clearing multi-turn position. After clearing, multi-turn position = 0, single-turn position unchanged, encoder absolute alarm reset.
Home-return range: one motor turn. Mechanical home offset must be within one-turn range. Adjust position with panel value “D21 Single-turn Value”.
Set P10.09=2 to clear multi-turn position, via panel or bus communication.

5.8.3 Absolute Encoder Related Alarm

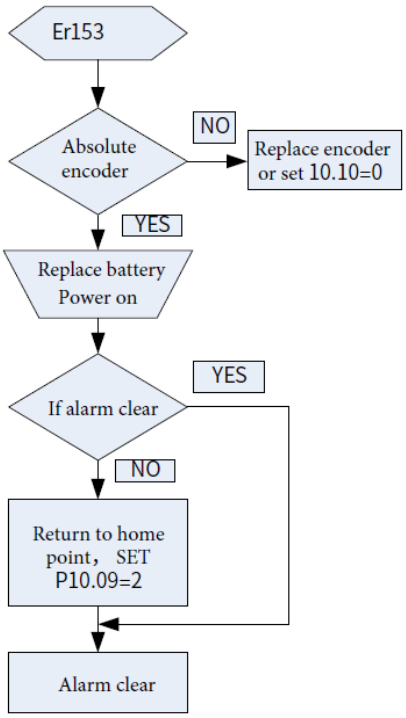
The alarm can determine if absolute value encoder is valid. If battery power is low, not a motor with absolute encoder, encoder error etc. occurs, user can find out about the error from alarm output or on the front panel. Controller will stop any operation until alarm is cleared.
Alarm output:
Er153 will be shown on front panel or by I/O ALM signal and from controller.
Er153 might occur,

1) If absolute encoder is used for the first time and due to installation of new batteries Axis needs to be homed and multiturn data needs to be cleared.
2) Battery voltage ＜3.0 V: drive outputs absolute-battery undervoltage warning ArA03. Warning clears automatically after battery replacement.
3) Voltage ＜2.5 V or battery power loss: absolute-value alarm remains after battery replacement. Homing + multi-turn clearing required.

4、Alarm processing flow chart

Two alarm-clearing cases:

1) Resettable alarms (e.g. battery undervoltage): alarm clears after battery replacement & power-on.
2) Non-resettable alarms (e.g. battery power loss): alarm remains after battery replacement. Verify absolute-value motor, complete homing, then clear multi-turn position to recalibrate absolute origin.



5.8.4 Battery kit

In multiturn absolute mode, Er153 might occur upon first time installation. P10.09 needs to be set to 2 to reset error and clear multiturn data.

When battery supply voltage < 3.0V, ArA03 might occur. Change battery as per steps below:

1) Power on driver (Make sure axis is disabled)
2) Change battery
3) Servo drive will reset warning automatically.

5.9 Functions

5.9.1 Motor overspeed alarm

Parameter P04.07 is used to set the overspeed alarm threshold during motor operation; if this speed is exceeded during motion, anEr1A0 alarm will be triggered.
Related parameters:

P04.07	**Label**	Overspeed Level Setting					
	Range	0~10000		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	10407
	If the motor speed exceeds this set value, Er1A0 "Over-speed" will occur.When the speed level set value is set to 0, the speed level is equivalent to 1.2 times the maximum motor speed.						

5.9.2 Servo stop mode

■ Method 1: Set up P00.30 to set servo stop mode:

P00.30	**Label**	Stop Mode when Servo Enable Off				
	Range	0~8	**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RW	**PNU**	10030

Value	Description	Deceleration for Servo Braking Stop
0	Servo braking stop, the servo state is dynamic braking after stop;	Determined by P00.37 (Fault deceleration time).
1	Servo braking stop, the servo state is dynamic braking after stop;	In homing mode, deceleration is 609Ah (Homing acceleration/deceleration);in non-homing mode, deceleration is 6084h (Protocol deceleration).
2	Servo braking stop, the servo state is dynamic braking after stop;	Determined by 6085h (Emergency stop deceleration).
3	Servo braking stop, the servo state is free after stop;	When enable is off, the deceleration for servo braking stop is determined by P00.37 (Fault deceleration time).
4	Servo braking stop, the servo state is free after stop;	In homing mode, deceleration is 609Ah (Homing acceleration/deceleration);in non-homing mode, deceleration is 6084h (Protocol deceleration).
5	Servo braking stop, the servo state is free after stop;	Determined by 6085h (Emergency stop

			deceleration).	
	6	DB braking stop, the servo state is dynamic braking after stop;	-	
	7	DB braking stop, the servo state is free after stop;		
	8	Free stop, the servo state is free after stop;		

■ Method 2: Using these parameters to set Servo class 1/2 stop mode:

P00.31	**Label**	Class 1 Fault Stop Mode				
	Range	0~2	**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RW	**PNU**	10031
	Set the stop method and stop state for Class 1 faults. 0: Stop via dynamic braking, and the state after stop is dynamic braking state; 1: Stop via free stop method, and the state after stop is free state; 2: Stop via DB braking method, and the state after stop is free state.					

P00.32	**Label**	Class 2 Fault Stop Mode				
	Range	0~8	**Default**	0	**Unit**	-
	Activation	Immediate	**Attribute**	RW	**PNU**	10032

Set the stop method and stop state for Class 1 faults. P00.32 is equivalent to PF2.08 (605Eh), and the parameters are interrelated, i.e., changing the value of P00.32 will synchronously update PF2.08, and vice versa.

Refer to the table below for the stop methods of Class 2 alarms (excluding Er260/Er570/Er571):

Value	Description	Deceleration for Servo Braking Stop
0	Servo braking stop, the servo state is dynamic braking after stop;	Deceleration is determined by P00.37 (Fault deceleration time)
1	Servo braking stop, the servo state is dynamic braking after stop;	In homing mode, deceleration is 609Ah (Homing acceleration/deceleration);In non-homing mode, deceleration is 6084h (Protocol deceleration)
2	Servo braking stop, the servo state is dynamic braking after stop;	Deceleration is determined by 6085h (Emergency stop deceleration)
3	Servo braking stop, the servo state is free after stop;	Deceleration is determined by P00.37 (Fault deceleration time)
4	Servo braking stop, the servo state is free after stop;	In homing mode, deceleration is 609Ah (Homing acceleration/deceleration);In non-homing mode, deceleration is 6084h (Protocol deceleration)
5	Servo braking stop, the servo state is free after stop;	Deceleration is 6085h (Emergency stop deceleration)

6	DB braking stop, the servo state is dynamic braking after stop;	-
7	DB braking stop, the servo state is free after stop;	
8	Free stop, the servo state is free after stop;	

Note：

• The stop method and deceleration of Er260 (Positive/Negative limit input valid) are selected by P00.34 (Positive/Negative limit stop mode).

• The stop method and deceleration of Er570 (Force alarm input) and Er571 (PC force alarm) are selected by P00.33 (Force stop mode).

5.9.3 Maximum Stop Time After Servo Disable

This parameter configures the maximum stop time after the servo is disabled. If the motor speed remains higher than the speed set in P00.27 when this time elapses, the drive's brake signal BRK is set to OFF (triggering brake holding). If no brake is installed, the drive will execute a forced stop based on whether dynamic braking is enabled.

Related parameters:

P00.28	Label	Max. time to stop after disabling				
	Range	0~3000	Default	500	Unit	ms
	Activation	Immediate	Attribute	RW	PNU	10028

To set the max. time allowed for the axis to stop on emergency stop or normal axis disabling. After disabling axis, if motor speed is still higher than P04.39 but the time set in P00.28 is reached, BRK_ON given and holding brake activated.
BRK_ON given time is determined by P00.28 or when motor speed goes below P04.39, whichever comes first.

Applications:
1. After disabling axis, if motor speed is still higher than Trigger brake speed but the time set in P00.28 is reached, BRK_ON given and holding brake activated.
2. After disabling axis, if motor speed is already lower than P04.39 but the time set in P00.28 is not yet reached, BRK_ON given and holding brake activated.

5.9.4 Maximum Stop Time After Servo Disable

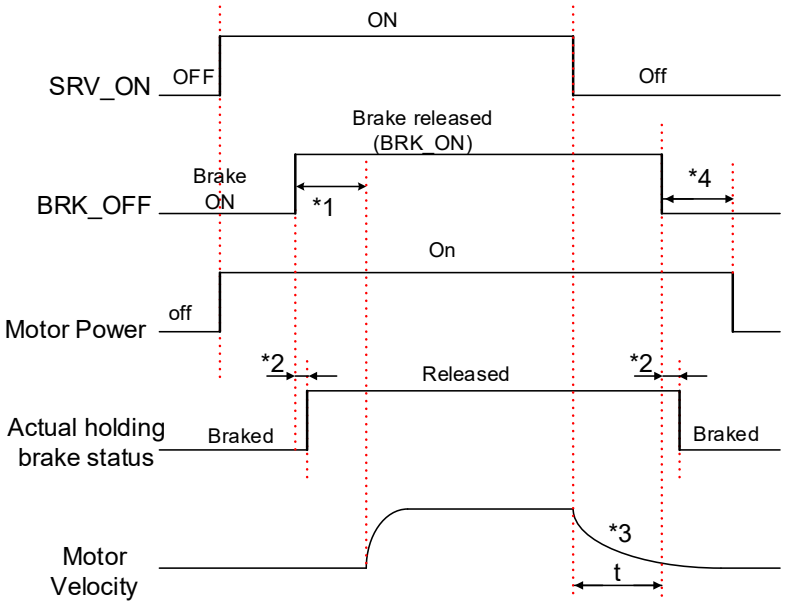
This function can be configured via the IO output function parameter, refer to the description of IO parameter P01.16. When the conditions set by P00.27 or P00.28 are met after an alarm occurs or the servo is disabled, the corresponding configured output IO port will output OFF.

Related parameters:

P00.25	**Label**	Motor power-off delay time				
	Range	0~3000	**Default**	150	**Unit**	ms
	Activation	Immediate	**Attribute**	RW	**PNU**	10025
To set delay time for holding brake to be activated after motor power off to prevent axis from sliding.						

P00.26	**Label**	Delay time for holding brake release				
	Range	0~3000	**Default**	0	**Unit**	ms
	Activation	Immediate	**Attribute**	RW	**PNU**	10026

To set delay time for holding brake to be released after motor power on. Motor will remain at current position and input command is masked to allow holding brake to be fully released before motor is set in motion.



*1: Delay time set in P00.25

*2: Delay time from the moment BRK_OFF signal is given until actual holding brake is released or BRK_ON signal is given until actual holding brake is activated. It is dependent on the holding brake of the motor.

*3: Deceleration time is determined by P00.28 or if motor speed goes below Trigger brake speed, whichever comes first. BRK_OFF given after deceleration time.

*4: P00.25 set time value.

Delay time from the moment SRV_ON is given until BRK_OFF switch to BRK_ON, is less than 500ms.

P00.27	Label	Brake release speed setting				
	Range	10~3000	Default	30	Unit	r/min
	Activation	Immediate	Attribute	RW	PNU	10027

Set the motor speed threshold when the speed signal BRK is set to OFF (start holding brake) during disable.

When the servo enable is turned off (SRV-OFF), the motor starts to decelerate. When the motor speed is lower than the set value of this parameter and the time of P00.28 has not elapsed, the holding brake signal (BRK-OFF) is output. The actual timing for BRK to be set to OFF is whichever comes first: the time of P00.28 or the time taken for the motor speed to drop to the speed set by P00.27.

Application examples:

Case 1: After disable, if the motor deceleration time has reached the set time of P00.28, even if the motor speed is still higher than the speed set by P00.27, the drive's holding brake signal BRK is set to OFF (start holding brake).Case 2: After disable, if the motor deceleration time has not reached the set time of P00.28, but the motor speed is already lower than the speed set by P00.27, the drive's holding brake signal BRK is set to OFF (start holding brake).

5.9.5 Emergency Stop function

Emergency Stop is a function where the servo drive decelerates the motor using the configured servo braking torque when it receives a forced alarm signal or a drive disable input signal while in the operating state (servo enabled).

■ Method : This function can be configured via the IO input parameters

P00.34	Label	Positive/Negative Limit Stop Mode				
	Range	0~6	Default	0	Unit	-
	Activation	Immediate	Attribute	RW	PNU	10034

Set the Positive/Negative Limit Stop Mode.

Value	Description
0	Limit Valid Mode: Stop via servo braking, and the deceleration is selected as the larger value between P00.35 (Positive/Negative Limit Deceleration Time) and P00.38 (Maximum Deceleration Time).
1	Limit Invalid Mode.
2	Limit Alarm Trigger Mode: Stop via servo braking, the deceleration is selected as the larger value between P00.35 (Positive/Negative Limit Deceleration Time) and P00.38 (Maximum Deceleration Time), and the servo state is dynamic braking state after stopping.
3	Limit Alarm Trigger Mode: Stop via servo braking, the deceleration is selected as the larger value between P00.35 (Positive/Negative Limit Deceleration Time) and P00.38 (Maximum Deceleration Time), and the servo state is free state after stopping.
4	Limit Alarm Trigger Mode: Stop via DB braking, and the servo state is DB braking state after stopping.
5	Limit Alarm Trigger Mode: Stop via DB braking, and the servo state is free state after stopping.
6	Limit Alarm Trigger Mode: Free stop, and the servo state is free state after stopping.

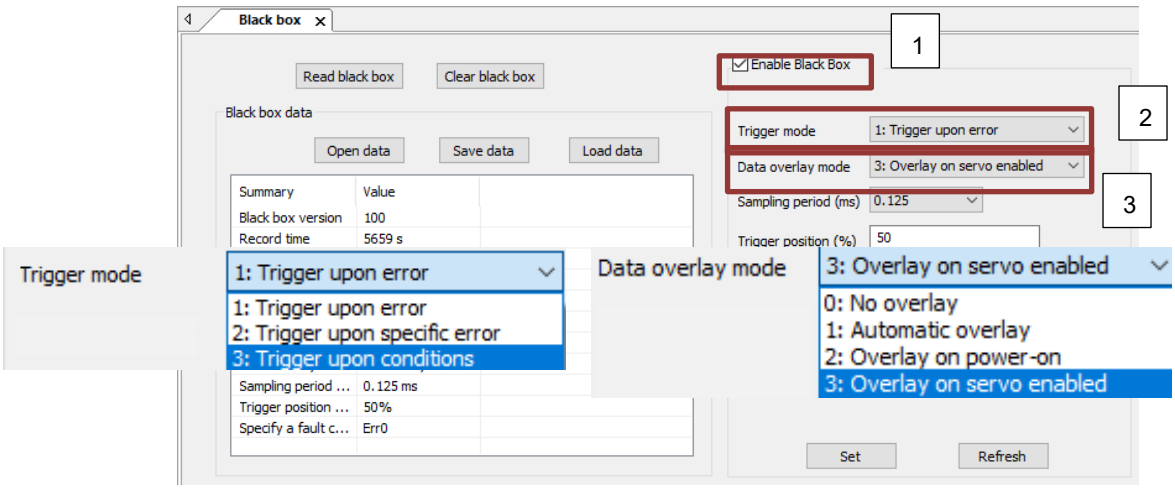
P00.40	Label	E-Stop Function Selection				
	Range	0~1	Default	0	Unit	-
	Activation	Immediate	Attribute	RW	PNU	10040

0：Emergency stop is valid, servo driver will be forced to STOP and alarm occurs.
1：Emergency stop is invalid, servo driver will not be forced to STOP.

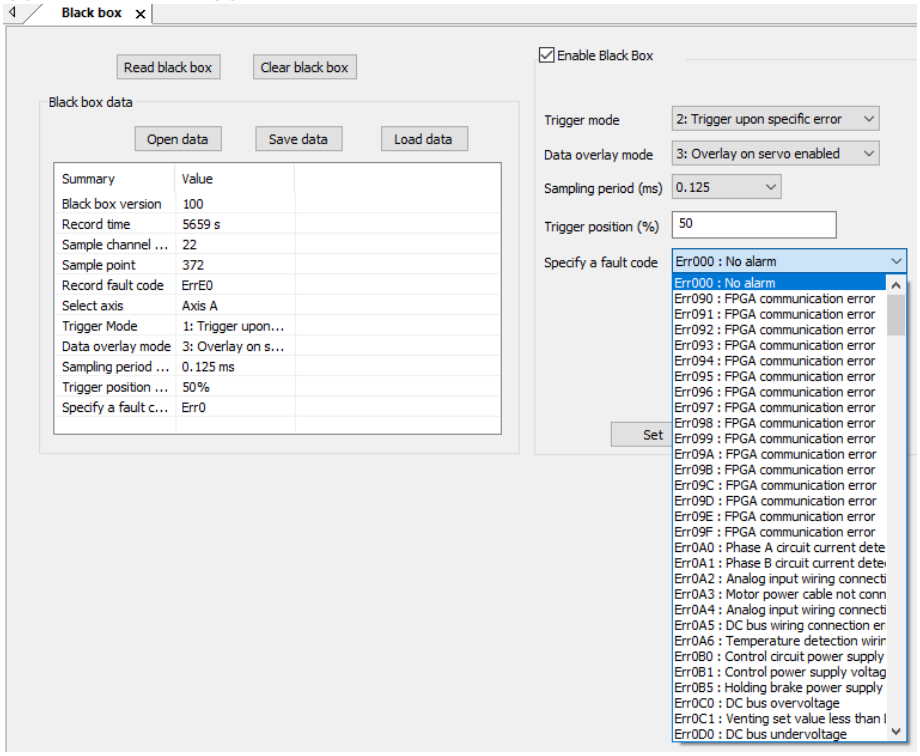
5.10 Black box

Black box is a function which allows users to set conditions or data to be captured whenever error occurs. The data will be recorded by black box at the moment of error occurrence and automatically saved. Thus, through Motion Studio, user can analyze cause of the problem with the aid of black box data.
Black box is deactivated by default. It is user configurable to choose whether to overwrite current data or when to overwrite the data in black box.

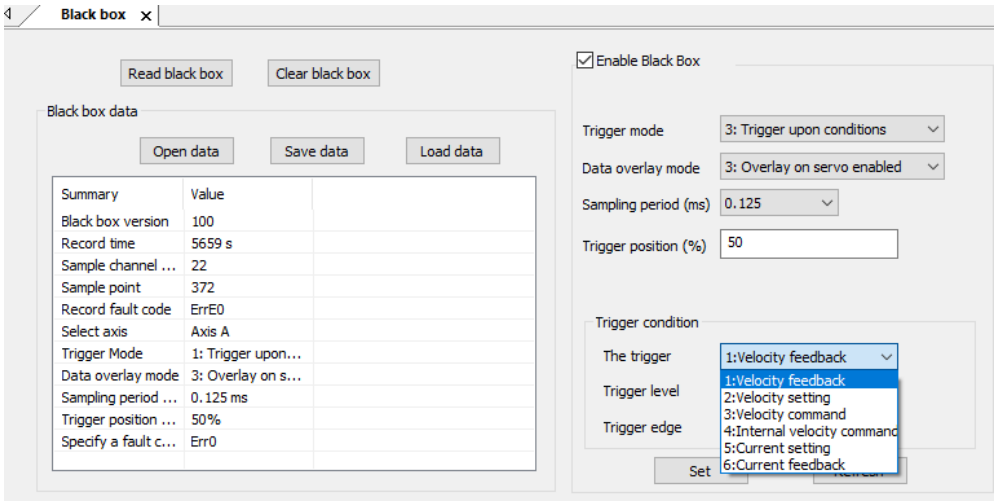
1. Click on “Black Box” under “Tool” to enter Black box setup. There 3 methods to trigger black box function: 1. Random error, 2. Specific error, 3. Conditions triggering. Choose trigger method as accordance to needs. Please pay attention to Data Overlay Mode and choose the option needed before start.



2. Trigger mode 2: Trigger black box whenever a chosen specific error occurs.



3. Trigger mode 3: Conditions for black box functions to be triggered can set. Set the source, level and edge of the trigger as shown below.

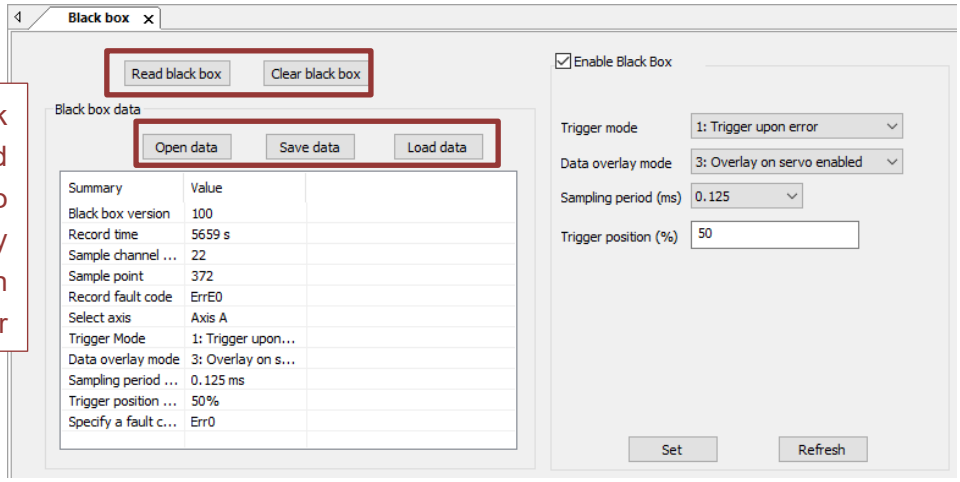


4. Data overlay mode: To select how and when black box data is overlaid. 0: Do not overlay data (Black box will only preserve the data of the first trigger). 1: Always overlay (Black box data will be overlaid every time). 2: Overlay upon powered on (Data overlaid occurs when servo drive is powered on) 3: Overlay when enabled (Data overlaid occurs when servo drive is enabled).

5. Sampling period (ms): The lower the set value, the more precise the samples are but sampling time will be shorter.

6. Trigger position (%): Set the position of trigger within the sampling period.
7. Click on “Set” to save the settings to driver.

Data recorded in Black Box can be read and cleared. The data can also be saved and read by anyone from this function interface for further



5.11 Position comparison

Position comparison is achieved by using instantaneous position data in comparison with preset position in position parameters. When the condition(s) is fulfilled, a pulse width configurable DO signal or ABZ/OCZ signal through frequency divider will be delivered. This function is operated in CPLD, without communication delay between processors hence it is suitable for application where high velocity motion is required.

Position comparison		Description
Output trigger	Output	6 DO or frequency divider ABZ/OCZ signal
	Logic	DO output valid as set in P04.10-P04.15
		ABZ/OCZ output valid as set in P05.42
		Output mode：Pulse / Flip
	Pulse width	P0C.02 set pulse width
	Delay compensation	P0C.03 compensate for hardware delay
Comparison source	Motor enclosed	Supported
	Closed loop ABZ encoder	Supported
Comparison value	Points of comparison	42 points
Comparison attribute	Comparison method	Comparison ON/OFF for positive/negative crossover
		Set comparison output

When the position comparison output function is needed, the corresponding DO needs to be configured as the CMP-OUT position comparison output signal or the frequency division ABZ needs to be allocated as the position comparison function.

Working principle

■ **Position Comparison Enable (P41.00)**

When position comparison enable P41.00 is set from 0 to 1, comparison starts, and the current comparison status is updated to the start comparison point. When position comparison enable is set to 0, comparison stops immediately, and the comparison status is cleared.

■ **Sequence Comparison Mode**

In sequence comparison mode:

When the end comparison point is completed, comparison enable is automatically turned off, and the current comparison value is reset to zero. The comparison function is re-enabled only when the comparison enable switch is detected to turn on again.

Real-time position feedback is absolute: after each point comparison, P41.10 (real-time position feedback) is linearly accumulated based on the previous comparison point and will not be automatically cleared.

■ Reciprocating Comparison Mode

In reciprocating comparison mode:
When the end comparison point is completed, comparison enable remains active, and the current comparison value is reset to the start comparison point. After each point comparison, P41.10 (real-time position feedback) is cleared and recounted for reciprocating comparison.
Target positions are relative incremental: after the current comparison point is completed, real-time position feedback automatically clears and recounts to compare with the new target point.

■ Position Comparison Output Width (P41.02)

When the position comparison condition is met, the DO output / frequency division output valid level signal is triggered. The width of the valid level can be set via P41.02 (Position Comparison Pulse Output Width), with a range of 1~4095 × 0.1ms. During the DO output period, comparison logic is suspended, so ensure the operation time between two target points is longer than the DO output width.

■ Target Position Comparison Points

There are a total of 42 target position comparison points. Target position comparison values and attributes must be set in P42.00~P42.83.

■ Start Comparison Point (P41.04)

The target position start comparison point indicates the position of the first comparison point. For example, if the start comparison point is set to 5, comparison begins from the 5th target position point.

■ End Comparison Point (P41.05)

The target position end comparison point indicates the position of the last comparison point. For example, if the end comparison point is set to 7, comparison stops at the 7th target position or restarts from the start comparison point.

■ Position Comparison Zero Offset (P41.08)

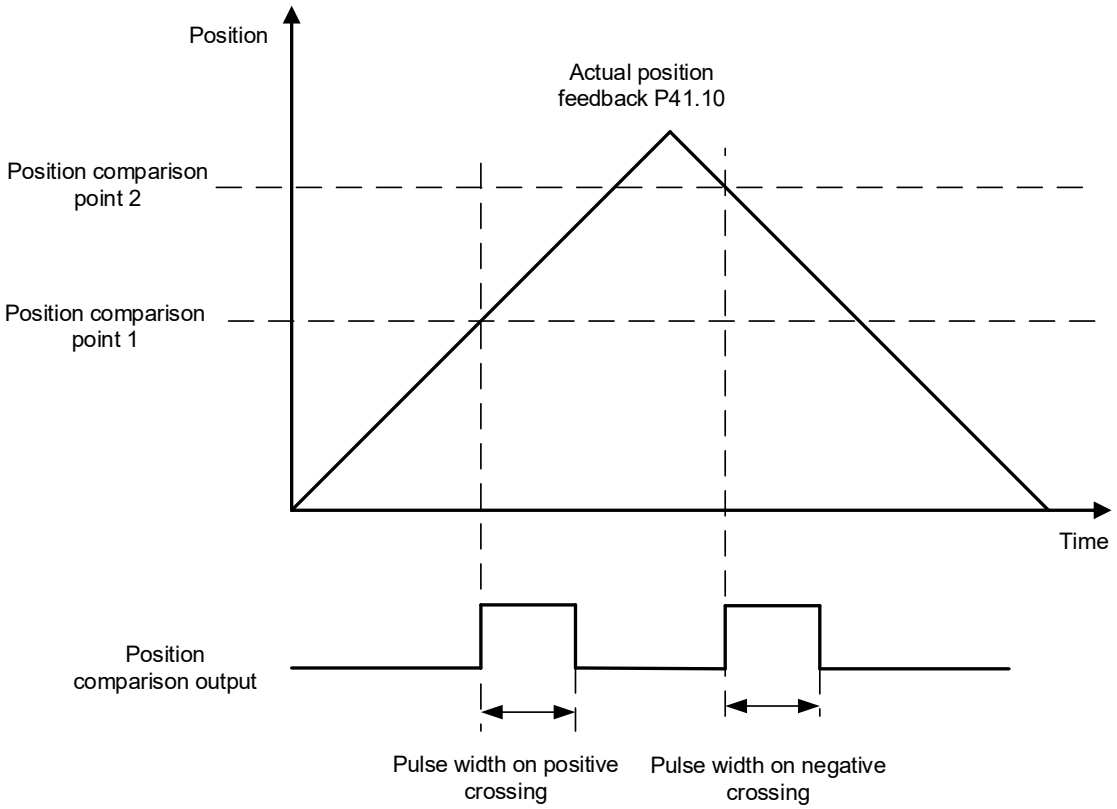
With the current position as the origin, on the rising edge of P41.07 changing from 0 → 1, the current real-time position value of P41.10 will automatically change to the offset value set in P41.08.

Applying position comparison

When the position passes through the target position comparison point, the output condition of the output attribute of the comparison point is satisfied, and the output width of the output port is the width pulse set by P41. 02.

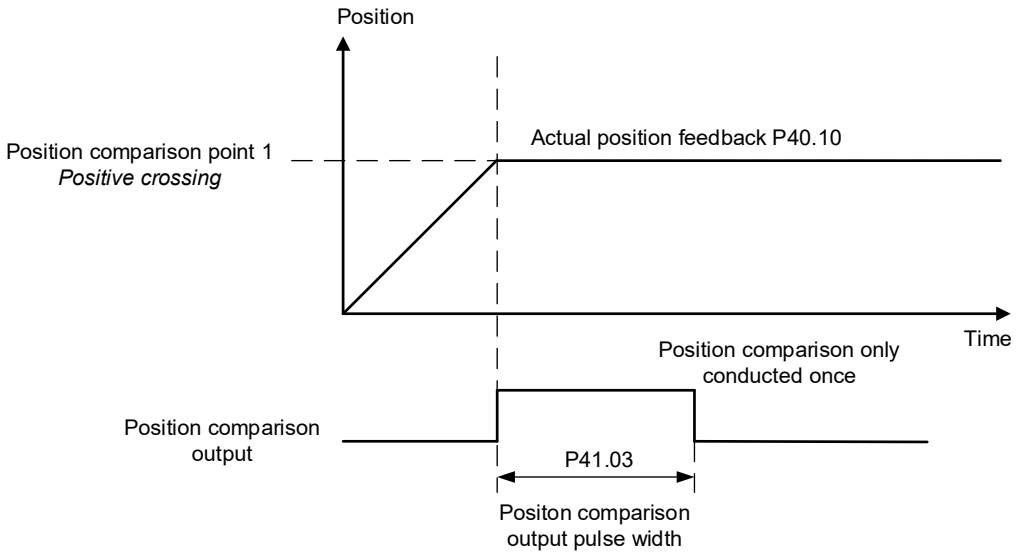
When the position comparison point attribute is set to pass through the comparison output in the forward direction, when the position feedback changes from small to large, the comparison output port will output the position comparison signal; if the position feedback changes from large to small, it will pass through the comparison point in the reverse direction, and the comparison output will not be performed.

For example, the comparison point 1 in the figure below is set to forward traversal comparison, and the comparison point 2 is set to reverse traversal comparison. When the comparison point 2 in forward traversal position is set, no comparison output will be performed.

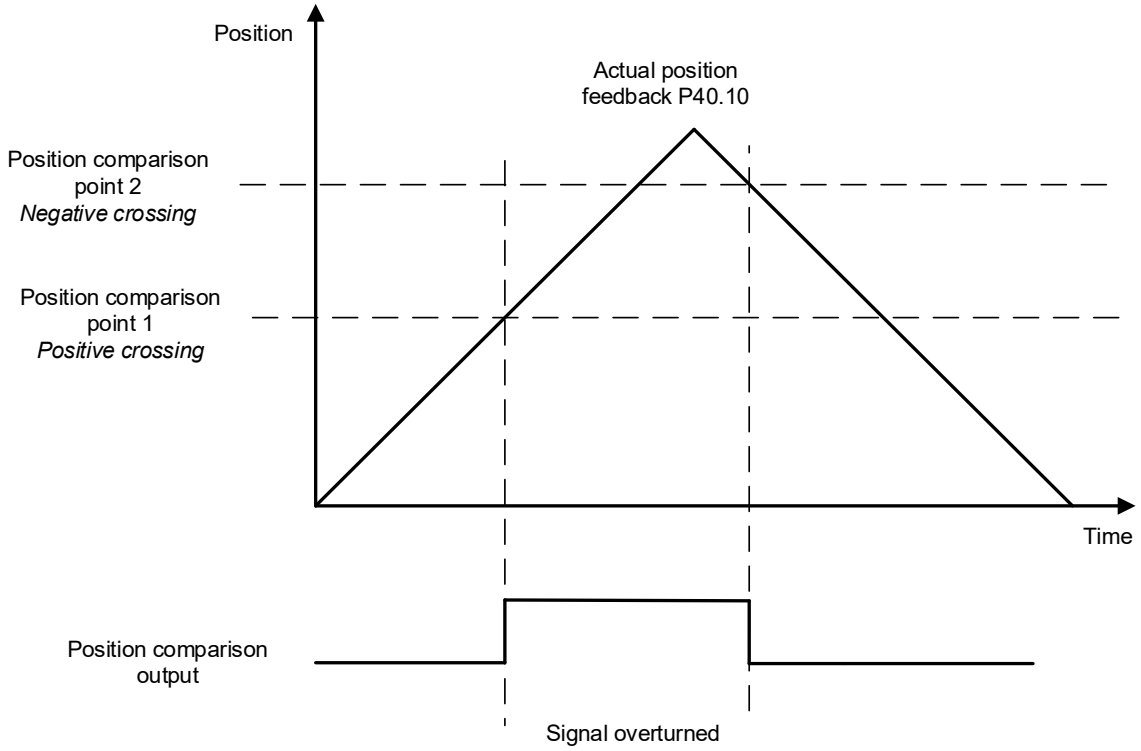


When setting multiple position comparison values, the comparison operation will not be performed during the valid period of the position comparison output port, so please keep the running time between the two target position comparison points greater than the width of the pulse output.

The following figure shows that the running time between the comparison points of the two target positions is less than the pulse output width, which leads to the reverse crossing of the target point, and no comparison operation is performed
In the case of stopping at the same position as the position comparison value, as in the case of passing, only one pulse is output.



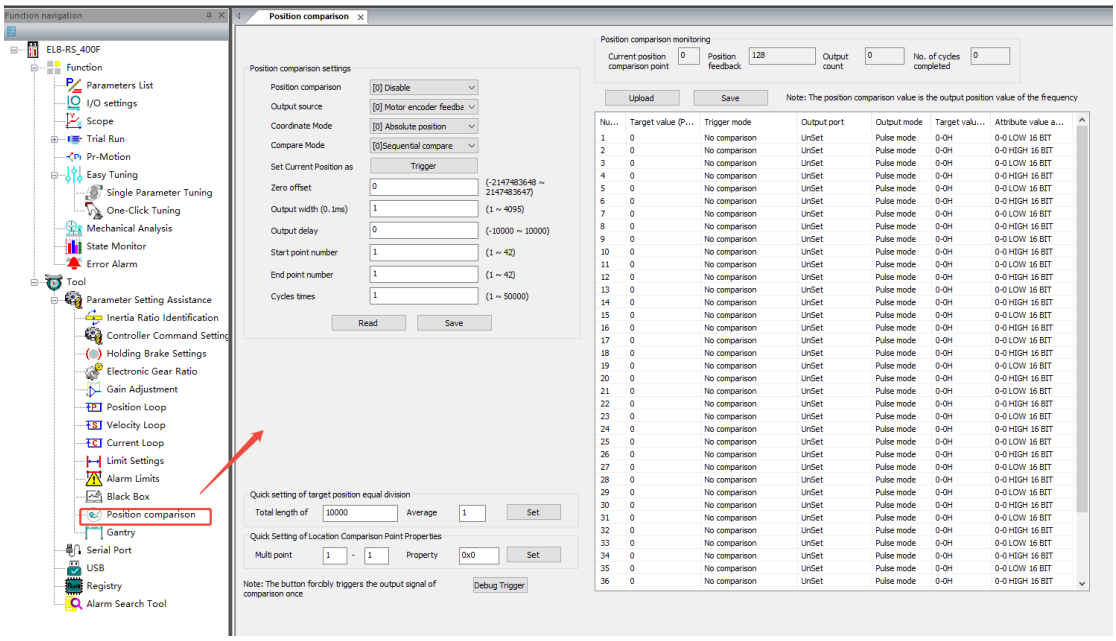
When the output mode is configured as the flip mode, when the position comparison point is reached and the output condition is met, the configured output port changes from the output setting width to the level flip.


Position
Actual position
feedback P40.10
Position comparison
point 2
Negative crossing
Position comparison
point 1
Positive crossing
Time
Position comparison
output
Signal overturned

MotionStudio Quick Configuration Interface

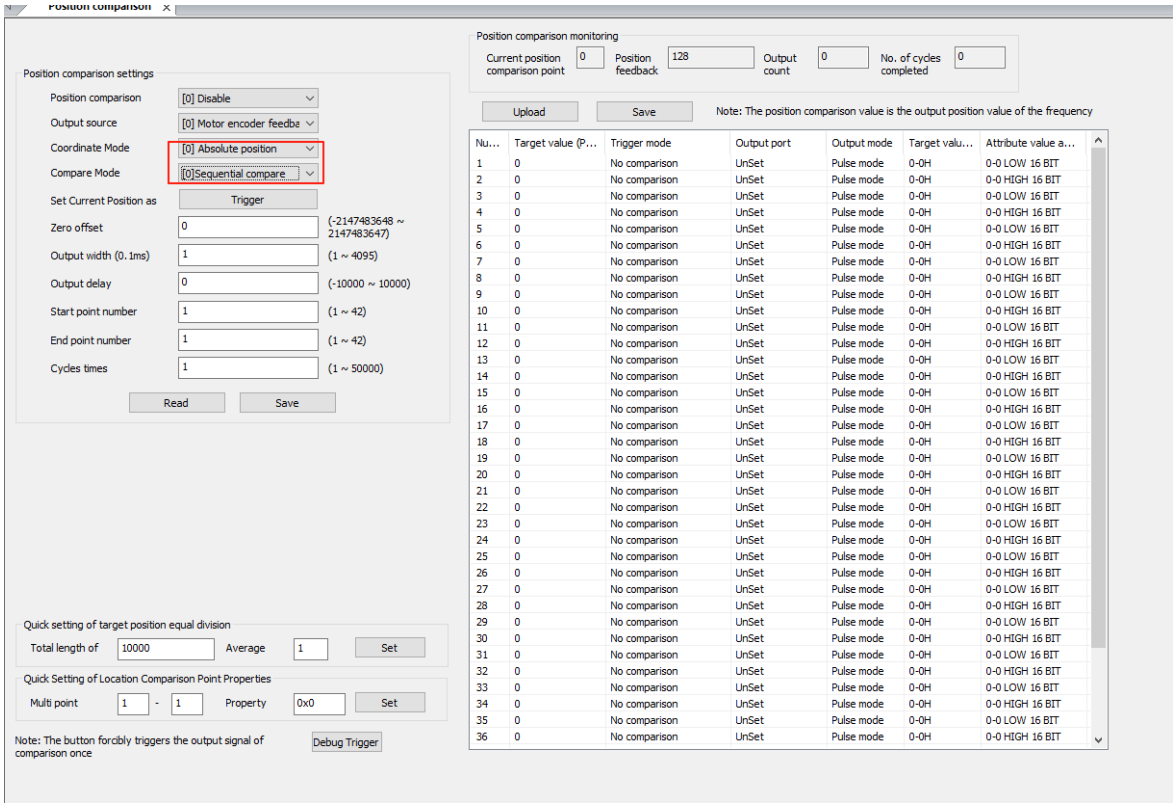
For faster configuration of the debug position compare output, the EL7S series drives support the position compare function in the MotionStudio for configuration.

Select the location comparison function and double click to open:



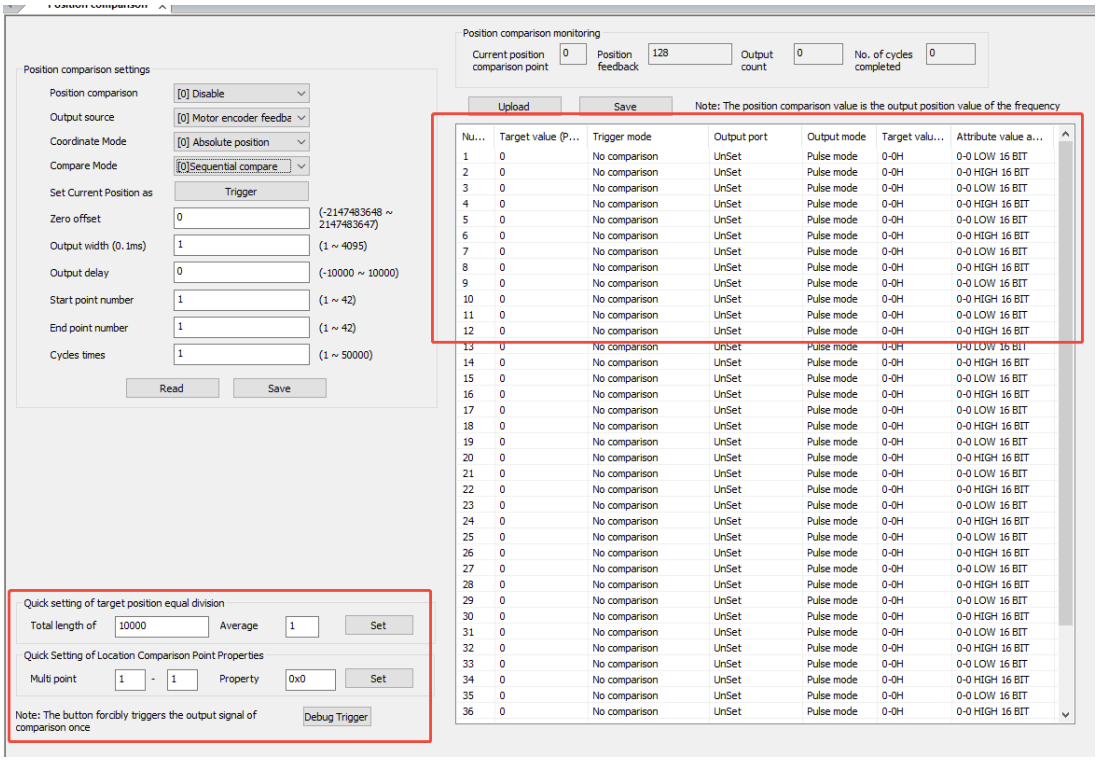
■ **Sequence comparison mode for absolute positions**

1. Set the position comparison mode to 0-absolute position sequence comparison mode, and configure the output pulse width, comparison start and end points and other parameters.



2. The target position parameter setting, the comparison target position value can be set in the table on the right. If the actual working condition is equidistant, the target position can be set quickly by dividing the target position, and the target position can be set by setting the total running length and the average number of points.

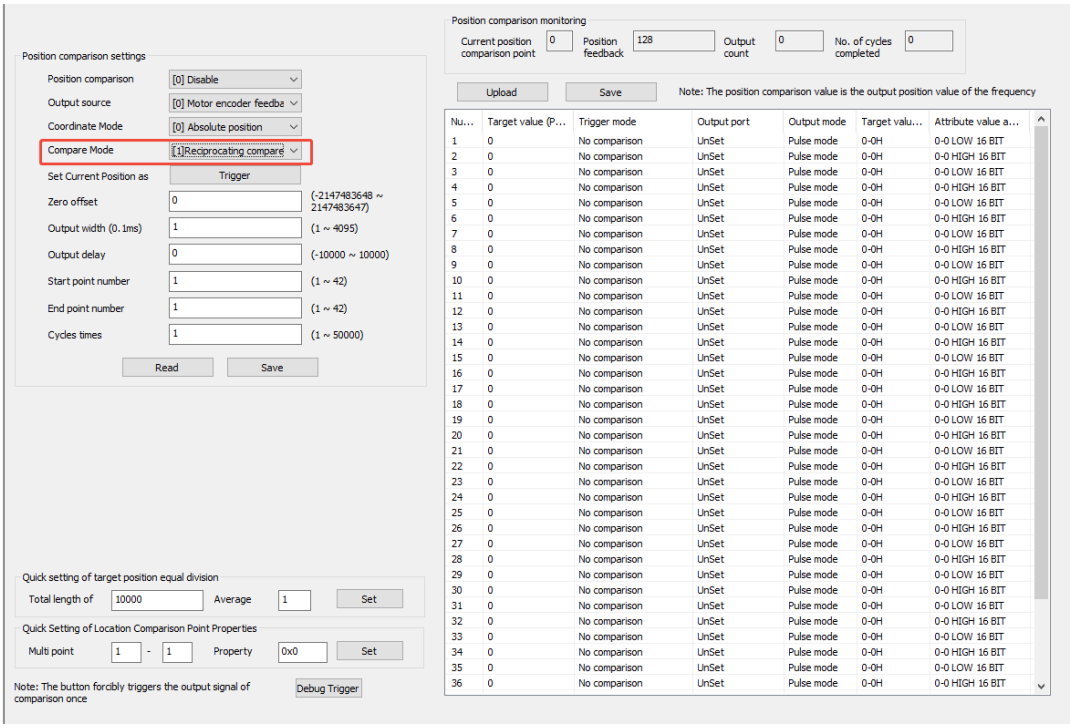
   Comparison point N Target position = N * (total length of position/average points)
   Properties can also be configured through Quick Settings.



When the position comparison enable changes from 0 to 1 (the rising edge enables the position comparison output function), the current position comparison point changes from 0 to the position comparison starting point. At this time, the starting point is 1, and the first target position value is compared. After the position feedback reaches the first target position value, the current position comparison point changes to the next point, and so on.

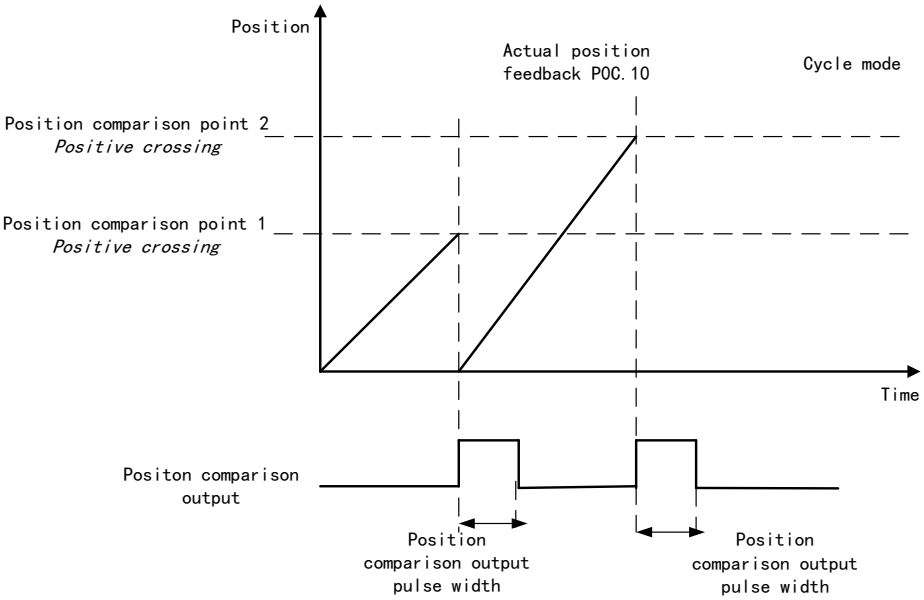
■ **Reciprocating comparison mode for absolute position**

3. Set the position comparison mode to the reciprocating comparison mode of absolute position.



4. The target position parameter is set, and the comparison target position value can be set in the table on the right. At this time, the fast setting can set the running distance of two adjacent points and set the number of cycle points. The target position can be set by setting the running length and the average number of points equally. After the average number of points is set, the target values of the first to n comparison points are updated to the value of the total length of the positions at equal intervals.

5. When the position comparison enable changes from 0 to 1 (the rising edge enables the position comparison output function), the current comparison point changes from 0 to the comparison initial point, and the first target position value is compared. When the position feedback reaches the first target position value, the current comparison point becomes the next comparison point, and the position feedback starts from zero, and so on. As shown in the following figure:



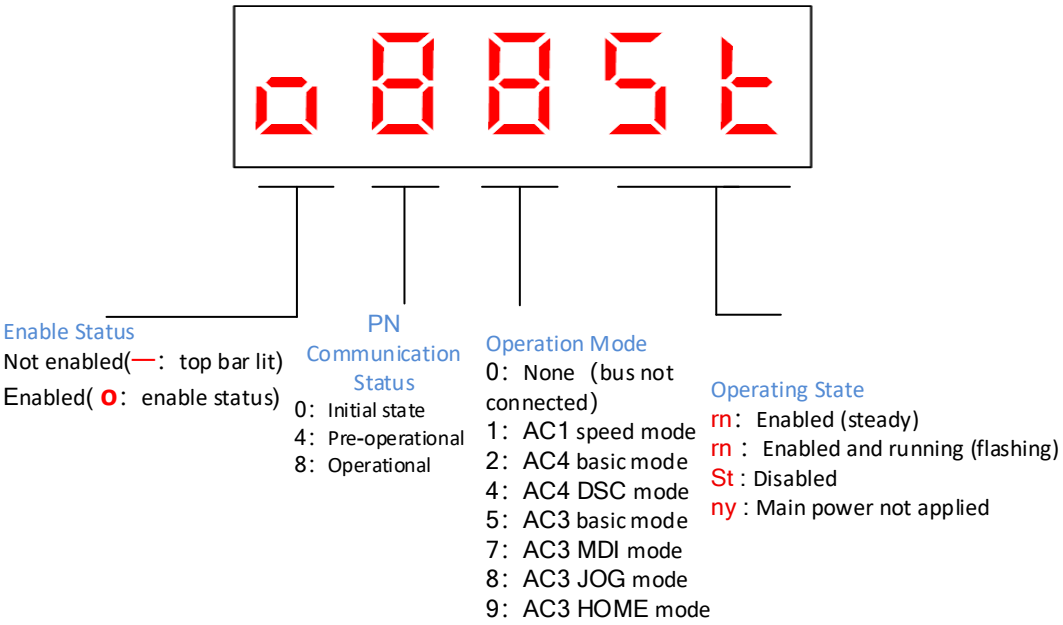
Note:
It is necessary to ensure that the direction of crossing the set point during the first operation is consistent with the set direction to ensure the normal use of the function.

When setting the serial comparison mode, the comparison point position value is set to be consistent with the direction of the trigger mode.

Chapter 6 PROFINET communication

Panel Display

The drive status display is divided into 4 parts: enable status, PN communication status, operation mode and operating state. The specific meanings of the seven-segment display are as follows:



The status display is explained as follows:

Status	Meaning
Enable status	Not enabled (—: top bar lit) / Enabled (O: enable status)
PN communication status	0: Initial state / 4: Pre-operational state / 8: Operational state
Operation mode	0: None (bus not connected) / 1: AC1 speed mode / 2: AC4 basic mode / 4: AC4 DSC mode / 5: AC3 basic mode / 7: AC3 MDI mode / 8: AC3 JOG mode / 9: AC3 HOME mode
Operating state	m steady: Enabled / m flashing: Enabled and running / St: Disabled / my: Main power not applied

The example display means: enable status is Enabled, PN communication status is Operational, operation mode is AC3 JOG mode, and the servo is in the disabled state.

6.1 Overview

PROFINET is an automation bus standard based on industrial Ethernet technology, launched by the PROFINET International Organization. PROFINET provides two kinds of real-time communication: PROFINET IO RT (Real-Time communication) and PROFINET IO IRT (Isochronous Real-Time communication).

In the PROFINET IO RT channel, real-time data is transmitted via prioritized Ethernet frames, with no special hardware requirements.

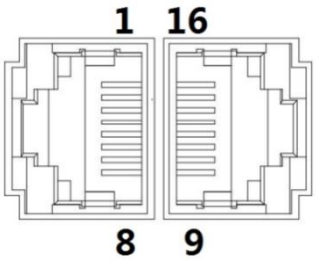
The PROFINET IO IRT channel is suitable for transmitting data with more precise timing requirements, but requires the support of IO devices and switches with special hardware.

All diagnostic and configuration data is transmitted through the non-real-time (NRT) channel using the TCP/IP protocol. Therefore, there is no definable cycle period, and the cycle period may exceed 100 ms.

6.2 Hardware Configuration

6.2.1 PN Port

PN port description:

Port	Pin	Signal	Description
	1, 9	TX+	PROFINET Data sending positive terminal
	2, 10	TX-	PROFINET Data sending negative terminal
	3, 11	RX+	PROFINET Data receiving positive terminal
	4, 12	--	--
	5, 13	--	--
	6, 14	RX-	PROFINET Data receiving negative terminal
	7, 15	--	--
	8, 16	--	--
	Frame	PE	Shielded ground

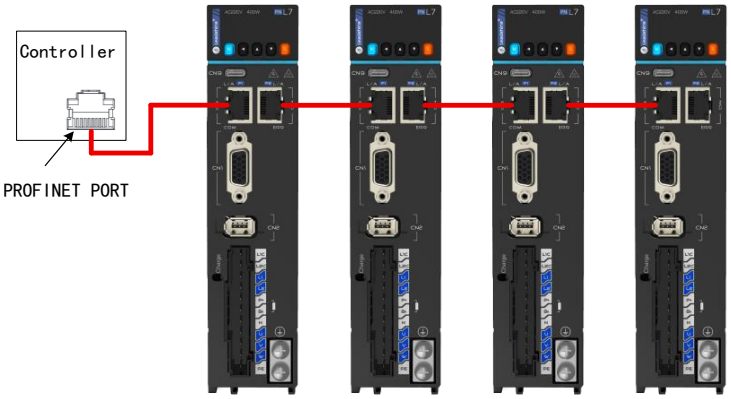
Port LED indicator description:

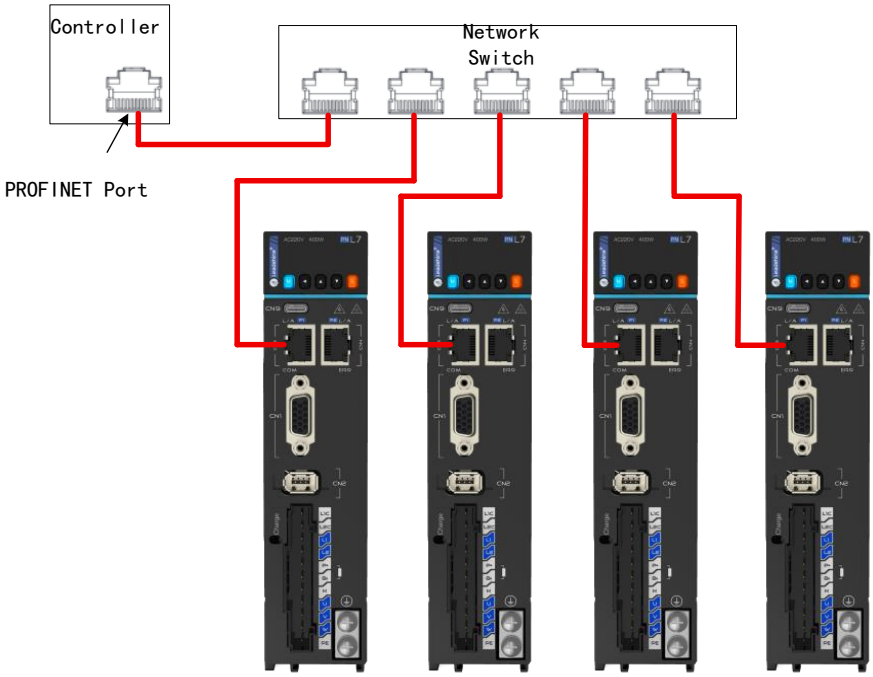
LED	Color	Description
L/A	Green	Link/Activity indicator: steady ON when the network cable is properly connected; OFF when the cable is disconnected.
COM	Green	PROFINET communication status: steady ON when PN communication is properly established with the controller; OFF in other states
ERR	Red	Fault indicator: flashes when a protocol-stack fault of the drive occurs; OFF after no alarm

6.2.2 Network Topology

PROFINET supports line, star and tree topologies, etc. Networking is achieved through the proper use of switches. Special attention must be paid: if IRT isochronous real-time communication is enabled in the system configuration, the selected switches must forward IRT telegrams.

The following are the schematic diagrams of the line and star topologies:


Controller
PROFINET PORT


Controller
Network
Switch
PROFINET Port

6.3 Telegram Overview

The EL7-PNS series drives support the AC1, AC3, AC4 and AC5 application classes. In the speed control mode and the basic positioner control mode, standard telegrams and Siemens telegrams are supported. From the drive's point of view, the received process data are receive words, and the process data to be sent are send words. The detailed description is shown in the following table:

Note: One PZD corresponds to one word. A single drive supports at most one main telegram plus one supplementary telegram. The supplementary telegram must be used together with the main telegram and cannot be used alone.

6.3.1 Supported Main Telegrams

Main telegrams used for speed control mode:

Telegram	Receive words	Send words
Standard telegram 1	2	2
Standard telegram 3	5	9
Siemens telegram 102	6	10
Siemens telegram 105	10	10
Siemens telegram 111	12	12
Siemens telegram 750 (supplementary)	3	1
Leadshine telegram 901 (supplementary)	4	4

Main telegrams used for basic positioner control mode:

PZD	1(Rx)	1(Tx)	3(Rx)	3(Tx)	102(Rx)	102(Tx)	105(Rx)	105(Tx)
App class	AC1	AC1	AC4	AC4	AC4	AC4	AC4	AC4
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_A	NIST_A	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3			NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD4			STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
PZD5			G1_STW	G1_ZSW	MOMRED	MELDW	MOMRED	MELDW
PZD6				G1_XIST1	G1_STW	G1_ZSW	G1_STW	G1_ZSW
PZD7				G1_XIST1		G1_XIST1	XERR	G1_XIST1
PZD8				G1_XIST2		G1_XIST1	XERR	G1_XIST1

PZD9				G1_XIST 2		G1_XIST 2	KPC	G1_XIST 2
PZD1 0						G1_XIST 2	KPC	G1_XIST 2

Note: The columns marked with (Rx) are receive words; those marked with (Tx) are send words.

Telegram 111 (AC3, basic positioner control mode):

PZD	Receive	Send
PZD1	STW1	ZSW1
PZD2	POS_STW1	POS_ZSW1
PZD3	POS_STW2	POS_ZSW2
PZD4	STW2	ZSW2
PZD5	OVERRIDE	MELDW
PZD6	MDI_TARPOS	XIST_A
PZD7	MDI_TARPOS	XIST_A
PZD8	MDI_VELOCITY	XIST_B
PZD9	MDI_VELOCITY	XIST_B
PZD10	MDI_ACC	FAULT_CODE
PZD11	MDI_DEC	WARN_CODE
PZD12	USER	USER

Note: USER is the user-defined receive word / send word.

6.3.2 Supported Supplementary Telegrams

When using the Siemens 750 supplementary telegram, if any of the following settings is made, the motor may accelerate uncontrollably:

• Set a negative value for the torque upper limit via PZD M_LIMIT_POS;

• Set a positive value for the torque lower limit via PZD M_LIMIT_NEG.

PZD	Receive	Send
PZD1	M_ADD1	M_ACT
PZD2	M_LIMIT_POS	-
PZD3	M_LIMIT_NEG	-

The Leadshine 901 supplementary telegram is used to set real-time acceleration/deceleration control in speed mode:

PZD	Receive	Send
PZD1	ACC_Time	XIST_L
PZD2	DEC_Time	XIST_H
PZD3	-	FAULT_CODE
PZD4	-	-

7.3.3 IO Data Signals

Signal	Description	Receive/Send word	Data type	Scaling
STW1	Control word 1	Receive word	U16	-
STW2	Control word 2	Receive word	U16	-
ZSW1	Status word 1	Send word	U16	-
ZSW2	Status word 2	Send word	U16	-
NSOLL_A	Speed setpoint A (16-bit)	Receive word	I16	4000hex ≈ rated speed
NSOLL_B	Speed setpoint B (32-bit)	Receive word	I16	40000000hex ≈ rated speed
NIST_A	Speed actual value A (16-bit)	Send word	I16	4000hex ≈ rated speed
NIST_B	Speed actual value B (32-bit)	Send word	I16	40000000hex ≈ rated speed
MOMRED	Torque reduction	Receive word	U16	4000hex ≈ maximum torque
M_ADD1	Torque additional value	Send word	I16	4000hex ≈ maximum torque / C000hex ≈ minimum torque
M_LIMIT_POS	Positive torque limit	Send word	I16	4000hex ≈ maximum torque
M_LIMIT_NEG	Negative torque limit	Send word	I16	C000hex ≈ minimum torque
M_ACT	Actual torque	Send word	Float	4000hex ≈ maximum torque
MELDW	Message word	Send word	U16	-
G1_STW	Encoder 1 control word	Receive word	U16	-
G1_ZTW	Encoder 1 status	Send word	U16	-
G1_XIST1	Encoder 1 actual position 1	Send word	U32	-
G1_XIST2	Encoder 1 actual position 2	Send word	U32	-
MDI_TARPOS	MDI position	Receive word	I32	1hex ≈ 1 LU[1]
MDI_VELOCITY	MDI velocity	Receive word	I32	1hex ≈ 1000 LU/min
MDI_ACC	MDI acceleration factor	Receive word	I16	4000hex ≈ 100%
MDI_DEC	MDI deceleration factor	Receive word	I16	4000hex ≈ 100%
XIST_A	Position actual value A	Send word	I32	1hex ≈ 1 LU
OVERRIDE	Position velocity factor	Receive word	I16	4000hex ≈ 100%
MDI_MODE	Position MDI mode	Receive word	U16	-
POS_ZSW	Position status word	Send word	U16	-
KPC	Position controller gain factor	Receive word	I32	-
XERR	Position offset	Receive word	I32	-

FAULT_CODE	Fault code	Send word	U16	-
WARN_CODE	Warning code	Send word	U16	-
user	User-defined receive word P61.12: 0 - no function / 1 - additional torque (0x4000 represents 300%) / 2 - DO status (bit0 indicates DO1...)	Receive word	I16	4000hex ≈ 300%
user	User-defined send word P61.13: 0 - no function / 1 - actual torque / 2 - actual current / 3 - DI status	Send word	I16	4000hex ≈ 300%

[1] LU stands for command unit (length unit).

6.4 Control Word Definitions

6.4.1 STW1 Control Word

STW1 control word (used for telegrams 1/3):

Bit	Description
STW1.0	↑ = ON (enable pulse) / 0 = OFF1 (braking via ramp-function generator deceleration time 2 P00.37, suppress pulses, ready for switch-on)
STW1.1	1 = No OFF2 (enable allowed) / 0 = OFF2 (coast to stop, immediately suppress pulses and inhibit switch-on)
STW1.2	1 = No OFF3 (enable allowed) / 0 = OFF3 (braking via OFF3 ramp-function generator deceleration time 1 P00.36, suppress pulses and inhibit switch-on)
STW1.3	1 = Enable operation (enable pulse) / 0 = Inhibit operation (cancel pulses)
STW1.4	1 = Operating condition (enable ramp-function generator) / 0 = Disable ramp-function generator (set the output of the ramp-function generator to zero)
STW1.5	1 = Continue ramp-function generator / 0 = Freeze ramp-function generator (freeze the output of the ramp-function generator), not applicable for AC4
STW1.6	1 = Enable setpoint / 0 = Inhibit setpoint (set the input of the ramp-function generator to zero)
STW1.7	↑ = 1. Active on rising edge, acknowledge fault
STW1.8	Reserved
STW1.9	Reserved
STW1.10	1 = Control by PLC / 0 = Not controlled by PLC
STW1.11	1 = Invert setpoint / 0 = Do not invert setpoint
STW1.12	Reserved
STW1.13	Reserved
STW1.14	Reserved
STW1.15	Reserved

Note: ↑ represents the rising edge process from 0 to 1. STW1.10 must be set to 1 to allow the PLC to control the drive.

Used for telegrams 102/105:

Bit	Description
STW1.0	↑ = ON (enable pulse) / 0 = OFF1 (braking via ramp-function generator deceleration time 2 P00.37, suppress pulses, ready for switch-on)
STW1.1	1 = No OFF2 (enable allowed) / 0 = OFF2 (coast to stop, immediately suppress pulses and inhibit switch-on)
STW1.2	1 = No OFF3 (enable allowed) / 0 = OFF3 (braking via OFF3 ramp-function generator deceleration time 1 P00.36, suppress pulses and inhibit switch-on)
STW1.3	1 = Enable operation (enable pulse) / 0 = Inhibit operation (cancel pulses)
STW1.4	1 = Operating condition (enable ramp-function generator) / 0 = Disable ramp-function generator (set the output of the ramp-function generator to zero)

STW1.5	1 = Continue ramp-function generator / 0 = Freeze ramp-function generator (freeze the output of the ramp-function generator), not applicable for AC4
STW1.6	1 = Enable setpoint / 0 = Inhibit setpoint (set the input of the ramp-function generator to zero)
STW1.7	↑ = 1. Active on rising edge, acknowledge fault
STW1.8	Reserved
STW1.9	Reserved
STW1.10	1 = Control by PLC / 0 = Not controlled by PLC
STW1.11	1 = Ramp-function generator effective / 0 = Ramp-function generator not effective
STW1.12	1 = Open the brake unconditionally
STW1.13	Reserved
STW1.14	1 = Closed-loop torque control effective / 0 = Closed-loop speed control effective / (only supported by telegram 105)
STW1.15	Reserved

Note: STW1.10 must be set to 1 to allow the PLC to control the drive. When closed-loop torque control is enabled with telegram 105, STW1.4, STW1.5 and STW1.6 are disabled.

Used for telegram 111:

Bit	Description
STW1.0	↑ = ON (enable pulse) / 0 = OFF1 (braking via ramp-function generator deceleration time 2 P00.37, suppress pulses, ready for switch-on)
STW1.1	1 = No OFF2 (enable allowed) / 0 = OFF2 (coast to stop, immediately suppress pulses and inhibit switch-on)
STW1.2	1 = No OFF3 (enable allowed) / 0 = OFF3 (braking via OFF3 ramp-function generator deceleration time 1 P00.36, suppress pulses and inhibit switch-on)
STW1.3	1 = Enable operation (enable pulse) / 0 = Inhibit operation (cancel pulses)
STW1.4	1 = Do not reject the task / 0 = Reject the task
STW1.5	1 = Do not pause the running task / 0 = Pause the running task
STW1.6	↑ = Activate the running task, active on rising edge
STW1.7	↑ = Acknowledge fault, active on rising edge
STW1.8	1 = Start JOG1 / 0 = Stop JOG1
STW1.9	1 = Start JOG2 / 0 = Stop JOG2
STW1.10	1 = Control by PLC / 0 = Not controlled by PLC
STW1.11	1 = Start homing / 0 = Pause homing
STW1.12	Reserved
STW1.13	Reserved
STW1.14	Reserved
STW1.15	Reserved

6.4.2 STW2 Control Word

Used for telegrams 3/102/105/111:

Bit	Description
STW2.0~STW2.7	Reserved
STW2.8	1 = Run to fixed stop
STW2.9~STW2.11	Reserved
STW2.12	PLC heartbeat counter value, bit 0
STW2.13	PLC heartbeat counter value, bit 1
STW2.14	PLC heartbeat counter value, bit 2
STW2.15	PLC heartbeat counter value, bit 3

6.4.3 G1_STW (used for telegrams 3/102/105)

Used for telegrams 3/102/105:

Bit	Description
G1_STW.0	When set to 1: when G1_STW.7 = 0, search reference point 1
G1_STW.1	When set to 1: when G1_STW.7 = 0, search reference point 2
G1_STW.2	When set to 1: when G1_STW.7 = 0, search reference point 3
G1_STW.3	When set to 1: when G1_STW.7 = 0, search reference point 4
G1_STW.4	
G1_STW.5	
G1_STW.6	
G1_STW.7	Mode in which the function needs to be activated: 1 = real-time measurement / 0 = search reference point
G1_STW.8~G1_STW.10	Reserved
G1_STW.11	1 = Relative position setting / 0 = Absolute position setting
G1_STW.12	Active on rising edge, request to set the zero position
G1_STW.13	Active on rising edge, request periodic transmission of the absolute position in G1_XIST2
G1_STW.14	Resident encoder
G1_STW.15	Active on rising edge, acknowledge encoder fault

6.4.4 POS_STW1/2 (used for telegram 111)

POS_STW1 (used for telegram 111):

Bit	Description
POS_STW1.0	Reserved
POS_STW1.1	Reserved
POS_STW1.2	Reserved
POS_STW1.3	Reserved
POS_STW1.4	Reserved
POS_STW1.5	Reserved
POS_STW1.6	Reserved

POS_STW1.7	Reserved
POS_STW1.8	1 = Absolute positioning / 0 = Relative positioning
POS_STW1.9	Reserved
POS_STW1.10	Reserved
POS_STW1.11	Reserved
POS_STW1.12	1 = Continuous transmission / 0 = Trigger MDI motion via the ↑ of the running task (STW1.6)
POS_STW1.13	Reserved
POS_STW1.14	Reserved
POS_STW1.15	1 = MDI selection

POS_STW2 (telegram 111):

Bit	Description
POS_STW2.0	Reserved
POS_STW2.1	1 = Set reference point
POS_STW2.2	1 = Reference point cam active
POS_STW2.3	Reserved
POS_STW2.4	Reserved
POS_STW2.5	1 = JOG incremental mode / 0 = JOG velocity mode
POS_STW2.6	Reserved
POS_STW2.7	Reserved
POS_STW2.8	Reserved
POS_STW2.9	Reserved
POS_STW2.10	Reserved
POS_STW2.11	Reserved
POS_STW2.12	Reserved
POS_STW2.13	Reserved
POS_STW2.14	1 = Activate software limit switch / 0 = Deactivate software limit switch
POS_STW2.15	1 = Activate hardware limit switch / 0 = Deactivate hardware limit switch

6.5 Status Word Definitions

6.5.1 ZSW1 Status Word

Used for telegrams 1, 3:

Bit	Description
ZSW1.0	1 = Servo ready for switch-on / 0 = Servo not ready
ZSW1.1	1 = Ready for operation, main circuit powered / 0 = Not ready for operation
ZSW1.2	1 = Operation enabled / 0 = Operation not enabled
ZSW1.3	1 = Fault present / 0 = No fault
ZSW1.4	1 = Coast-to-stop not active (OFF2 not active) / 0 = Coast-to-stop active
ZSW1.5	1 = Quick stop not active (OFF3 not active) / 0 = Quick stop active
ZSW1.6	1 = Switch-on inhibited active
ZSW1.7	1 = Warning present
ZSW1.8	1 = Deviation between speed setpoint and actual value within the t_off tolerance / 0 = Deviation between speed setpoint and actual value outside the t_off tolerance
ZSW1.9	1 = PLC control request active
ZSW1.10	1 = Speed reached
ZSW1.11	Reserved
ZSW1.12	1 = Brake opened
ZSW1.13	1 = No motor over-temperature alarm (not supported yet)
ZSW1.14	1 = Motor rotating in positive direction / 0 = Motor rotating in negative direction
ZSW1.15	1 = No thermal overload alarm of the power unit

Used for telegram 102:

Bit	Description
ZSW1.0	1 = Servo ready for switch-on / 0 = Servo not ready
ZSW1.1	1 = Ready for operation, main circuit powered / 0 = Not ready for operation
ZSW1.2	1 = Operation enabled / 0 = Operation not enabled
ZSW1.3	1 = Fault present / 0 = No fault
ZSW1.4	1 = Coast-to-stop not active (OFF2 not active) / 0 = Coast-to-stop active
ZSW1.5	1 = Quick stop not active (OFF3 not active) / 0 = Quick stop active
ZSW1.6	1 = Switch-on inhibited active
ZSW1.7	1 = Warning present
ZSW1.8	1 = Deviation between speed setpoint and actual value within tolerance / 0 = Deviation outside tolerance
ZSW1.9	1 = PLC control request active
ZSW1.10	1 = Speed reached
ZSW1.11~ZSW1.13	Reserved
ZSW1.14	1 = Motor rotating in positive direction / 0 = Motor rotating in negative direction

ZSW1.15	Reserved

Used for telegram 105:

Bit	Description
ZSW1.0	1 = Servo ready for switch-on / 0 = Servo not ready
ZSW1.1	1 = Ready for operation, main circuit powered / 0 = Not ready for operation
ZSW1.2	1 = Operation enabled / 0 = Operation not enabled
ZSW1.3	1 = Fault present / 0 = No fault
ZSW1.4	1 = Coast-to-stop not active (OFF2 not active) / 0 = Coast-to-stop active
ZSW1.5	1 = Quick stop not active (OFF3 not active) / 0 = Quick stop active
ZSW1.6	1 = Switch-on inhibited active
ZSW1.7	1 = Warning present
ZSW1.8	1 = Deviation between speed setpoint and actual value within tolerance / 0 = Deviation outside tolerance
ZSW1.9	1 = PLC control request active
ZSW1.10	1 = Speed reached
ZSW1.11~ZSW1.13	Reserved
ZSW1.14	1 = Closed-loop torque control effective
ZSW1.15	Reserved

Used for telegram 111:

Bit	Description
ZSW1.0	1 = Servo ready for switch-on
ZSW1.1	1 = Ready for operation / 0 = Not ready for operation
ZSW1.2	1 = Operation enabled
ZSW1.3	1 = Fault present / 0 = No fault
ZSW1.4	1 = Coast-to-stop not active (OFF2 not active)
ZSW1.5	1 = Quick stop not active (OFF3 not active)
ZSW1.6	1 = Switch-on inhibited active
ZSW1.7	1 = Warning present
ZSW1.8	1 = Position following error within limit
ZSW1.9	1 = PLC control request active
ZSW1.10	1 = Position reached / 0 = Position not reached
ZSW1.11	1 = Reference point set
ZSW1.12	↑ = 1. Position motion activated; use the rising edge to confirm acceptance of a new motion task or MDI setpoint
ZSW1.13	1 = Axis stopped / 0 = Axis running
ZSW1.14	1 = Axis accelerating
ZSW1.15	1 = Axis decelerating

6.5.2 ZSW2 Status Word

Used for telegrams 3/102/105/111:

Bit	Description
ZSW2.0~ZSW2.09	Reserved
ZSW10	1 = Pulse enable
ZSW2.12	Drive heartbeat counter value, bit 0
ZSW2.13	Drive heartbeat counter value, bit 1
ZSW2.14	Drive heartbeat counter value, bit 2
ZSW2.15	Drive heartbeat counter value, bit 3

6.5.3 G1_ZSW1 (used for telegrams 3/102/105)

Bit	Description
G1_ZSW.0	1 = Function 1 activated
G1_ZSW.1	1 = Function 2 activated
G1_ZSW.2	1 = Function 3 activated
G1_ZSW.3	1 = Function 4 activated
G1_ZSW.4	1 = Actual value 1 readable
G1_ZSW.5	1 = Actual value 2 readable
G1_ZSW.6	1 = Actual value 3 readable
G1_ZSW.7	1 = Actual value 4 readable
G1_ZSW.8	Probe 1 (not supported yet)
G1_ZSW.9	Probe 2 (not supported yet)
G1_ZSW.10	Reserved
G1_ZSW.11	Acknowledge encoder fault
G1_ZSW.12	Set zero position acknowledge
G1_ZSW.13	Periodic transmission of the absolute position in G1_XIST2
G1_ZSW.14	Resident encoder activated
G1_ZSW.15	Encoder fault

6.5.4 POS_ZSW1/2 (used for telegram 111)

POS_ZSW1 (used for telegram 111):

Bit	Description
POS_ZSW1.0	Reserved
POS_ZSW1.1	Reserved
POS_ZSW1.2	Reserved
POS_ZSW1.3	Reserved
POS_ZSW1.4	Reserved
POS_ZSW1.5	Reserved
POS_ZSW1.6	Reserved
POS_ZSW1.7	Reserved
POS_ZSW1.8	1 = Negative hardware limit active / 0 = Negative hardware limit not active
POS_ZSW1.9	1 = Positive hardware limit active / 0 = Positive hardware limit not active

POS_ZSW1.10	1 = JOG mode active / 0 = JOG mode not active
POS_ZSW1.11	1 = Homing active
POS_ZSW1.12	Reserved
POS_ZSW1.13	Reserved
POS_ZSW1.14	Reserved
POS_ZSW1.15	1 = MDI active / 0 = MDI inactive

POS_ZSW2 (used for telegram 111):

Bit	Description
POS_ZSW2.0	Reserved
POS_ZSW2.1	1 = Velocity limit active
POS_ZSW2.2	Reserved
POS_ZSW2.3	Reserved
POS_ZSW2.4	1 = Axis moving in positive direction / 0 = Axis not moving
POS_ZSW2.5	1 = Axis moving in negative direction / 0 = Axis not moving
POS_ZSW2.6	1 = Negative software limit switch reached / 0 = Negative software limit switch not reached
POS_ZSW2.7	1 = Positive software limit switch reached / 0 = Positive software limit switch not reached
POS_ZSW2.8	Reserved
POS_ZSW2.9	Reserved
POS_ZSW2.10	Reserved
POS_ZSW2.11	Reserved
POS_ZSW2.12	Reserved
POS_ZSW2.13	Reserved
POS_ZSW2.14	Reserved
POS_ZSW2.15	1 = Running command active

6.6 Homing Modes Supported by Telegram 111

6.6.1 Parameter

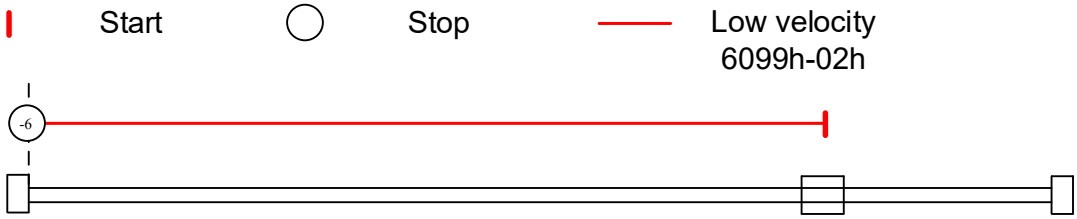
P30.00	**Label**	Homing Mode					
	Range	-6~37		**Default**	19	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	14800
Homing Mode setting , check homing page for more details.							

P30.01	**Label**	Homing High Speed					
	Range	0~2147483647		**Default**	139 810 13	**Unit**	unit/s
	Activation	Immediate	**Attribute**	RW		**PNU**	14801
Homing High Speed setting							
P30.02	**Label**	Homing Low Speed					
	Range	0~2147483647		**Default**	139 810 1	**Unit**	unit/s
	Activation	Immediate	**Attribute**	RW		**PNU**	14802
Homing Low Speed setting							
P30.03	**Label**	Homing Acceleration/Deceleration					
	Range	0~2147483647		**Default**	139 810 133 3	**Unit**	unit/s2
	Activation	Immediate	**Attribute**	RW		**PNU**	14803
Homing Acceleration/Deceleration setting							
P30.04	**Label**	Current position as origin					
	Range	0~1		**Default**	0	**Unit**	unit
	Activation	Immediate	**Attribute**	RW		**PNU**	14804
Force-set the current servo position as the coordinate origin to establish a new coordinate reference for subsequent absolute positioning and relative positioning.							
P30.08	**Label**	Homing Position Offset					
	Range	-2147483647~2147483647		**Default**	0	**Unit**	unit
	Activation	Immediate	**Attribute**	RW		**PNU**	14808
Homing Position Offset setting							
P30.09	**Label**	Torque Homing Force Limit					
	Range	0~150		**Default**	80	**Unit**	%
	Activation	Immediate	**Attribute**	RW		**PNU**	14809
Torque Homing Force Limit setting							
P30.10	**Label**	Torque Homing Time					
	Range	0~200		**Default**	50	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	14810

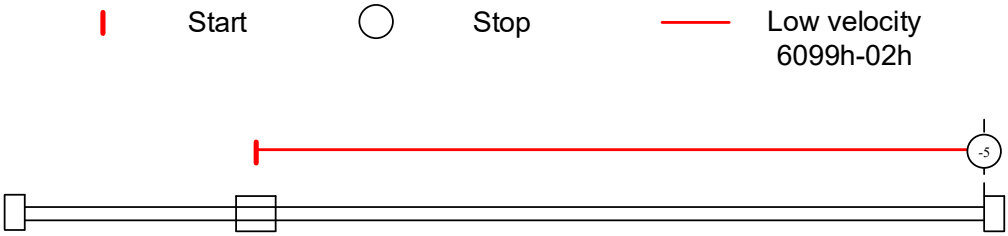
	Torque Homing & Torque Holding Time setting						
P30.11	**Label**	Homing Overtravel					
	Range	0~214748364.7		**Default**	0	**Unit**	r
	Activation	Immediate	**Attribute**	RW		**PNU**	14811
	Homing Overtravel setting						
P30.12	**Label**	Homing Timeout					
	Range	0~1000000		**Default**	60000	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	14812
	Set the threshold value for the return-to-zero timeout alarm. If the return-to-zero time exceeds the set threshold, the system will trigger the alarm Er741 (HomingTimeout).						
P30.14	**Label**	Homing In-Place Threshold					
	Range	0~100		**Default**	8	**Unit**	unit
	Activation	Immediate	**Attribute**	RW		**PNU**	14814
	Homing In-Place Threshold setting						
P30.15	**Label**	Homing Auxiliary Function					
	Range	0x0~0x1		**Default**	0x1	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	14815
	Bit0: Set 1, clear the origin position.						
P30.18	**Label**	Homing Axis Delay Time					
	Range	0~15000		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	14818
	Homing Axis Delay Time setting						
P30.22	**Label**	Homing Maximum speed limit					
	Range	0~3000		**Default**	0	**Unit**	rpm
	Activation	Immediate	**Attribute**	RW		**PNU**	14822
	Homing Maximum speed limit setting						

Torque limiting mode

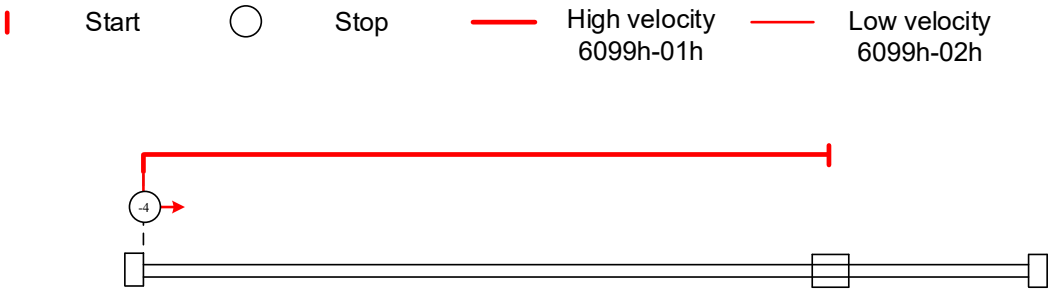
Mode-6： Search for homing point in negative direction at low speed. Stop immediately when torque reaches the value set in P30.09 (Torque Homing Torque Limit), and the homing done signal is delivered after the time set in P30.10 (Torque Homing Time) has elapsed.



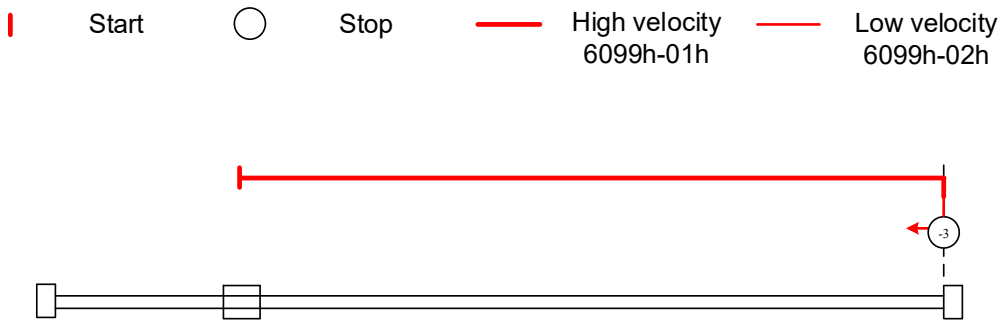
Mode -5： Search for homing point in positive direction at low velocity. Stop immediately after torque reaches the value set in P30.09, and homing done signal is delivered after the delay set in P30.10.



Mode -4： Search for homing point in negative direction at high speed. When torque reaches the value set in P30.09 (Torque Homing Torque Limit), the drive reverses direction after the time set in P30.10 (Torque Homing Time) has elapsed, and stops immediately when the torque drops below the limit.

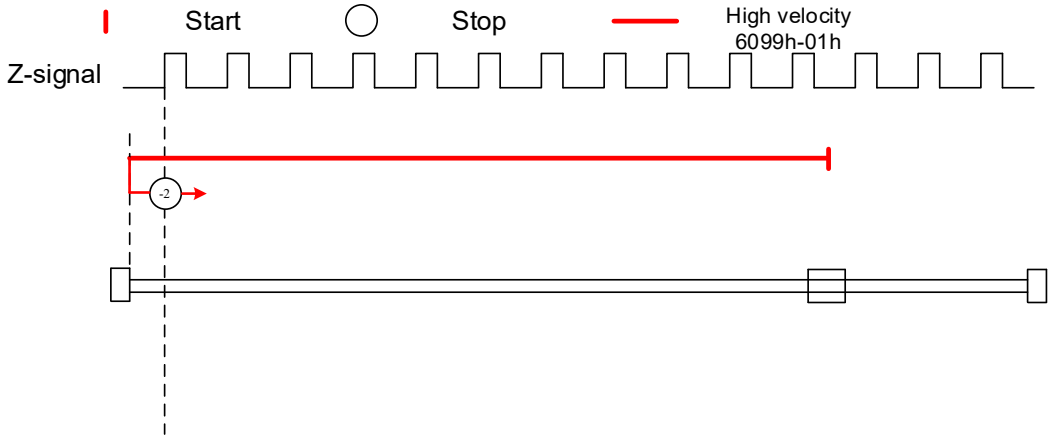


Mode -3：Search for homing point in positive direction at high speed. When torque reaches the value set in P30.09 (Torque Homing Torque Limit), reverse direction after the time set in P30.10 (Torque Homing Time) has elapsed, and stop immediately when the torque drops below the limit.

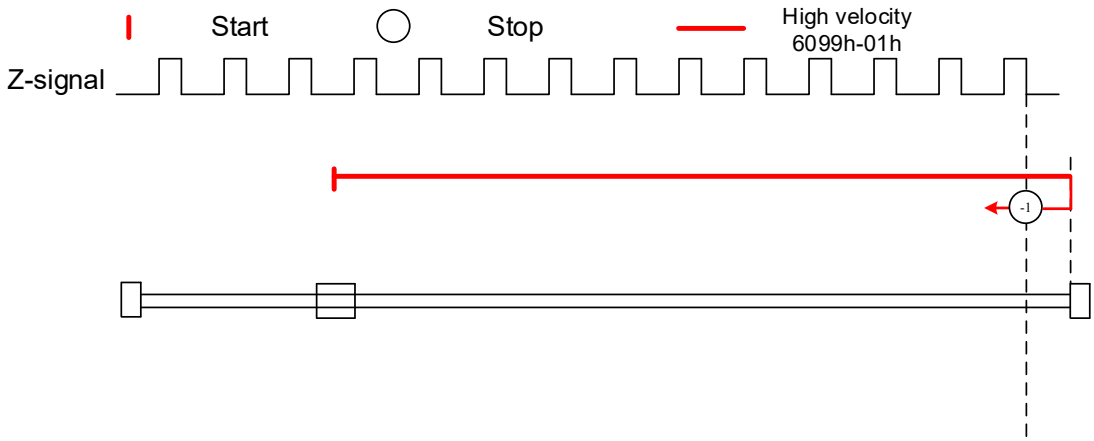


Torque limiting + Z-signal mode

Mode -2：Search for homing point in negative direction at high speed. When torque reaches the value set in P30.09 (Torque Homing Torque Limit) and after the time set in P30.10 (Torque Homing Time) has elapsed, the drive reverses direction and stops at the first Z-signal after the torque drops below the limit.



Mode -1：Search for homing point in positive direction at high speed. When torque reaches the value set in P30.09 (Torque Homing Torque Limit) and after the time set in P30.10 (Torque Homing Time) has elapsed, the drive reverses direction and stops at the first Z-signal after the torque drops below the limit.



Limit switch signal + Z-signal mode

Mode 1:

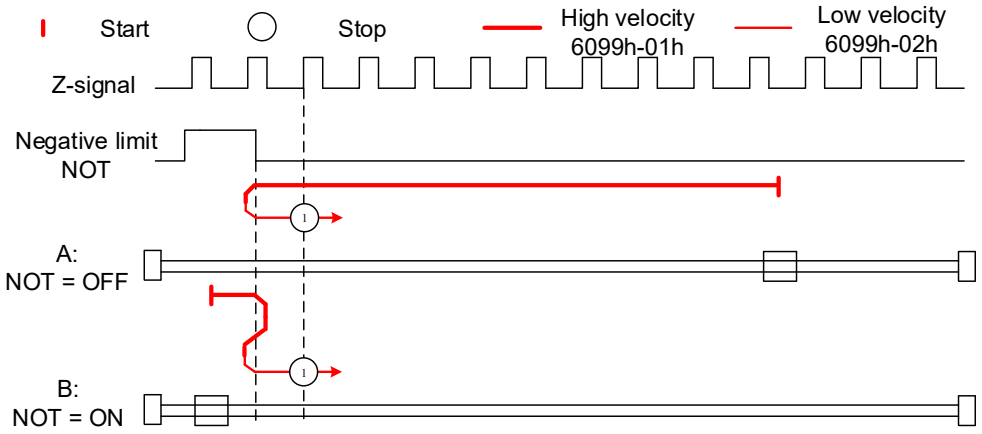
Diagram A: *Negative limit switch = OFF*

1. Move in **negative direction** at **high velocity** until **negative limit switch valid.**
2. Move in **positive direction** at **low velocity** and stops **after negative limit switch** and **first encoder Z-signal valid**

Diagram B: *Negative limit switch = ON*

1. Start to move at **negative limit switch position** in **positive direction** at **high velocity** until **negative limit switch invalid.**
2. Move in **negative direction** at **high velocity** until **negative limit switch valid.**
3. Move in **positive direction** at **low velocity** and stops **after negative limit switch** and **first encoder Z-signal valid**

If the positive limit signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating homing error and the motor will stop Immediately.



Mode 2:

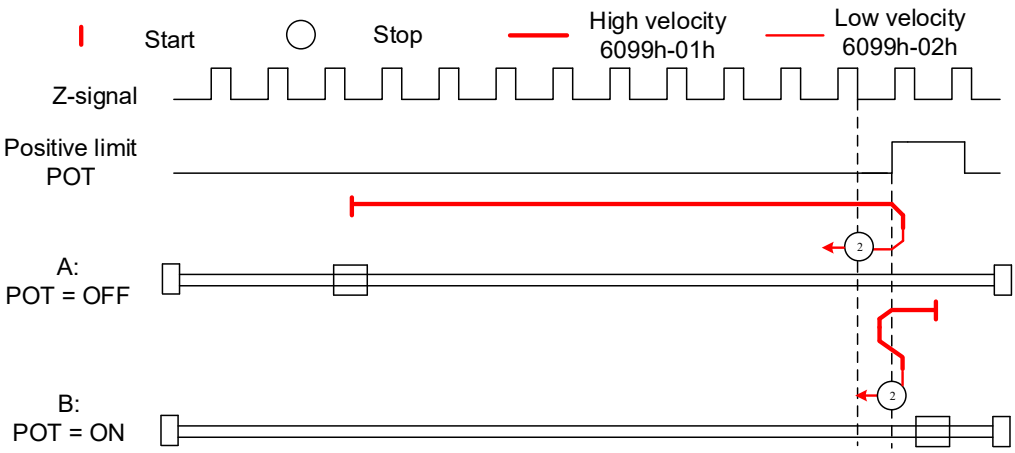
Diagram A: *Positive limit switch = OFF*

1. Move in **positive direction** at **high velocity** until **positive limit switch valid.**
2. Move in **negative direction** at **low velocity** and stops **after positive limit switch** and **first encoder Z-signal valid**

Diagram B: *Positive limit switch = ON*

1. Start to move at **positive limit switch position** in **negative direction** at **high velocity** until **positive limit switch invalid.**
2. Move in **positive direction** at **high velocity** until **positive limit switch valid.**
3. Move in **negative direction** at **low velocity** and stops **after positive limit switch** and **first encoder Z-signal valid**

If the negative limit signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating homing error and the motor will stop Immediately.



Homing switch signal + Z-signal mode

Mode 3:

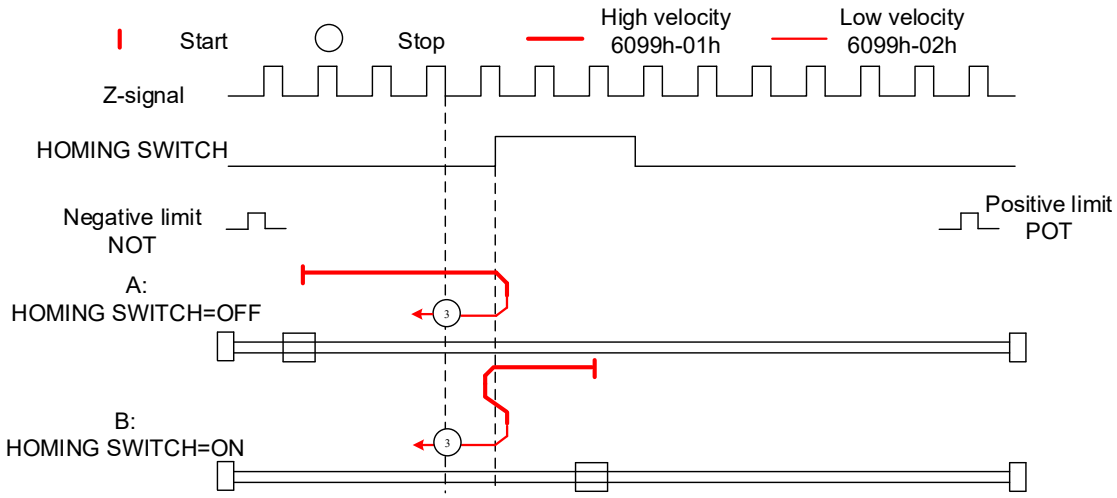
Diagram A: *Homing switch = OFF*

1. Move in **positive direction** at **high velocity** until **homing switch valid.**
2. Move in **negative direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid**

Diagram B: *Homing switch = ON*

1. Start to move at **homing switch position** in **negative direction** at **high velocity** until **after homing switch.**
2. Move in **positive direction** at **high velocity** until **homing switch valid.**
3. Move in **negative direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid**

If the positive/negative limit switch signal is valid during the homing process, the motor will stop Immediately.



Mode 4:

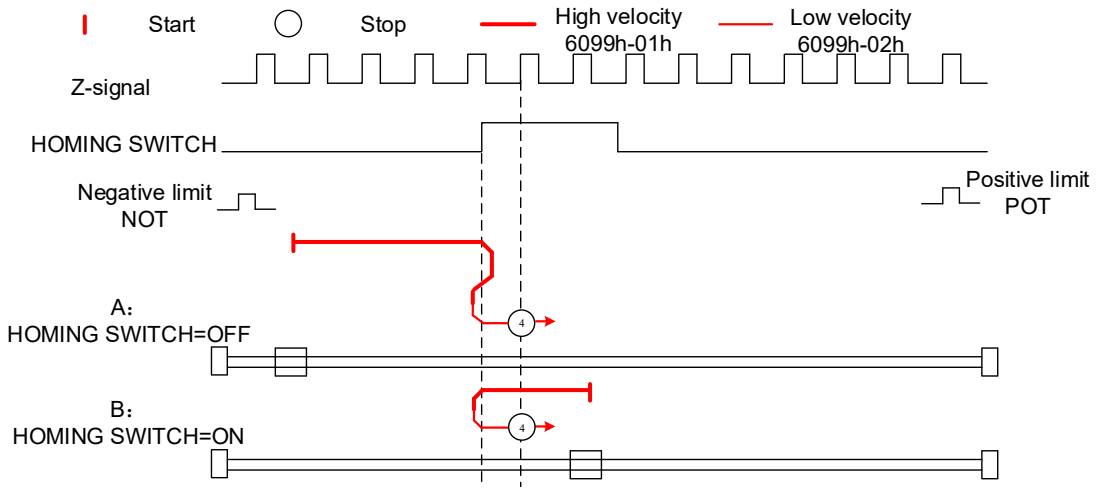
Diagram A: *Homing switch = OFF*

1. Move in **positive direction** at **high velocity** until **homing switch valid.**
2. Move in **negative direction** at **high velocity** until **homing switch invalid.**
3. Move in **positive direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid**

Diagram B: *Homing switch = ON*

1. Start to move at **homing switch position** in **negative direction** at **high velocity** until **after homing switch.**
2. Move in **positive direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid**

If the positive/negative limit switch signal is valid during the homing process, the motor will stop Immediately.



Mode 5:

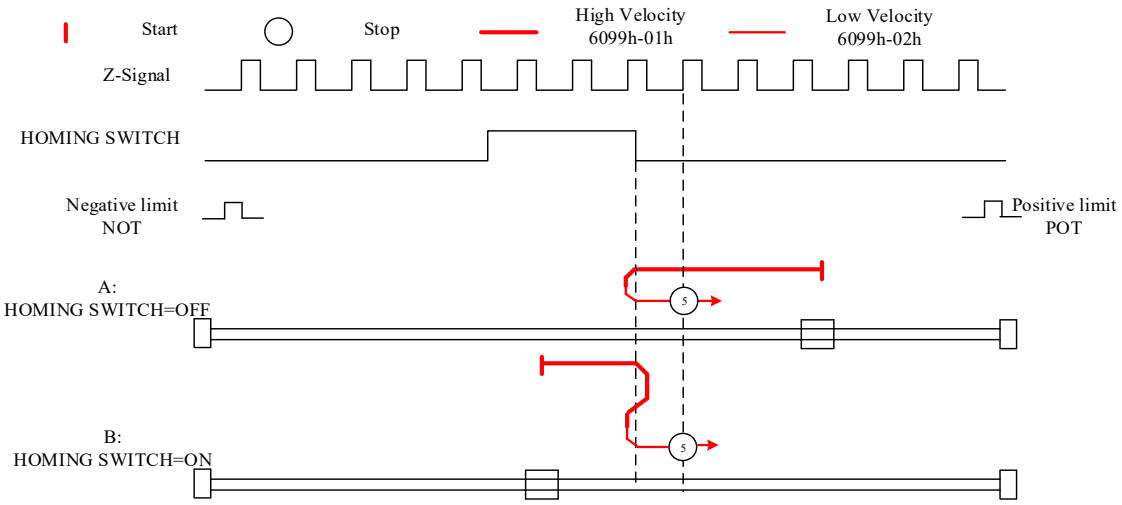
Diagram A: *Homing switch = OFF*

1. Move in **negative direction** at **high velocity** until **homing switch valid.**
2. Move in **positive direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid**

Diagram B: *Homing switch = ON*

1. Start to move at **homing switch position** in **positive direction** at **high velocity** until **after homing switch.**
2. Move in **negative direction** at **high velocity** until **homing switch valid.**
3. Move in **positive direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid**

If the positive/negative limit switch signal is valid during the homing process, the motor will stop Immediately.



Mode 6:

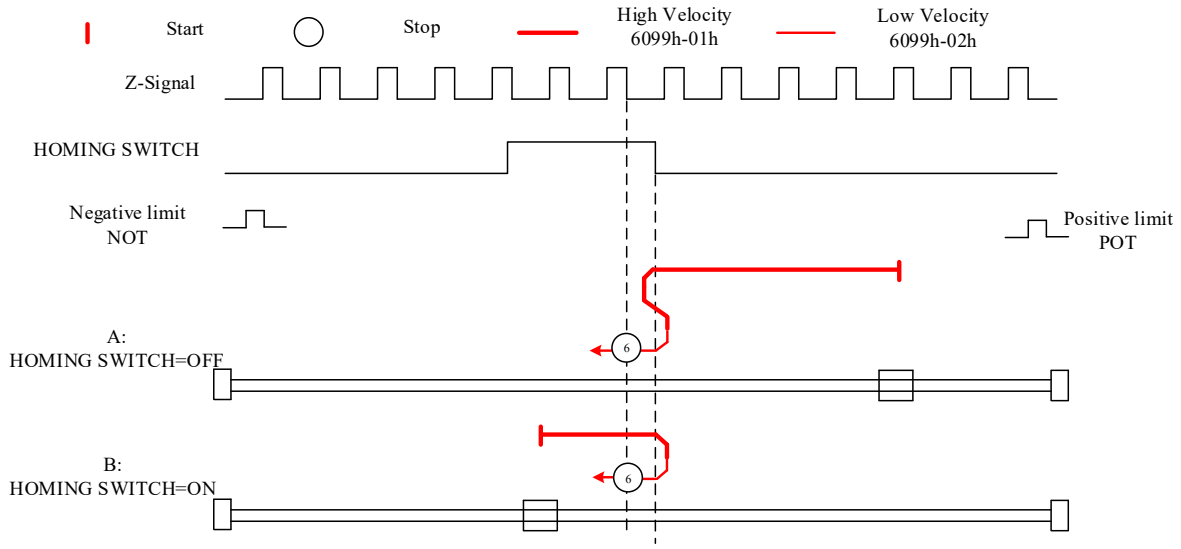
Diagram A: *Homing switch = OFF*

1. Move in **negative direction** at **high velocity** until **homing switch valid.**
2. Move in **positive direction** at **high velocity** until **homing switch invalid.**
3. Move in **negative direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid**

Diagram B: *Homing switch = ON*

1. Start to move at **homing switch position** in **positive direction** at **high velocity** until **after homing switch.**
2. Move in **negative direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid**

If the positive/negative limit switch signal is valid during the homing process, the motor will stop Immediately.



Limit switch signal + homing switch signal + Z-signal mode

Mode 7

Diagram A: *Homing switch & positive limit switch = OFF*

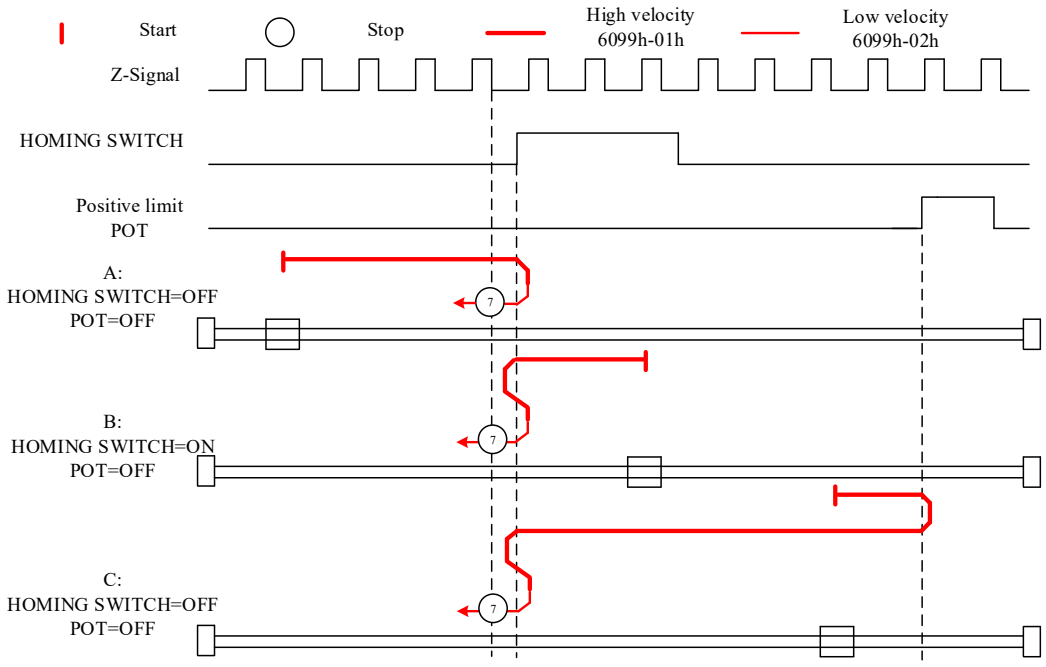
1. Move in **positive direction** at **high velocity** until **homing switch valid.**
2. Move in **negative direction** at **low velocity** and stops after **homing switch** and **first encoder Z-signal valid.**

Diagram B: *Homing switch = ON, positive limit switch = OFF*

1. Start to move at **homing switch position** in **negative direction** at **high velocity** until **after homing switch.**
2. Move in **positive direction** at **high velocity** until **homing switch valid.**
3. Move in **negative direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid**

Diagram C: *Homing switch & positive limit switch = OFF*

1. Move in **positive direction** at **high velocity** until **positive limit switch valid**.
2. Move in **negative direction** at **high velocity** until **after homing switch**.
3. Move in **positive direction** at **high velocity** until **homing switch valid**.
4. Move in **negative direction** at **low velocity** and stops **after homing switch** and **first encoder Z signal valid**



Mode 8

Diagram A: *Homing switch & positive limit switch = OFF*

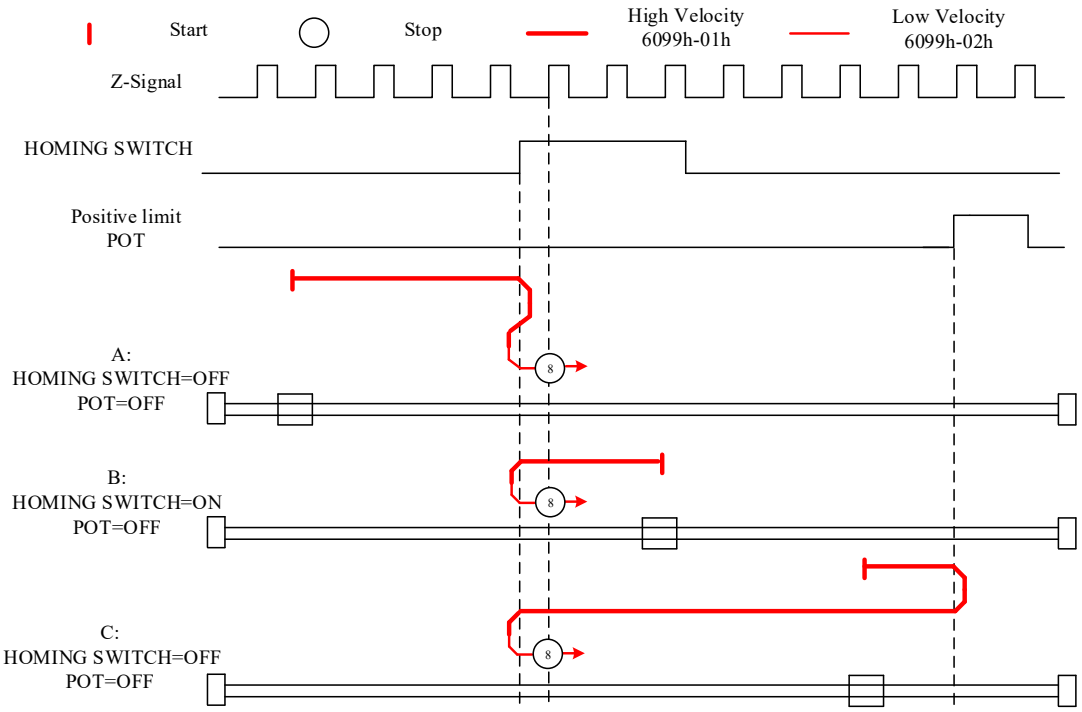
1. Move in **positive direction** at **high velocity** until **homing switch valid.**
2. Move in **negative direction** at **high velocity** until **after homing switch.**
3. Move in **positive direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid.**

Diagram B: *Homing switch = ON, positive limit switch = OFF*

1. Start to move at **homing switch position** in **negative direction** at **high velocity** until **after homing switch.**
2. Move in **positive direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid**

Diagram C: *Homing switch & positive limit switch = OFF*

1. Move in **positive direction** at **high velocity** until **positive limit switch valid**.
2. Move in **negative direction** at **high velocity** until **after homing switch**.
3. Move in **positive direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid.**



Mode 9

Diagram A: *Homing switch & positive limit switch = OFF*

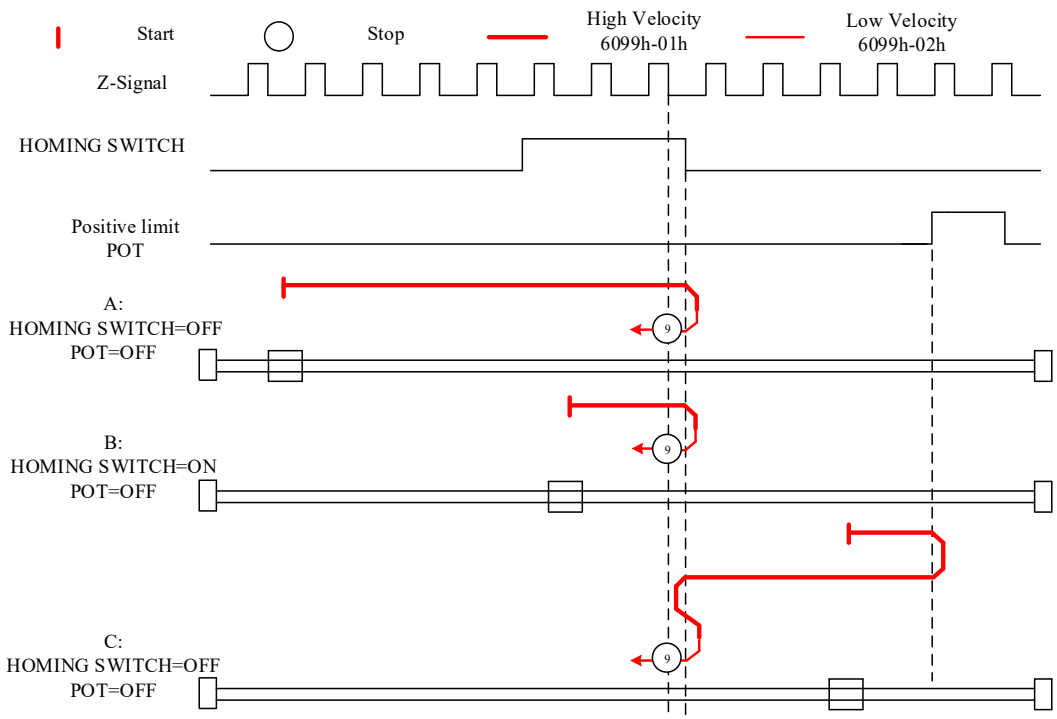
1. Move in **positive direction** at **high velocity** until **after homing switch.**
2. Move in **negative direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid.**

Diagram B: *Homing switch = ON, positive limit switch = OFF*

1. Start to move at **homing switch position** in **positive direction** at **high velocity** until **homing switch invalid.**
2. Move in **negative direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid**

Diagram C: *Homing switch & positive limit switch = OFF*

1. Move in **positive direction** at **high velocity** until **positive limit switch valid**.
2. Move in **negative direction** at **high velocity** until **homing switch valid**.
3. Move in **positive direction** at **high velocity** until **after homing switch**.
4. Move in **negative direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z signal valid**



Mode 10

Diagram A: *Homing switch & positive limit switch = OFF*

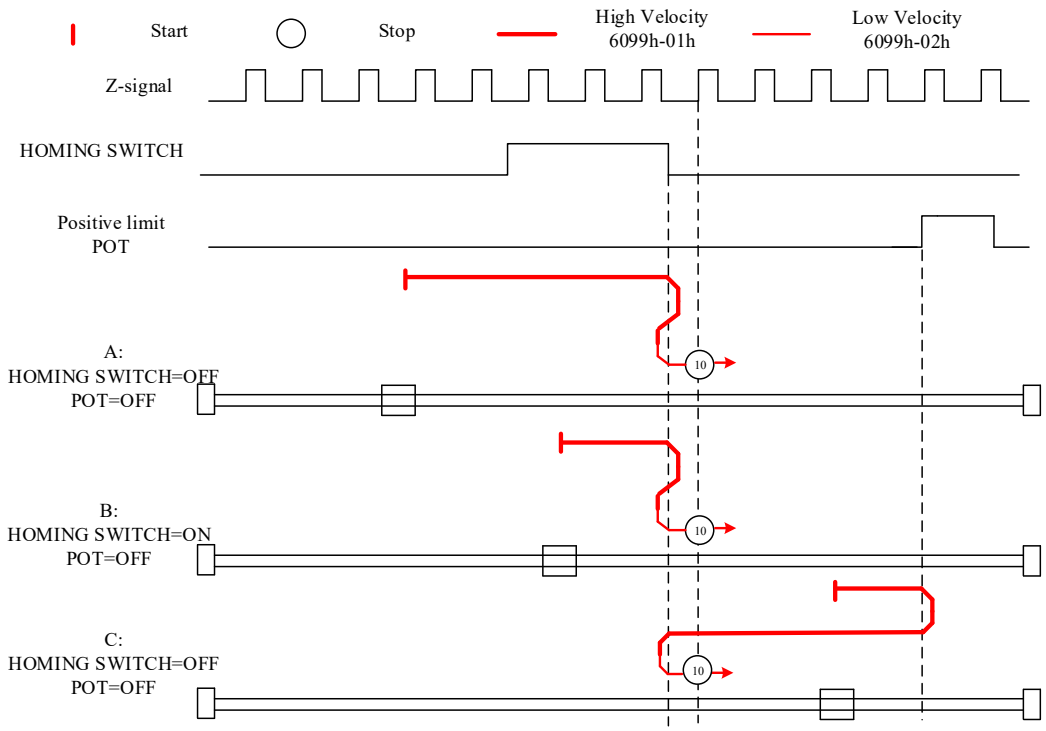
1. Move in **positive direction** at **high velocity** until **after homing switch.**
2. Move in **negative direction** at **high velocity** until **homing switch valid.**
3. Move in **positive direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid.**

Diagram B: *Homing switch = ON, positive limit switch = OFF*

1. Start to move at **homing switch position** in **positive direction** at **high velocity** until **after homing switch.**
2. Move in **negative direction** at **high velocity** until **homing switch valid.**
3. Move in **positive direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid**

Diagram C: *Homing switch & positive limit switch = OFF*

1. Move in **positive direction** at **high velocity** until positive **limit switch valid**.
2. Move in **negative direction** at **high velocity** until **homing switch valid**.
3. Move in **positive direction** at **low velocity** and stops **after homing switch** and **first encoder Z signal valid**



Mode 11

Diagram A: *Homing switch & negative limit switch = OFF*

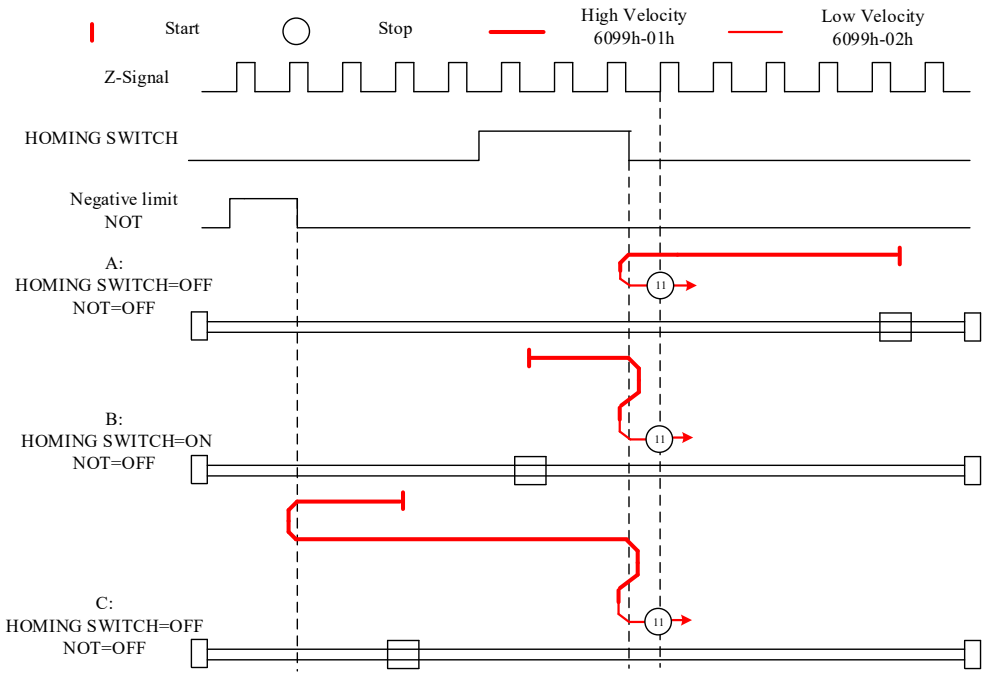
1. Move in **negative direction** at **high velocity** until **homing switch valid.**
2. Move in **positive direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid**

Diagram B: *Homing switch = ON, negative limit switch = OFF*

1. Start to move at **homing switch position** in **positive direction** at **high velocity** until **after homing switch.**
2. Move in **negative direction** at **high velocity** until **homing switch valid.**
3. Move in **positive direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid**

Diagram C: *Homing switch & negative limit switch = OFF*

1. Move in **negative direction** at **high velocity** until the **negative limit switch valid**.
2. Move in **positive direction** at **high velocity** until **homing switch invalid**.
3. Move in **negative direction** at **high velocity** until **homing switch valid**.
4. Move in **positive direction** at **low velocity** and stops **after homing switch** and **first encoder Z signal valid**



Mode 12

Diagram A: *Homing switch & negative limit switch = OFF*

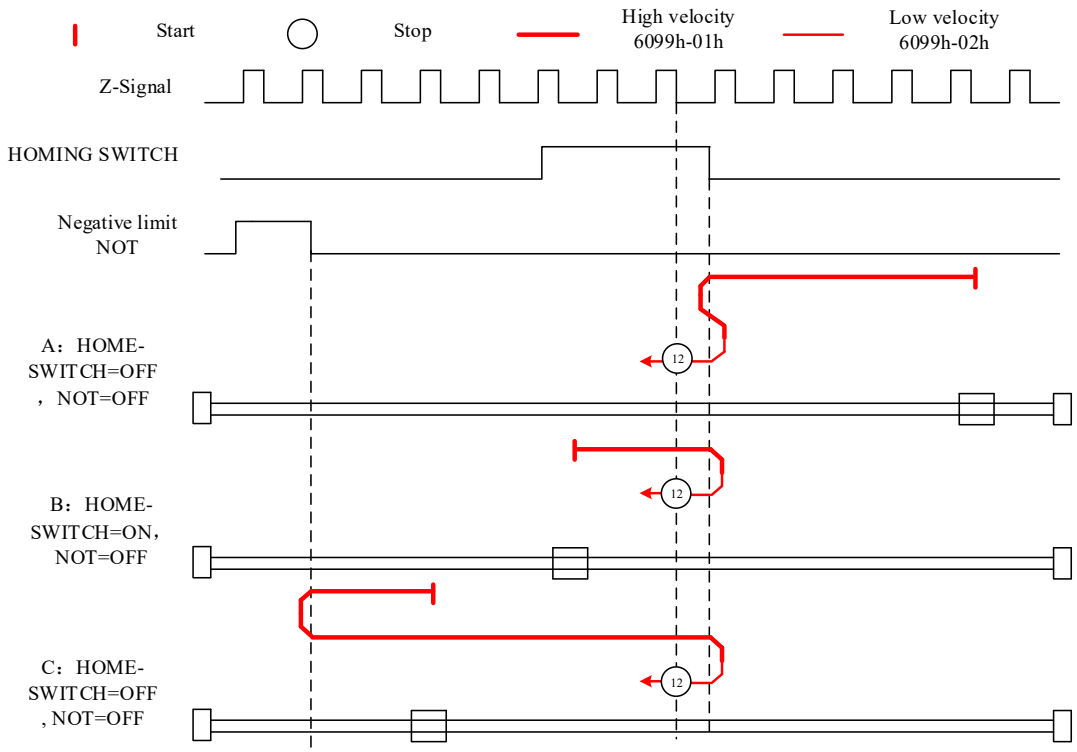
1. Move in **negative direction** at **high velocity** until **homing switch valid.**
2. Move in **positive direction** at **high velocity** until **after homing switch.**
3. Move in **negative direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid**

Diagram B: *Homing switch = ON, negative limit switch = OFF*

1. Move at **homing switch position** in **negative direction** at **high velocity** until **after homing switch**.
2. Move in **positive direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid.**

Diagram C: *Homing switch & negative limit switch = OFF*

1. Move in **negative direction** at **high velocity** until **negative limit switch valid.**
2. Move in **positive direction** at **high velocity** until **after homing switch**.
3. Move in **negative direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid.**



Mode 13

Diagram A: *Homing switch & negative limit switch = OFF*

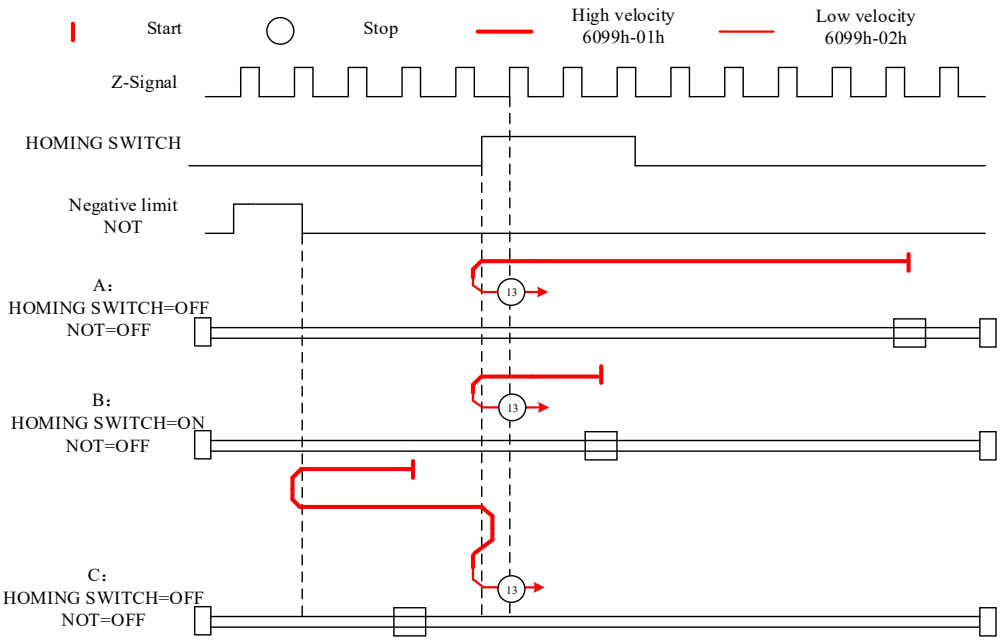
1. Move in **negative direction** at **high velocity** until **after homing switch**.
2. Move in **positive direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid**.

Diagram B: *Homing switch = ON, negative limit switch = OFF*

1. Start to move at **homing switch position** in **negative direction** at **high velocity** until **after homing switch.**
2. Move in positive **direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid.**

Diagram C: *Homing switch & negative limit switch = OFF*

1. Move in **negative direction** at **high velocity** until **negative limit switch valid**.
2. Move in **positive direction** at **high velocity** until **homing switch valid**.
3. Move in **negative direction** at **high velocity** until **after homing switch**.
4. Move in **positive direction** at **low velocity** and stops after **homing switch valid** and **first encoder Z-signal valid.**



Mode 14

Diagram A: *Homing switch & negative limit switch = OFF*

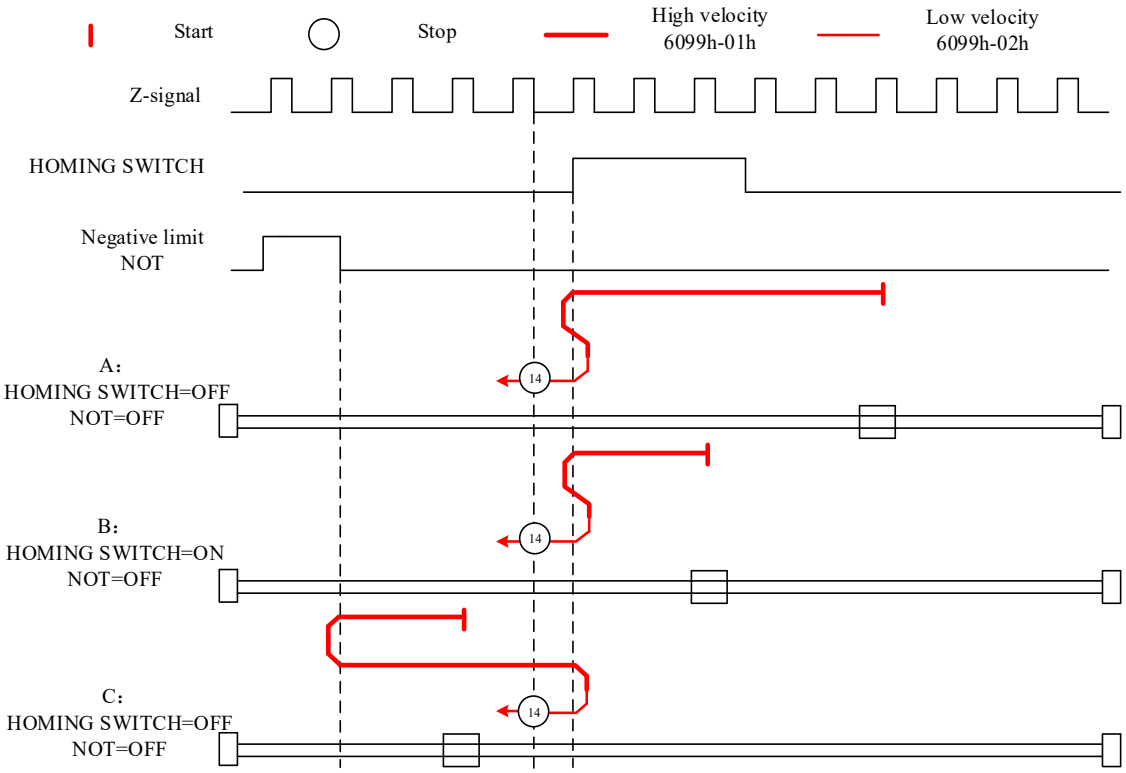
1. Move in **negative direction** at **high velocity** until **after homing switch**.
2. Move in **positive direction** at **high velocity** until **homing switch valid**.
3. Move in **negative direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid.**

Diagram B: *Homing switch = ON, negative limit switch = OFF*

1. Start to move at **homing switch position** in **negative direction** at **high velocity** until **homing switch invalid**.
2. Move in **positive direction** until **homing switch valid**.
3. Move in **negative direction** at **low velocity** and stops **after homing switch** and **first encoder Z signal valid.**

Diagram C: *Homing switch & negative limit switch = OFF*

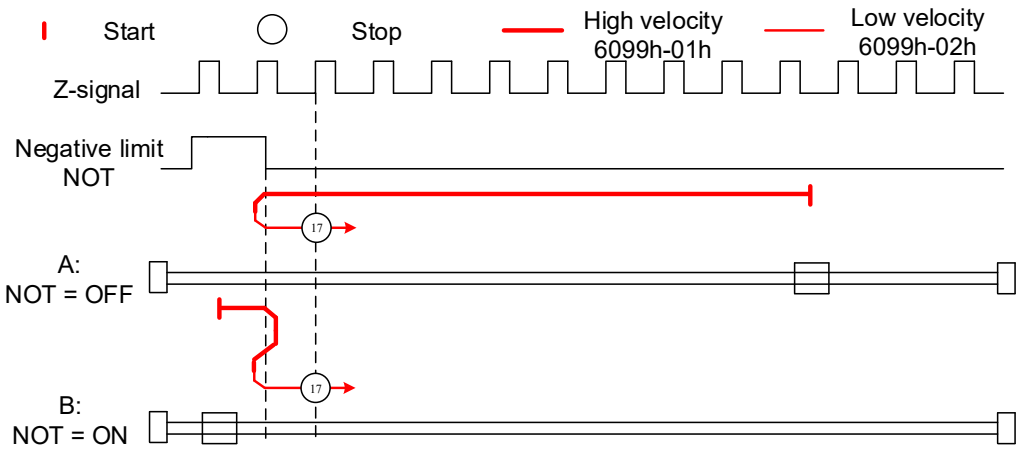
1. Move in **negative direction** at **high velocity** until **negative limit switch valid**.
2. Move in **positive direction** at **high velocity** until **homing switch valid**.
3. Move in **negative direction** at **low velocity** and stops **after homing switch** and **first encoder Z-signal valid.**



Limit switch signal triggering detection mode

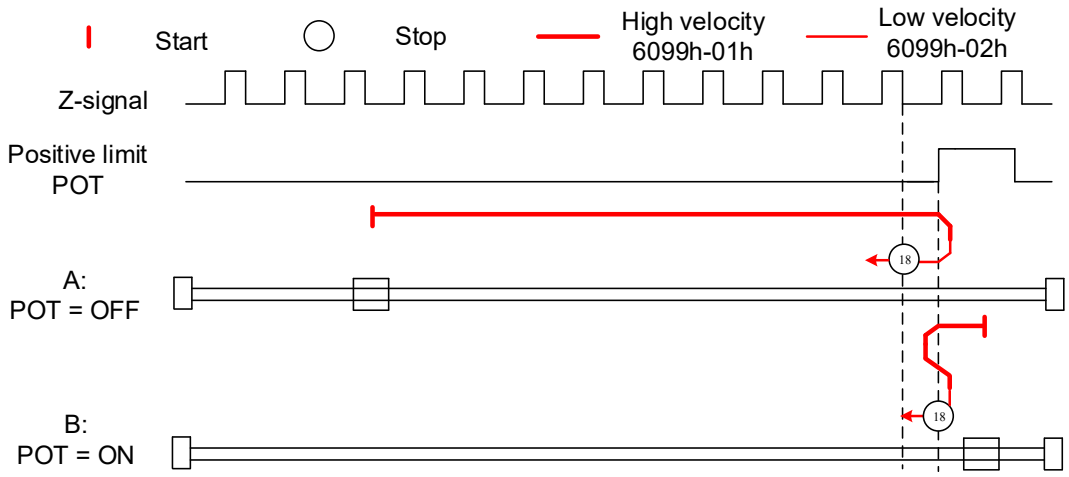
Mode 17：

This mode is similar to mode 1. Only difference is that homing point detection is not through Z-signal but through triggering of negative limit switch signal



Mode 18：

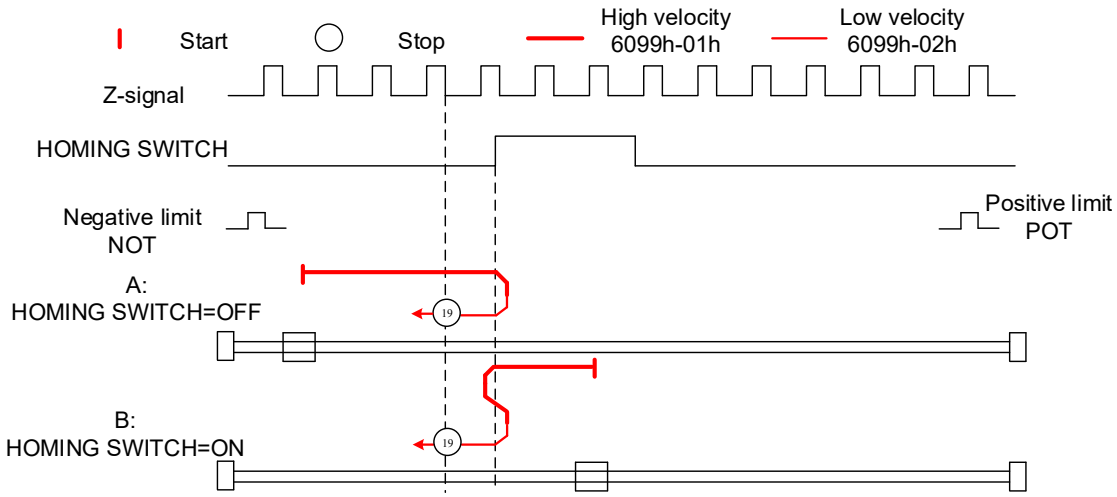
This mode is similar to mode 2. Only difference is that homing point detection is not through Z-signal but through switching of positive limit switch signal



Homing switch signal triggering detection mode

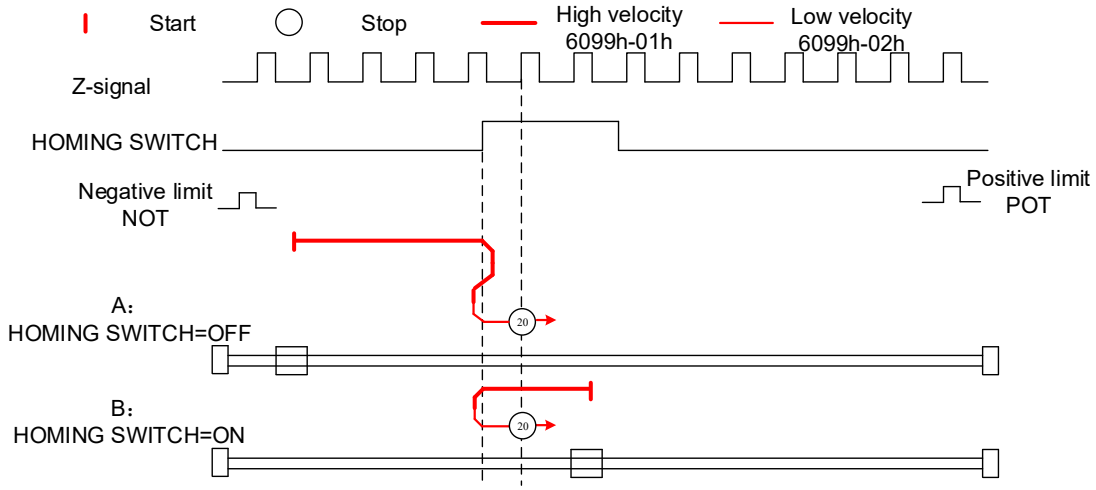
Mode 19：

This mode is similar to mode 3. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal



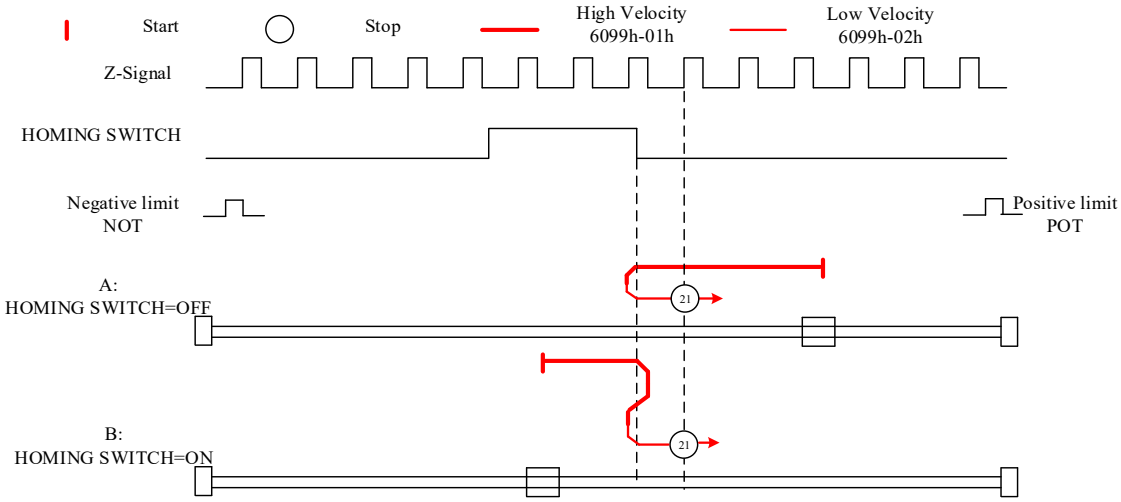
Mode 20：

This mode is similar to mode 4. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal



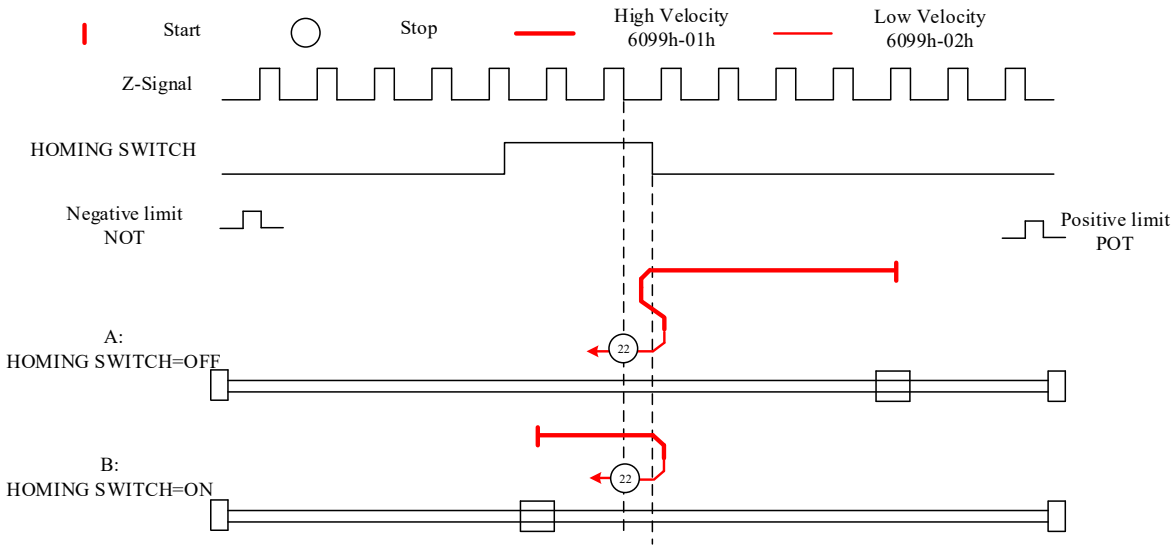
Mode 21：

This mode is similar to mode 5. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal.



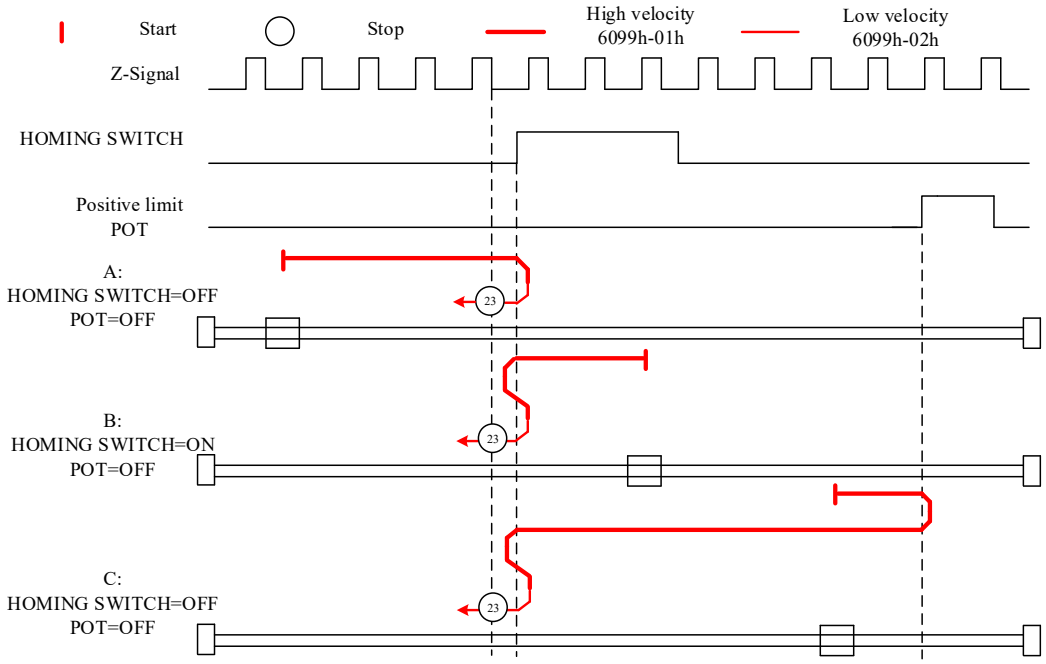
Mode 22：

This mode is similar to mode 6. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal.



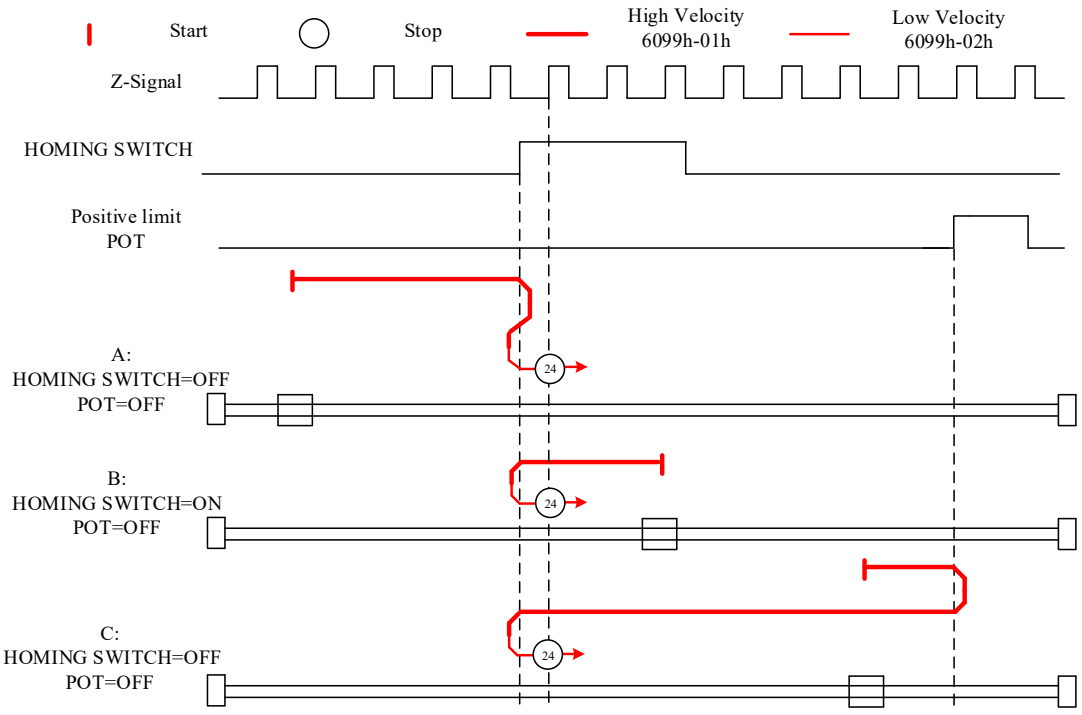
Mode 23:

This mode is similar to mode 7. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal.



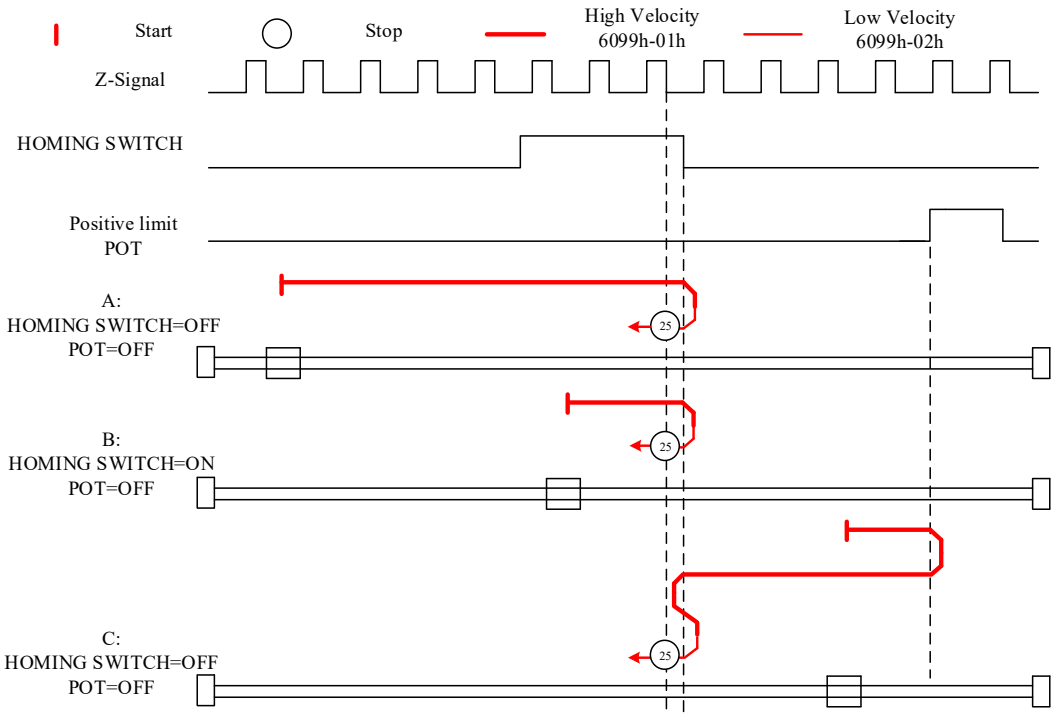
Mode 24:

This mode is similar to mode 8. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal.



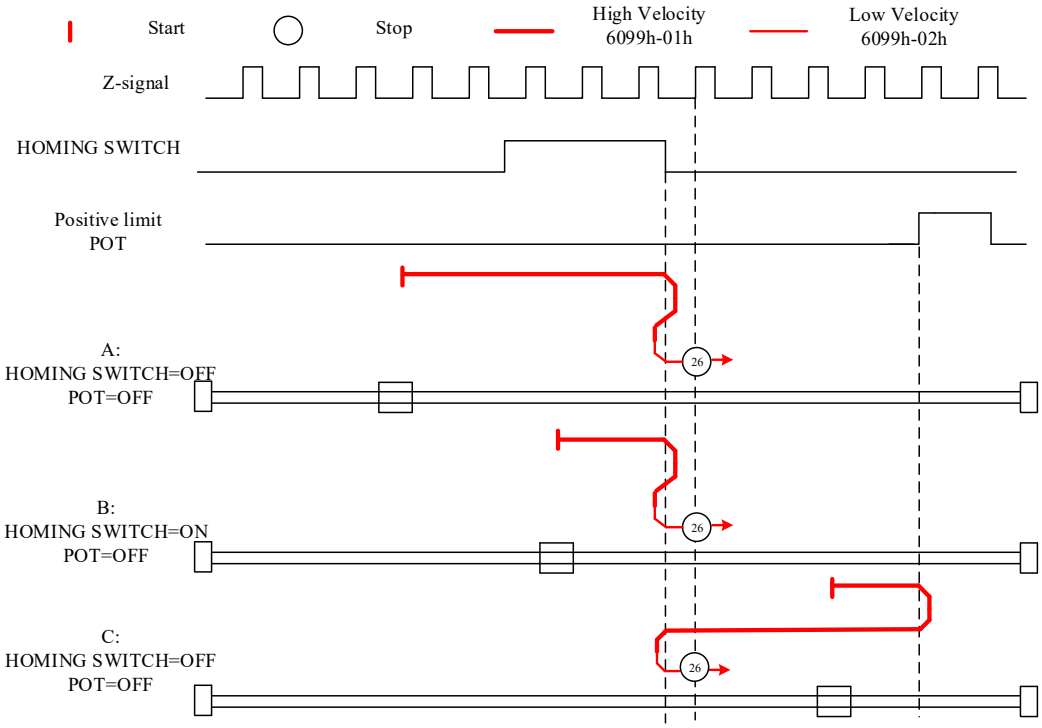
Mode 25:

This mode is similar to mode 9. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal



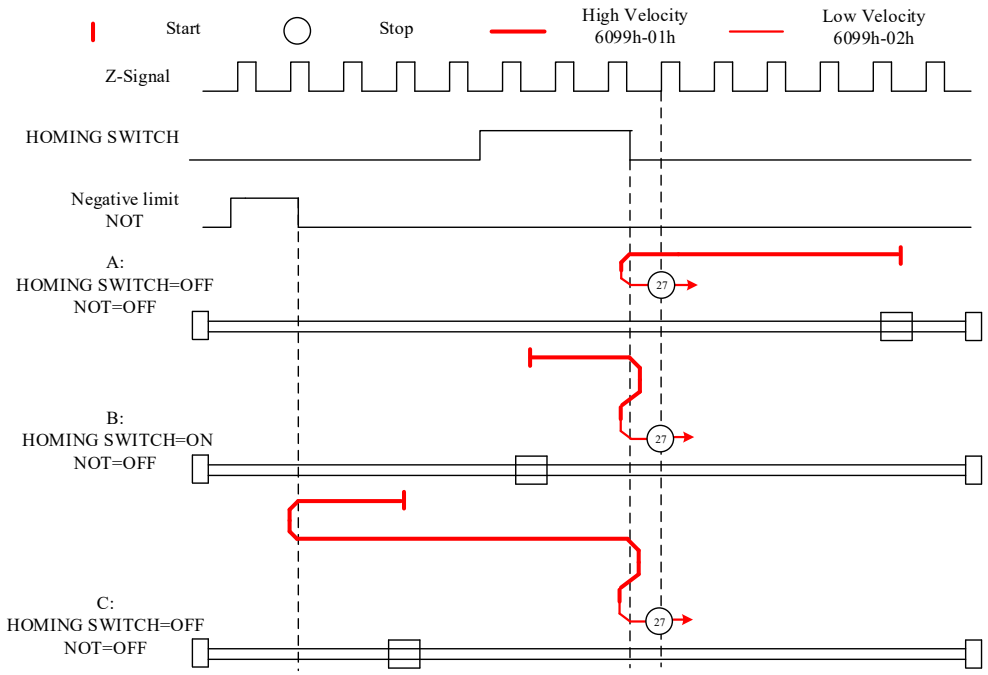
Mode 26:

This mode is similar to mode 10. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal



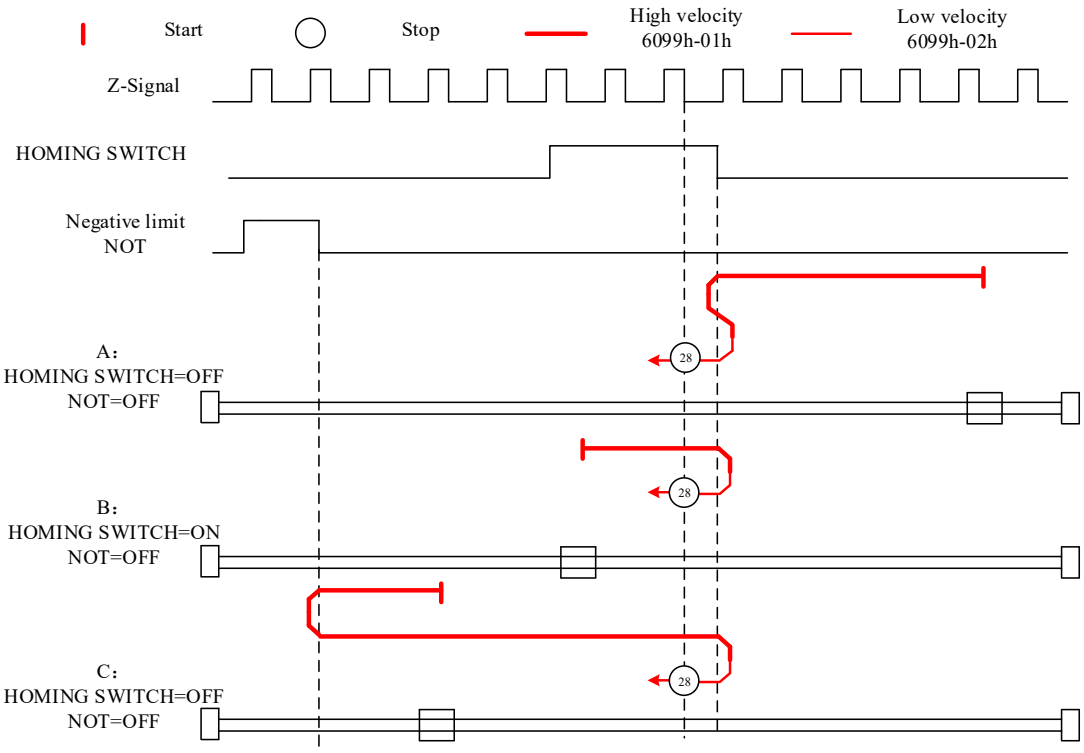
Mode 27：

This mode is similar to mode 11. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal



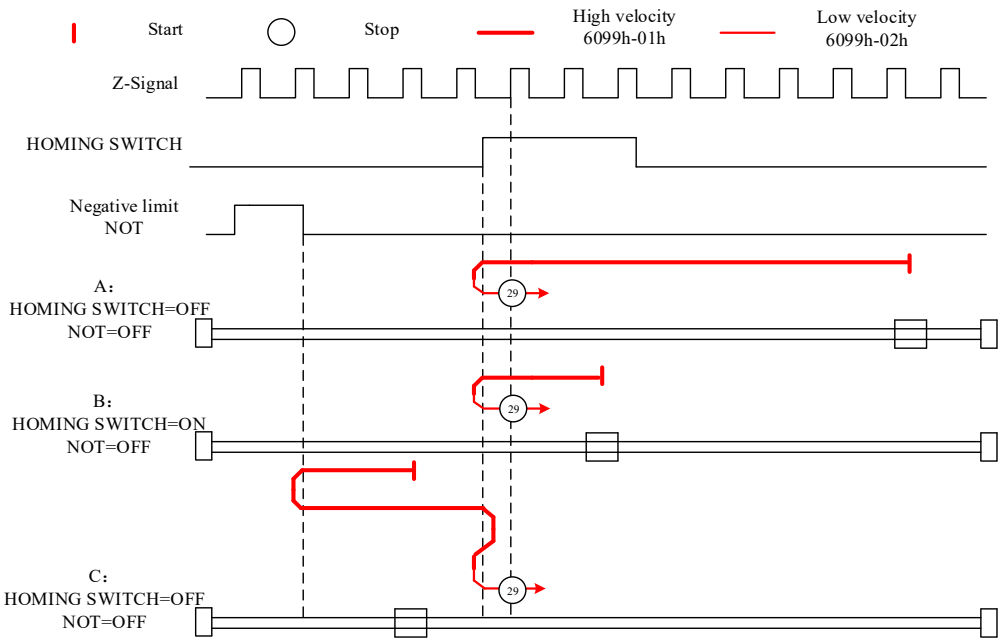
Mode 28：

This mode is similar to mode 12. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal



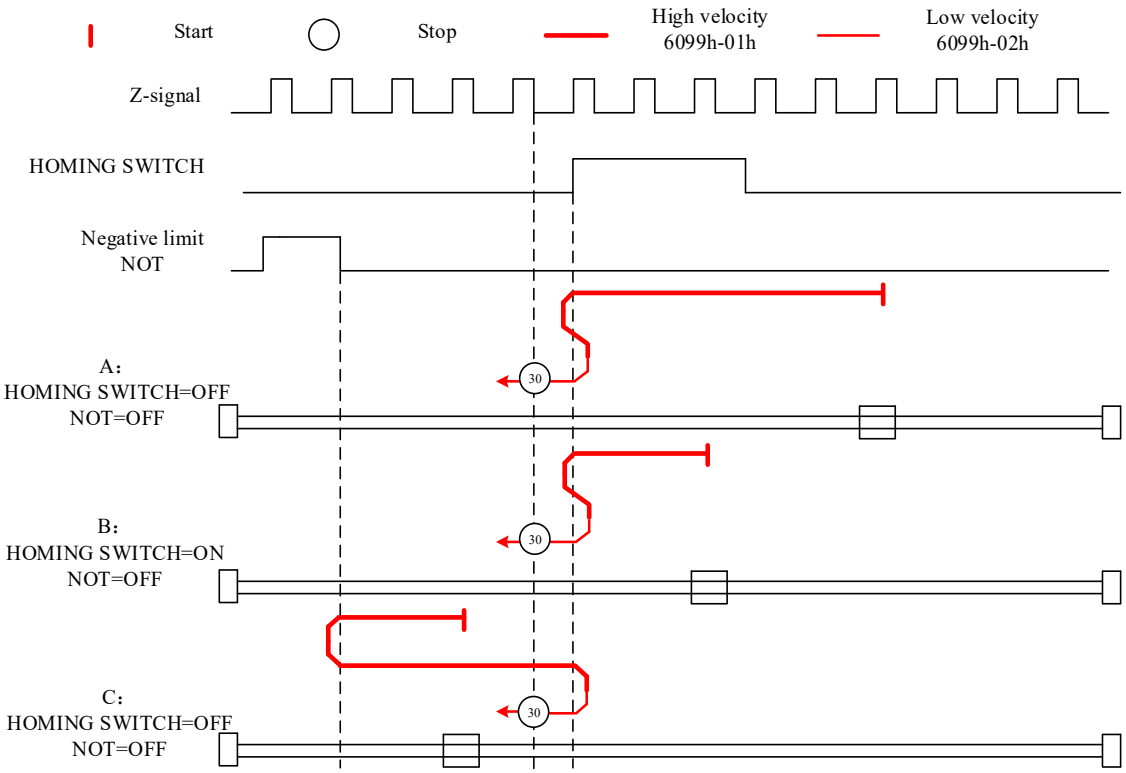
Mode 29：

This mode is similar to mode 13. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal



Mode 30：

This mode is similar to mode 14. Only difference is that homing point detection is not through Z-signal but through triggering of homing switch signal

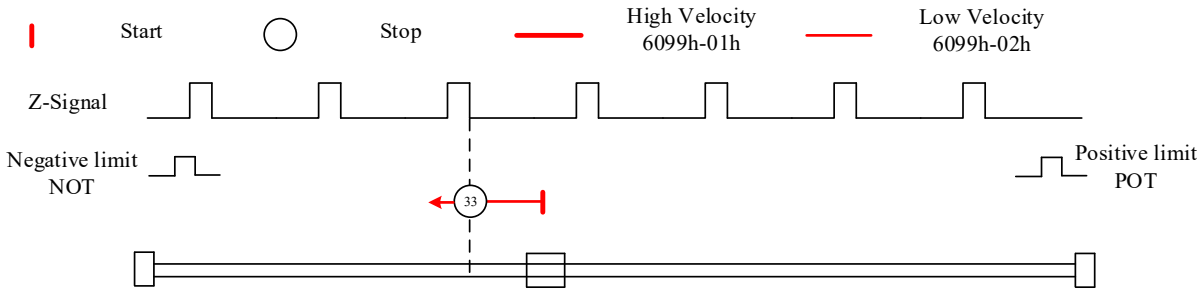


Other modes

Mode 33：

The motor starts to move in **negative direction** and stops when the **Z-signal is valid**.

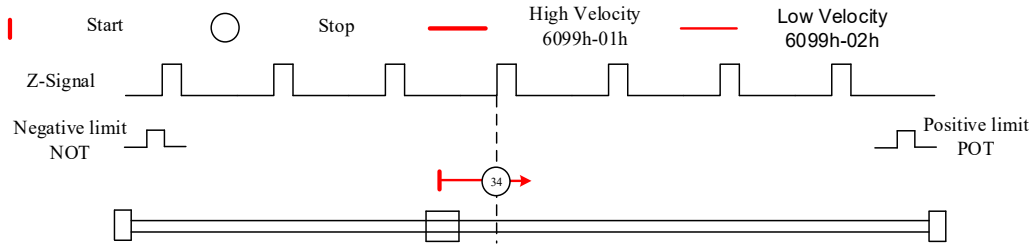
If the positive/negative limit switch signal or homing switch is valid during the homing process, the motor will stop Immediately.



Mode 34：

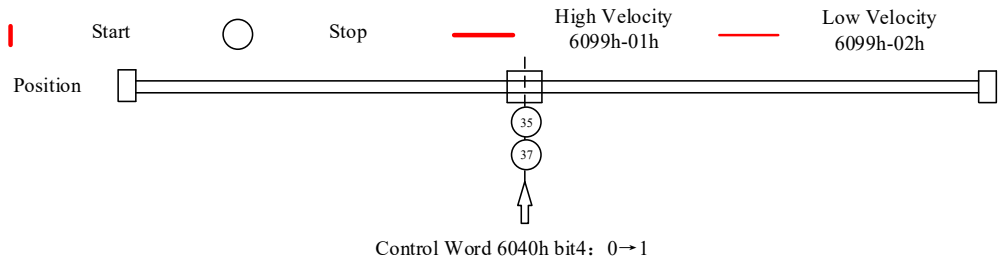
The motor starts to move in **positive direction** and stops when the **Z-signal is valid**.

If the positive/negative limit switch signal or homing switch is valid during the homing process, the motor will stop Immediately.



Mode 35/37：

Set the current position as homing point. Using this mode, motor doesn't have to be enabled.

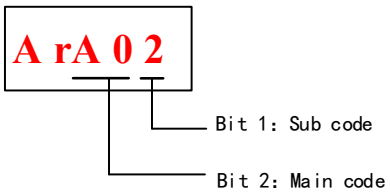


Chapter 7 Warning and Alarm

7.1 Servo drive warning

When warning occurs, driver will set protective function but **motor won't stop moving**. Error code will be displayed on the front panel.

Example of warning code:



Warning Code		Content
Main	Code	
ArA	00	Quick stop valid
	01	Overload warning
	02	Regeneration energy overload warning (85% of the regeneration threshold)
	03	Absolute encoder battery voltage low (<3.1V). Valid when Pr0.15 is set to 1.
	04	Parameter setting error alarm
	05	Incorrect control mode settings warning
	06	Overheat warning
	07	Temperature sensor disconnected warning
	08	Positive limit switch valid. POT blinking on front panel
	09	Negative limit switch valid. NOT blinking on front panel
	0A	Positive and negative limit switch valid. PNOT blinking on front panel
	0B	Software positive limit switch valid warning. SPOT blinking on front panel
	0C	Software negative limit switch valid warning. SNOT blinking on front panel
	0D	Software negative and positive limit switch valid warning. SPNOT blinking on front panel
	0E	Restart after parameter restored to default
	10	Software limit settings error
	12	Motor collision warning
	13	Disable clearing of encoder multi-turn data and alarms when servo is disabled / Disable clearing of multi-turn values for non-multi-turn encoders
	1C	Parameter out of range

	20	Undervoltage alarm
	21	Two channel STO signal activitied simultaneously
	22	First channel STO signal activitied
	23	Second channel STO signal activitied
	24	Input power Phase T disconnected
	25	Input power Phase R disconnected
	26	Input power Phase S disconnected
	27	PHY ANAR write error
	28	PHY CR1 write error
	29	PHY BMCR write error
	2A	PHY CR2 write error
	2B	PHY CR3 write error
	2C	PHY initialization failure
POFF		Main power supply not connected. Check the wiring of L1/L2/L3 or R/S/T.
COFF		Control power supply not connected. Check the wiring of L1C/L2C.

7.2 Warning Handling Methods

When a warning occurs, the drive will not stop the motor from rotating, and the corresponding warning code will be automatically displayed on the front panel. If the corresponding warning is addressed—for example, in the case of alarm ArA03—replace the battery with a new one while the drive is powered on, ensuring the absolute encoder battery voltage exceeds 3.0 V to clear the alarm.

Appropriate handling methods can be adopted based on the specific warning content!

warning code	Main	Sub	Display : "ArA00"
	A0	0	Content : Quick stop valid
Cause of warning		Inspection methods	Disposal methods
E-STOP active (P00.40=1 Stop without alarm triggered).		Check if the DI function E-STOP correctly triggers the DI report.	Confirm safety, then cancel the valid E-STOP signal.

warning code	Main	Sub	Display : "ArA01"
	A0	1	Content : overload warning
Cause of warning		Inspection methods	Disposal methods
Overload warning (80% reached).		Confirm the motor overload curve, and check whether the actual load is rated load, you can monitor the status to see whether the servo drive average load factor D07_01 is greater than 100% for a long period of time; confirm whether the D15 overload rate has a rising trend to reach 100 will alarm ER100	Replace the high-capacity servo drive and matching motor; Reduce the load or increase the acceleration and deceleration time
warning code	Main	Sub	Display : "ArA02"
	A0	2	Content : Drain overload warning
Cause of warning		Inspection methods	Disposal methods
Discharge overload warning (85% reached).		Confirm whether the actual motion involves acceleration/deceleration times that are too small or motion that is too intense, causing the discharge resistor to discharge frequently..	Replace with a discharge resistor of larger power specifications or reduce load/reduce rotation speed.

warning code	Main	Sub	Display：**"ArA03"**
	A0	**3**	**Content：Encoder battery voltage low**
Cause of warning		Inspection methods	Disposal methods
Abs. encoder battery <3.0V (Multi-turn enabled).		Measure if the encoder battery voltage is lower than 3.0V.	Replace with a new battery in time.

warning code	Main	Sub	Display：**"ArA04"**
	A0	**4**	**Content：Parameter setting error alarm**
Cause of warning		Inspection methods	Disposal methods
Parameter modification pending (Power cycle required).		/	/
warning code	Main	Sub	Display：**"ArA05"**
	A0	**5**	**Content：Incorrect control mode settings warning**
Cause of warning		Inspection methods	Disposal methods
Control mode P00.01 is not 9.		Check if the P00.01 parameter value setting is correct.	Set P00.01 to 9.
warning code	Main	Sub	Display：**"ArA06"**
	A0	**6**	**Content：Overheat warning**
Cause of warning		Inspection methods	Disposal methods
Drive overheating		Drive temperature is greater than the set threshold (PA2.49).	Improve heat dissipation conditions and lower the ambient temperature;Increase the drive and motor capacity; increase acceleration/deceleration time; reduce the load.
warning code	Main	Sub	Display：**"ArA06"**
	A0	**7**	**Content：Temperature sensor disconnected warning**
Cause of warning		Inspection methods	Disposal methods
Temperature sensor disconnected.		Check if the temperature sensor connection is loose.	Tighten the temperature sensor wiring.
warning code	Main	Sub	Display：**"Pot"**
	A0	**8**	**Content：Hardware Positive Limit Valid Alarm**

Cause of warning		Inspection methods	Disposal methods
Positive limit active (panel display POT)		Check that DI is assigned a positive limit signal and that the positive limit input signal logic is valid.	Check whether the positive limit trigger is triggered normally; Non-normal triggering to confirm whether the wiring and parameter setting values are incorrect.
warning code	**Main**	**Sub**	**Display：**"not"
	A0	**9**	**Content：Hardware Negative Limit Valid Alarm**
Cause of warning		Inspection methods	Disposal methods
Negative limit valid (panel display NOT)		Check if DI is assigned the negative limit signal, and if the negative limit input signal logic is in the active state.	Check whether the negative limit trigger triggers normally; for abnormal triggering, confirm if wiring and parameter setting values are incorrect.
warning code	**Main**	**Sub**	**Display：**"Pnot"
	A0	**A**	**Content：Hardware alarms for both positive and negative limits**
Cause of warning		Inspection methods	Disposal methods
Positive and negative limits valid (panel display Pnot)		Check whether DI is assigned positive/negative limit signals, and whether both positive/negative limit input signal logic is in a valid state.	Check whether the positive/negative limit triggering is triggered normally; abnormal triggering confirms whether the wiring and parameter setting values are incorrect.
warning code	**Main**	**Sub**	**Display：**"SPot"
	A0	**B**	**Content：Software Positive Limit Valid Alarm**
Cause of warning		Inspection methods	Disposal methods
Software positive limit valid (panel display SPOT)		Servo drive position feedback exceeds the set software positive limit position	Reasonable planning of servo drive commands to ensure that the load travel is within the soft limit range; set a reasonable software limit range
warning code	**Main**	**Sub**	**Display：**"Snot"
	A0	**C**	**Content：Software Negative Limit Valid Alarm**
Cause of warning		Inspection methods	Disposal methods
Software negative limit valid (panel display snot)		Servo drive position feedback exceeds the set software negative limit position	Reasonable planning of servo drive commands to ensure that the load travel is within the soft limit range; set a reasonable software limit range

warning code	Main	Sub	Display：SPnot
	A0	d	Content：Software alarms for both positive and negative limits
Cause of warning		Inspection methods	Disposal methods
Software positive and negative limits valid (panel display spnot)		Servo drive position feedback exceeds set software positive/negative limit positions	Reasonable planning of servo drive commands to ensure that the load travel is within the soft limit range; set a reasonable software limit range

warning code	Main	Sub	Display：ArA0E
	A0	E	Content：Parameters need to be saved and re-powered to take effect
Cause of warning		Inspection methods	Disposal methods
Parameters that require power failure to take effect have been changed or factory restoration has been performed.		Check whether you have changed parameters that require power failure to take effect or performed a factory restore operation.	If you do perform the above operation, the warning is a normal output, re-power off and power on to release the

warning code	Main	Sub	Display：ArA10
	A1	0	Content：Software limit settings error
Cause of warning		Inspection methods	Disposal methods
Software limit value setting error.		Check if the servo has enabled the soft limit function, and P00.56 < P00.57 (setting error).	Ensure P00.56 > P00.57.

warning code	Main	Sub	Display：ArA12
	A1	2	Content：Motor collision warning
Cause of warning		Inspection methods	Disposal methods
After collision detection mode is enabled, the motor collides, meeting the conditions of collision detection speed (P47.03) and current thresholds (P47.01, P47.02), triggering a collision detection alarm.		Check for actual mechanical collision, jamming, or stalling in the equipment.	Reset the mechanical structure, clear the alarm, confirm no issues, and restart the equipment.
After collision detection mode is enabled, no actual collision occurs, but the conditions of collision detection speed (P47.03) and current thresholds (P47.01, P47.02) are met.		Verify whether the collision detection speed threshold and current threshold settings are reasonable.	Set reasonable collision detection speed threshold and current threshold values.
warning code	Main	Sub	Display：ArA13
	A1	3	Content：Clearing encoder multiturns and alarms when disabling/prohibiting clearing of non-multiturn encoder multiturn values
Cause of warning		Inspection methods	Disposal methods
P10.10 written 5/9 (Clear Data) while enabled.		Prohibit clearing encoder multi-turn and alarm when enabled.	Clear encoder multi-turn and alarm when disabled.
warning	Main	Sub	Display：ArA14

code	**A1**	**4**	**Content：Bus Undervoltage Warning**
Cause of warning		Inspection methods	Disposal methods
Low main circuit power input voltage		1. Verify input voltage at L1/L2(L3)/RST meets specs: • 220V drive: 198–264V (220V±10%) • 380V drive: 342–484V (400V±10%) 2. Check charge indicator, d27 bus voltage, and DC bus voltage (P+/N): • 220V drive: ~310V (fault at <180V) • 380V drive: ~540V (fault at <540V)	Increase L1/L2(L3) or RST input voltage to meet the required specifications.
warning code	**Main**	**Sub**	**Display："ArA1C"**
	A1	**C**	**Content：Parameter out of range**
Cause of warning		Inspection methods	Disposal methods
Parameter import out of range.		Check the out-of-limit parameter displayed in the host computer pop-up window, whether the range exceeds the current drive maximum/minimum value. performance.	Change the parameter range to within the allowable range of the current drive.
warning code	**Main**	**Sub**	**Display："ArA20"**
	A2	**0**	**Content：Undervoltage alarm**
Cause of warning		Inspection methods	Disposal methods
Main input low; Bus voltage < PA2.43.		Check if the bus voltage is lower than the PA2.43 setting value, check for A20	Ensure main power input voltage meets the nameplate specified voltage

	undervoltage alarm.	

warning code	Main	Sub	Display：ArA21
	A2	1	Content：Two channel STO activated simultaneously
Cause of warning		Inspection methods	Disposal methods
Two channel STO activated simultaneously		Check if STO function is activated ;24V Input disconnected.	Under normal operating conditions, no action is required: once the STO terminal has been restored, the A21 warning will automatically reset.

warning code	Main	Sub	Display：ArA22
	A2	2	Content :First channel STO activated
Cause of warning		Inspection methods	Disposal methods
First channel STO 24v input disconnected.		Check if STO function is activated ;24V Input disconnected.	Under normal operating conditions, no action is required: once the STO terminal has been restored,use reset to clear the error.

warning code	Main	Sub	Display：ArA23
	A2	3	Content：Second channel STO activated
Cause of warning		Inspection methods	Disposal methods
Second channel STO 24v input disconnected.		Check if STO function is activated ;24V Input disconnected.	Under normal operating conditions, no action is required: once the STO terminal has been restored,use reset to clear the error.

warning code	Main	Sub	Display : "ArA24"
	A2	4	**Content : Input power Phase T disconnected**
Cause of warning		Inspection methods	Disposal methods
Input power T-phase disconnected.		Check if main power T phase is disconnected.	Correctly connect main power wiring

warning code	Main	Sub	Display : "ArA20"
	A2	5	**Content : Input power Phase R disconnected**
Cause of warning		Inspection methods	Disposal methods
Input power R-phase disconnected.		Check if main power R phase is disconnected.	Correctly connect main power wiring

warning code	Main	Sub	Display : "ArA26"
	A2	6	**Content : Input power Phase S disconnected**
Cause of warning		Inspection methods	Disposal methods
Input power S-phase disconnected.		Check if main power S phase is disconnected.	Correctly connect main power wiring

warning code	Main	Sub	Display : "ArA27"
	A2	7	**Content : PHY communication error**
Cause of warning		Inspection methods	Disposal methods
PHY data read error.		Repeatedly connect power, check if the fault still exists.	Replace the servo drive
The drive is subject to strong electromagnetic interference, resulting in write operation failures.		Check if the PROFINET communication cables run parallel to power lines, causing excessive interference.	Route communication cables separately from power lines, use shielded cables, and ensure reliable grounding.

warning	Main	Sub	Display : "ArA28"

code	A2	8	Content : PHY data checksum 1 error
Cause of warning		Inspection methods	Disposal methods
PHY data checksum error.		Repeatedly connect power, check if the fault still exists.	Replace the servo drive
The drive is subject to strong electromagnetic interference, resulting in write operation failures.		Check if the PROFINET communication cables run parallel to power lines, causing excessive interference.	Route communication cables separately from power lines, use shielded cables, and ensure reliable grounding.
warning code	Main	Sub	Display : "ArA29"
	A2	9	Content : PHY data checksum error
Cause of warning		Inspection methods	Disposal methods
PHY data checksum error.		Repeatedly connect power, check if the fault still exists.	Replace the servo drive
The drive is subject to strong electromagnetic interference, resulting in write operation failures.		Check if the PROFINET communication cables run parallel to power lines, causing excessive interference.	Route communication cables separately from power lines, use shielded cables, and ensure reliable grounding.
warning code	Main	Sub	Display : "ArA2A"
	A2	A	Content : PHY data checksum 2 error
Cause of warning		Inspection methods	Disposal methods
PHY data checksum error.		Repeatedly connect power, check if the fault still exists.	Replace the servo drive
The drive is subject to strong electromagnetic interference, resulting in write operation failures.		Check if the PROFINET communication cables run parallel to power	Route communication cables separately from power lines, use shielded cables, and ensure reliable grounding.

		lines, causing excessive interference.	
warning code	**Main**	**Sub**	**Display：**"ArA2B
	A2	B	**Content：PHY data checksum 3 error**
Cause of warning		Inspection methods	Disposal methods
PHY data checksum error.		Repeatedly connect power, check if the fault still exists.	Replace the servo drive
The drive is subject to strong electromagnetic interference, resulting in write operation failures.		Check if the PROFINET communication cables run parallel to power lines, causing excessive interference.	Route communication cables separately from power lines, use shielded cables, and ensure reliable grounding.

warning code	**Main**	**Sub**	**Display：**"ArA2C
	A2	C	**Content：PHY initialization failure**
Cause of warning		Inspection methods	Disposal methods
PHY chip initialization (reset/register config) timed out or failed after drive power-up.		Check power-up sequence for PHY initialization timeout/errors.	Power-cycle drive to restart PROFINET PHY initialization.
PHY chip power/reset/port circuit fault, chip not functional.		Check drive power stability and Ethernet port.	If repeated power cycles fail, contact manufacturer.

warning code		Display：PoFF Content：Main power disconnectted
Cause of warning	Inspection methods	Disposal methods
Main power not connected, L1/L2/L3 or R/S/T wiring abnormal	1. Check L1/L2/L3 or R/S/T wiring for looseness/breaks.2. Verify power switch is ON.3. Measure voltage with multimeter.	1. Reconnect power lines.2. Replace damaged cables.3. Confirm main power output.4. Check fuse/circuit breaker.
warning code		**Display：coFF** **Content：Control power disconnectted**
Cause of warning	Inspection methods	Disposal methods
Control power not connected, L1C/L2C wiring abnormal	1. Check L1C/L2C wiring for looseness/breaks.2. Verify power switch is ON.3. Measure voltage with multimeter.	1. Reconnect control power lines.2. Replace damaged cables.3. Confirm control power output.4. Check fuse.

7.3 Servo drive alarm & PROFINET Communication Alarm

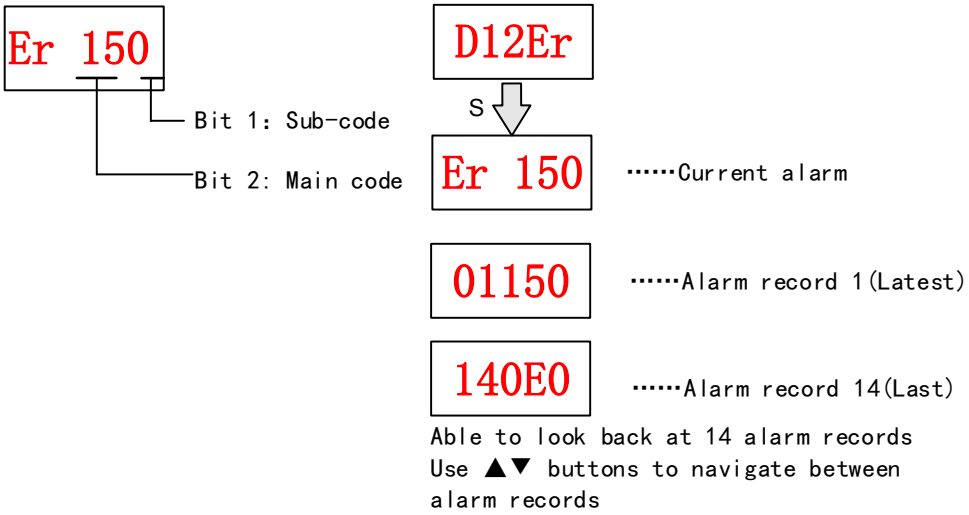
When a servo drive fault occurs, its panel will display the corresponding error code, and the corresponding detailed information can be viewed through the debugging software object dictionary PNU 503F.

For example:

- Panel error code: Er0A0

- The object dictionary PNU 503F in the commissioning software shows the value of 0x0A0.

When alarm occurs, driver will set protective function and **motor stops moving**. Error code will be displayed on the front panel. Alarm history record can also be viewed in data monitoring mode, with the alarm log sub-menu displaying "d12Er".



The list of error codes is shown below:
Save: Save the history of the error.
Stopping category: The drive will stop with an alarm fault when an error occurs, and the stopping method for category 1 and 2 faults can be set through P05.10 [Servo Alarm Stopping Sequence Mode].
Clearable: Alarms (reset alarms) can be cleared via DI inputs/front panel/commissioning software, but the conditions that actually caused the fault may still exist. To clear the alarm from the front panel, use the **AFACL** alarm clearing function in the auxiliary functions.

Table 8.1 Error Code List

Error code		Content	Attribute		
Main	Sub		Save	Type	Clearable
09	0	FPGA communication error	●	2	
	1	FPGA write CRC check error	●	2	
	2	FPGA read CRC check error	●	2	
0A	0~1	Circuiuit U;V currennt detection error	●	2	
	3	Motor power cable not connected	●	1	●
	5	DC bus circuit error	●	2	
	6	Temperature detection circuit error	●	2	
0b	0	Control circuit power supply voltage too low		2	
	1	Control circuit power supply voltage too high		2	●
	2	Control power off		2	
0c	0	DC bus overvoltage	●	1	●
0d	0	DC bus undervoltage	●	1	●
	1	RST main phase power loose	●	2	●
	2	No main power supply detected		2	●
	3	SEMI-F47 under voltage	●	1	●
	4	Phase R power supply disconnected		2	●
	5	Phase S power supply disconnected		2	●
	6	Phase T power supply disconnected		2	●
0E	0	Overcurrent	●	1	
	1	Intelligent Power Module (IPM) overcurrent	●	1	
	2	Power output to motor shorted to ground	●	1	

	4	Phase overcurrent	●	1	
	5	Phase U overcurrent	●	1	
	6	Phase V overcurrent	●	1	
	7	Phase W overcurrent	●	1	
0F	0	Driver overheated	●	2	
	1	Motor overheated alarm	●	2	
10	0	Motor overloaded	●	1	●
	1	Driver overloaded	●	1	●
	2	Motor rotor blocked	●	1	●
	3	Motor collision faults	●	2	●
	4	Driver output overload at low speeds	●	1	●
11	1	Cooling fan failure	●	2	
12	0	Regenerative resistor overvoltage	●	2	
	1	Discharge transistor fault	●	1	
	2	Regenerative resistor value too low		2	
	3	Regenerative circuit overcurrent	●	1	
15	0	Encoder disconnected	●	1	
	1	Encoder communication error	●	1	
	2	Encoder initial position error	●	1	
	3	Multiturn encoder battery error	●	2	
	4	Encoder parameter download failure	●	2	
	5	Multiturn encoder count jump	●	2	●
	6	Encoder overheated	●	2	●
	7	Multiturn encoder data count overflow	●	2	●
	8	SPI magnetic encoder status alarms (demagnetisation, under-voltage, over-voltage, etc.)	●	2	●
	d	Encoder Disconnection (UVW)	●	1	●
	E	Encoder single-turn reset fault	●	1	
	F	Encoder single-turn reset	●	1	

		fault			
17	0	Encoder data error	●	1	
	1	Encoder parameter initialization error	●	2	
18	0	Excessive position deviation	●	2	●
	1	Excessive velocity deviation	●	2	●
19	0	Excessive hybrid position deviation	●	2	●
1A	0	Overspeed	●	2	●
	1	Velocity out of control	●	1	
1b	0	Bus input signal dithering	●	2	●
	1	Incorrect electronic gear ratio	●	2	●
	2	Single-turn absolute value mode exceeds the upper and lower limits of the single-turn position	●	2	●
	3	External encoder frequency divider value error	●	2	●
	7	command overflow	●	2	●
	8	Absolute multiturn data setting out of limits	●	2	●
	9	Origin offset setting error	●	2	●
	A	Electronic gear ratio numerator error	●	2	●
1c	0	Both STO failed	●	1	●
	1	1st STO failed	●	1	●
	2	2nd STO failed	●	1	●
	3	STO power supply 1 anomaly	●	1	●
	4	STO power supply 2 anomaly	●	1	●
	5	STO input circuit 1 anomaly	●	1	●
	6	STO input circuit 2 anomaly	●	1	●
	7	STO circuit BUFFER 1 anomaly	●	1	●
	8	STO circuit BUFFER 2 anomaly	●	1	●
	9	STO Software Process Monitoring Abnormalities	●	1	●
21	0	I/O input interface assignment error	●	2	●

	1	I/O input interface function assignment error	●	2	●
	2	I/O output interface function assignment error	●	2	●
24	0	EEPROM parameters initialization error		2	
	1	EEPROM hardware error		2	
	2	EEPROM seve overspeed error		2	●
	3	EEPROM save vendor parameter error		2	
	4	EEPROM save communication parameter error		2	
	5	EEPROM save device parameter error		2	
	6	EEPROM save, read power failure information error		2	
	E	Hardware information parameter validation error		2	
	F	Hardware information parameter validation error		2	
26	0	Positive/negative out-of-range input valid	●	2	●
28	0	Pulse regeneration limit protection	●	2	●
41	0	Identified encoder line count does not match the set value		1	●
42	0	Motor parameter identification error		1	●
	1	Motor parameter identification error (motor not at standstill)		1	●
	2	Motor parameter identification error (resistance out of range)		1	●
	3	Motor parameter identification error (inductance out of range)		1	●
	4	Motor parameter identification error (back EMF out of range)		1	●
	5	Motor parameter		1	●

		identification error (travel distance too short)			
43	6	Relative continuous mode not supported		1	●
57	0	Forced alarm input valid	●	2	●
	1	PC forced alarm input active		2	●
5F	0	Motor code error		2	
	1	Driver chip select recognition abnormality		2	
	3	Drive power selection fault		2	
	4	Motor voltage level unmatched fault		2	
	5	Driver voltage level identity abnormal		2	
	6	Abnormal matching of drive model and motor model		2	
60	0	Main loop interrupted timeout		2	●
	1	Velocity loop interrupted timeout		2	●
	2	interrupt timeout fault		2	●
	3	Loss of interruptions for dual-core interactions		2	●
	4	Internal storage anomaly		2	●
	5	Timing configuration error	●	2	
70	0	Encryption error		2	
72	b	PLC control error		2	●
	c	Node protection or Hearbeat timeout		2	●
89	0	Homing error		2	●

[Note:]

Some newly added alarms have not been synchronised with 603F; in this case, the 603F corresponding to the alarm is 0XFFF0

7.4 Alarm Handling

***When error occurs, please solve accordingly. Then, restart.*

Error code	Main	Sub	**Display:** “Er 090” --“Er 092”	
	09	0~2	**Contents: FPGA communication error**	
Cause			Diagnosis	Solution
FPGA failure, can not start normally.			Power on several times, the fault still exists .	Replace servo drive; contact manufacturer.
Error code	Main	Sub	**Display:** “Er 0A0”--“Er 0A1”	
	0A	0~1	**Content: Circuit current detection error**	
Cause			Diagnosis	Solution
Motor power cable wiring error			Verify motor power cable wiring	Make sure U,V,W terminal wired properly
Main power supply undervoltage			Verify L1,L2,L3 terminal voltage	Increase main power supply voltage
Driver fault			Repeatedly connect power, check if the fault still exists.	Replace driver
Analog input 1 wiring error.			Check the wiring of analog input 1.	Ensure that the analog input 1 wiring is correct.
Internal drive fault.			Confirm that the analog input wiring is correct, and repeatedly connect power, check if the fault still exists.	Replace with a new drive.

Error code	Main	Sub	Display: "Er 0A3"	
	0A	3	Content: UVW Disconnect	
Cause			Diagnosis	Solution
Power cable disconnection or phase loss.			Check whether the power cable is disconnected or missing a phase.	Confirm if the power cable has a disconnection or poor contact
Motor winding open circuit.			With the extension cable connected to the motor, use a multimeter to measure the resistance between winding wires. If the three-phase resistance is inconsistent, the winding may be open or the motor may be damaged.	Replace motor
Driver fault			Check that the above two conditions are not present, and operation is normal after replacing the drive.	Replace driver
Excessive deviation between current reference and feedback.			Check whether the deviation between the current reference and feedback is too large using the debugging software oscilloscope.	Appropriately increase parameter PA7.19 field weakening current ; Contact manufacturer

Error code	Main	Sub	Display: "Er 0A5"	
	0A	5	Contents: DC bus circuit error	
Cause			Diagnosis	Solution
Whether the voltage of any two phases of the main circuit L1/L2(L3) or RST input terminals is too low.			Measure the main circuit cable L1/L2/(L3) or RST input voltage to ensure that it meets the following specifications: 220V Servo drive: Valid value: 220V-240V Allowable deviation: -10%~+10% (198V~264V) 380V Servo drive: Valid value: 380V-440V Allowable deviation: -10%~+10% (342V~484V). Check whether the charge indicator is lighted or not. 2. Check drive d27 bus voltage.	1. Ensure that the L1/L2(L3) or RST input voltage meets the following specifications

	3、Measure the DC voltage between P+(Pr), N bus voltage between P+(Pr) and N to meet the requirements: 220V drive DC bus voltage: about 310V 380V drive DC bus voltage: about 540V	
Driver fault	If all the above have been checked, repeatedly connect power, check if the fault still exists.	Replace driver

Error code	Main	Sub	**Display:** "Er0A6"
	0A	6	**Content: Temperature detection circuit error**

Cause	Diagnosis	Solution
Whether the voltage of any two phases of the main circuit L1/L2 (L3) or RST input terminals is too low.	Check whether the voltage of any two phases of the main circuit L1/L2 (L3) or RST input terminals is too low.	Make sure that the main circuit L1/L2 (L3) or RST input terminal voltage is in the proper range.
Driver fault	/	Replace driver

Error code	Main	Sub	**Display:** "Er0B0"
	0B	0	**Content: Control power supply voltage too low**

Cause	Diagnosis	Solution
The control power supply voltage of the Servo Drive with L1C/L2C power terminals is unstable, too low, or power down.	1. Confirm whether it is in the process of cutting off the control power (L1C L2C) or an instantaneous power failure occurs. 2.Measure whether the input voltage to the L1C and L2C terminals of the driver meets the following specifications: 220V servo drive: Valid value: 220V-240V Allowable deviation: -10%~+10% (198V~264V) 380V servo drive: Valid value: 380V-440V	1, re-power on . Check whether it still appears, if it still appears, you need to ensure that the power supply is not abnormal power loss or confirm whether the input voltage meets the specifications. 2、Check whether the input voltage of L1C and L2C terminals meets the left input specification.

<table>
<tr><td colspan="3"></td><td>Allowable deviation:
-10%~+10%
(342V~484V).</td><td></td></tr>
<tr><td colspan="3">Control power cable of servo drive with L1C/L2C power terminals, bad contact</td><td>Detect whether the cable is connected, and measure the voltage on the servo driver side (L1C, L2C) of the control cable to ensure that it meets the above requirements.</td><td>Rewire or replace cable</td></tr>
<tr><td colspan="3">Insufficient power supply capacity and voltage degradation due to mains shock.</td><td>Measurement of the input voltage of the control cable for sudden changes in voltage</td><td>Increase power supply capacity on L1C, L2C terminals</td></tr>
<tr><td colspan="3">Driver fault</td><td>/</td><td>Replace driver</td></tr>
<tr><td rowspan="2">Error code</td><td>Main</td><td>Sub</td><td colspan="2">Display: “Er 0b1”</td></tr>
<tr><td>0b</td><td>1</td><td colspan="2">Content: Control power supply voltage too high</td></tr>
<tr><td colspan="3">Cause</td><td>Diagnosis</td><td>Solution</td></tr>
<tr><td colspan="3">Input control power supply voltage is unstable or too high</td><td>Measure the input voltage of the control cable L1C/L2C to see if it meets the input specifications.
Measure the input voltage of the control cable L1C/L2C to ensure that it meets the input specifications:
220V Servo drive:
Valid values:
220V-240V
Allowable deviation:
-10%~+10%
(198V~264V)
380V Servo drive:
Valid value: 380V-440V

Allowable deviation:
-10%~+10%
(342V~484V)</td><td>Reconnect to a power source that meets the voltage specifications on the left side.</td></tr>
</table>

Driver fault	If all the above have been checked, repeatedly connect power, check if the fault still exists.	Replace driver

Error code	Main	Sub	**Display:** "Er0b2"
	0b	2	**Content: Control power off**

Cause	Diagnosis	Solution
Controls power down when USB is active only	Check that the fault is cleared when both mains and control power are switched on.	Check that the fault is cleared when both mains and control are powered up, normally this fault is only reported when the USB power supply is active.

Error code	Main	Sub	**Display:** "Er 0c0"
	0c	0	**Content: DC bus overvoltage**

Cause	Diagnosis	Solution
Motor operation acceleration and deceleration times are too short and regenerative energy exceeds the absorbable value.	Capture the waveform through the commissioning software oscilloscope to check if the bus voltage is in the deceleration section when the voltage exceeds the fault value.	Ensure that the main circuit input voltage is within specification, increase the acceleration and deceleration times where permitted, or replace the regenerative resistor with a more powerful one.
Braking resistor not discharging.(Commonly caused by failing to update PA2.52 when connecting an external resistor to a 400W drive lacking an internal resistor.)	Check if the braking resistor is actually connected, but parameter PA2.52 is not set to 0 to enable resistor discharge mode.	Set PA2.52 to 0 to discharge energy through the braking resistor.
Regenerative discharge threshold parameter error.	Check whether the bus voltage discharge threshold parameter PA2.53 is normal.	Change PA2.53 to the normal bus discharge voltage threshold parameter to enable discharge before the overvoltage point.
Overload; regenerative energy exceeds capacity.	Confirm whether the load is too large, causing the bus voltage to rise to the fault value during acceleration or deceleration.	Extend the acceleration/deceleration time or reduce the load.
Drive fault; internal braking circuit damaged.	If all the above have been checked, repeatedly connect power, check if the fault.	Replace with a new drive.

Error code	Main	Sub	**Display:** "Er 0d0"
	0d	0	**Content**: **DC bus undervoltage**

Cause	Diagnosis	Solution
Main circuit input undervoltage.	Verify the servo input power by measuring the voltage at terminals L1/L2(L3) or RST to ensure it meets specifications—specifically 198V–264V for 220V drives and 342V–484V for 380V drives—while confirming the charge indicator LED is illuminated; additionally, monitor the d27 bus voltage and measure the DC bus voltage between P+ and N, ensuring values of approximately 310V for 220V drives (undervoltage threshold at 180V) and approximately 540V for 380V drives (undervoltage threshold at 540V).	Increase the L1/L2(L3) or RST input voltage according to the power specifications on the left.
Power supply unstable or voltage fluctuation.	Monitor the servo drive input power voltage and check if the same main circuit power supply has too many loads, causing insufficient power capacity and leading to voltage drop.	Increase the power capacity or connect to a stable and reliable power supply.
Drive fault.	After powering off multiple times, the fault is still reported after reconnecting main circuit power L1, L2, (L3) / (RST).	Replace with a new drive.

Error code	Main	Sub	
	0d	1	**Display:** "Er 0d1"
			Content: **Mains input phase loss**

Cause	Diagnosis	Solution
Main power supply undervoltage	Verify L1,L2,L3 terminal voltage	Increase main power supply voltage
Main power supply wiring error	Loose connection of L1, L2, L3	Secure connections
Driver fault	/	Replace driver

Error code	Main	Sub	Display: "Er 0d2"	
	0d	2	Content: **No main power supply detected**	
Cause			Diagnosis	Solution
Main power input undervoltage.			Measure all three phases of the input voltage at the drive side. Ensure values meet specifications: 220V drive (198V~264V) or 380V drive (342V~484V).	Increase the L1/L2/L3 or RST input voltage according to the power specifications on the left.
Main circuit wiring abnormality.			Check whether the wiring of main circuit terminals L1, L2, L3 / RST is correct and reliable.	Reconnect the main circuit power cable correctly and reliably.
Drive fault.			If all the above have been checked, the fault is still reported after reconnecting main circuit power following multiple power-offs.	Replace with a new drive.

Error code	Main	Sub	Display: "Er 0d3"	
	0d	3	Content: **SEMI-F47 under voltage**	
Cause			Diagnosis	Solution
Main power loss exceeds P05.72 (SEMI F47) threshold.			Check the servo input power specifications and measure whether there is a power loss in the main circuit cable servo drive side L1/L2(L3) or RST input voltage.	Increase the reporting time of the P05.72 F47 undervoltage alarm without affecting the operation of the equipment.
Error code	Main	Sub	**Display:** "Er 0d4"	
	0d	4	Content: **Phase R power supply disconnected**	
Cause			Diagnosis	Solution
Power supply R-phase loss.			Check whether the wiring of main power R/S/T phases is correct and reliable.	Reconnect the main circuit R/S/T power wiring correctly and reliably.
Error code	Main	Sub	**Display:** "Er 0d5"	
	0d	5	Content: **Phase S power supply disconnected**	
Cause			Diagnosis	Solution
Power supply S-phase loss.			Check whether the wiring of main power R/S/T phases is correct and reliable.	Reconnect the main circuit R/S/T power wiring correctly and reliably.
Error code	Main	Sub	**Display:** "Er 0d6"	
	0d	6	Content: **Phase T power supply disconnected**	
Cause			Diagnosis	Solution

Power supply T-phase loss.			Check whether the wiring of main power R/S/T phases is correct and reliable.	Reconnect the main circuit R/S/T power wiring correctly and reliably.
Error code	Main	Sub	**Display:** "Er 0E0"	
	0E	0	**Content: Software overcurrent**	
Cause			Diagnosis	Solution
Driver power output short circuit			Verify if there is short circuit between UVW terminals, or shorted to PG.	1. Make sure there is no circuit. 2. Make sure motor is not damaged
Motor wiring error			Verify motor wiring	Reconnect motor wiring
IGBT module short circuit			Disconnect motor output cable. Then, enable servo driver to check for overcurrent	Replace driver
Excessive motor load			Verify if motor torque output is too high	1. Reduce load 2. Add a gearbox
Excessive acceleration and deceleration			Verify if acceleration and deceleration duration time are too low	Increase acceleration and deceleration duration time
Motor wiring short circuit			Connect motor power cable to driver power output. Verify if resistance value of UVW to PE is equal and if there is short circuit	Replace motor
Error code	Main	Sub	**Display:** "Er 0E1"	
	0E	1	**Content**: **Intelligent Power Module (IPM) overcurrent**	
Cause			Diagnosis	Solution
Driver power output short circuit			Verify if there is short circuit between UVW terminals, or shorted to PG.	1. Make sure there is no circuit. 2. Make sure motor is not damaged
Motor wiring error			Verify motor wiring	Reconnect motor wiring
IGBT module short circuit			Disconnect motor output cable. Then, enable servo driver to check for overcurrent	Replace driver
IGBT module undervoltage			/	Replace driver
Excessive motor load			Verify if motor torque output is too high	1. Reduce load 2. Add a gearbox
Excessive acceleration and deceleration			Verify if acceleration and deceleration duration time are too low	Increase acceleration and deceleration duration time
Motor wiring short circuit			Connect motor power cable to driver power output. Verify if resistance value of UVW to PE is equal and if there is short circuit	Replace motor

Error code	Main	Sub	Display: "Er 0E2"	
	0E	2	**Content**: **Power output to motor shorted to ground**	
Cause			Diagnosis	Solution
Driver U, V, W terminals shorted to ground			Disconnect motor power cable and check for short circuit between driver UVW and PE	1. Reconnect wiring. 2. Change motor power cable.
Motor shorted to ground			Connect motor power cable to driver power output. Verify if resistance value of UVW to PE is in the range of MegaOhm (MΩ)	Replace motor
Driver fault			/	Replace driver

Error code	Main	Sub	Display: "Er 0E4"	
	0E	4	**Content**: **Phase overcurrent**	
Cause			Diagnosis	Solution
Driver U, V, W terminals shorted to ground			Disconnect motor power cable and check for short circuit between driver UVW and PE	1. Reconnect wiring. 2. Change motor power cable.
Motor shorted to ground			Connect motor power cable to driver power output. Verify if resistance value of UVW to PE is equal and if there is short circuit	Replace motor
Driver fault			/	Replace driver
Error code	Main	Sub	**Display:** "Er 0E5"	
	0E	5	**Content**: **Phase U overcurrent**	
Cause			Diagnosis	Solution
Motor cable poor contact.			Check whether the connection between the two ends of the servo drive power cable and the servo drive U/V/W side of the motor cable is loose.	Tighten any loose or detached wiring.
Motor cable grounded.			Ensure that after the servo drive power cable and motor cable are tightly connected, measure whether the insulation resistance between the servo drive U/V/W terminals and the ground wire (PE) is in the megaohm (MΩ) range.	Replace the motor if insulation is poor.
Motor short circuit.			Unplug the motor cable and measure whether the resistance between any two phases of the motor cable U/V/W is balanced. Check if U/V/W is short-circuited to ground (PE).	Replace the motor if unbalanced.

Error code	Main	Sub	Display: "Er 0E6"	
	0E	6	Content: Phase V overcurrent	
Cause			Diagnosis	Solution
Motor cable poor contact.			Check whether the connection between the two ends of the servo drive power cable and the servo drive U/V/W side of the motor cable is loose.	Tighten any loose or detached wiring.
Motor cable grounded.			Ensure that after the servo drive power cable and motor cable are tightly connected, measure whether the insulation resistance between the servo drive U/V/W terminals and the ground wire (PE) is in the megaohm (MΩ) range.	Replace the motor if insulation is poor.
Motor short circuit.			Unplug the motor cable and measure whether the resistance between any two phases of the motor cable U/V/W is balanced. Check if U/V/W is short-circuited to ground (PE).	Replace the motor if unbalanced.
Error code	Main	Sub	Display: "Er 0E7"	
	0E	7	Content: Phase W overcurrent	
Cause			Diagnosis	Solution
Motor cable poor contact.			Check whether the connection between the two ends of the servo drive power cable and the servo drive U/V/W side of the motor cable is loose.	Tighten any loose or detached wiring.
Motor cable grounded.			Ensure that after the servo drive power cable and motor cable are tightly connected, measure whether the insulation resistance between the servo drive U/V/W terminals and the ground wire (PE) is in the megaohm (MΩ) range.	Replace the motor if insulation is poor.
Motor short circuit.			Unplug the motor cable and measure whether the resistance between any two phases of the motor cable U/V/W is balanced. Check if U/V/W is short-circuited to ground (PE).	Replace the motor if unbalanced.

Error code	Main	Sub	Display: "Er 0F0"	
	0F	0	Content: Driver overheated	
Cause			Diagnosis	Solution
Driver's power module overtemperature (D33 Driver's temperature exceeds PA2.49).			Measure whether the ambient temperature exceeds 55°C, and measure whether the actual temperature of the drive heatsink is higher than the PA2.49 over-temperature threshold setting.	Improve heat dissipation conditions and lower the ambient temperature
Fan failure causing overtemperature.			Check if the fan operates when enabled.	Replace the servo drive.
Improper installation/spacing causing overtemperature.			Confirm whether the installation of the servo drive is reasonable.	Install according to the servo drive installation standards.
Servo drive fault.			If the fault is still reported after restarting following a 10-minute power-off cooling period.	Replace the servo drive.
Error code	Main	Sub	Display: "Er 0F1"	
	0F	1	Content: Motor overheated alarm	
Cause			Diagnosis	Solution
Motor temperature exceeds P04.33 threshold.			Confirm whether the motor temperature exceeds the set range.	Improve ambient temperature or cooling if the motor overheats. For false alarms, contact the manufacturer to inspect for PTC sensor abnormalities.
Error code	Main	Sub	Display: "Er 100"	
	10	0	Content: Motor overloaded	
Cause			Diagnosis	Solution
Heavy load; torque exceeds rating for extended time.			Confirm the motor overload curve, and check if the actual load is the rated load. You can view via status monitoring whether the servo drive average load ratio D07_01 is greater than 100% for a long time; confirm whether the D15 overload ratio has a rising trend, and if it reaches 100, alarm ER100 will be reported.	Replace with a larger capacity servo drive and matching motor; Reduce the load or increase the acceleration/deceleration time.
Frequent			Calculate the mechanical inertia	Increase the acceleration/deceleration

accelerate/decelerate or high load inertia.	ratio or perform inertia identification to check if the P00.04 inertia ratio is set correctly; confirm the single run cycle when the motor operates reciprocally.	time in a single run； Reduce the operation frequency and lengthen the pause time.
Improper gain or high stiffness causing system oscillation.	Check whether the motor or machinery vibrates during operation, and whether the sound is abnormal.	Re-adjust gain parameters or reduce stiffness.
Motor/Encoder wiring error or poor contact.	Verify motor and encoder wiring for connection errors or cable breaks. For self-made cables, ensure the pinout definitions are correct.	Correct the wiring or replace with Leadshine original cables. Ensure self-made cables strictly follow the hardware pinout definitions.
P04.20 Overload level set too low.	Check whether the P04.20 overload level setting has been manually modified to be too small by mistake; overload is easily reported when it is less than 100%.	Change P04.20 to the default value.
Motor average load ratio too high.	You can check via status monitoring channel 23 whether the servo drive average load ratio is close to or reaches 100% for a long time.	Change P04.20 to 115; when setting this parameter value, ensure that the motor heat dissipation environment is good and the motor will not overheat.
Motor brake failed to operate.	Check whether the motor brake wiring and whether the brake is open.	Re-adjust the brake wiring to ensure the brake opens after enabling.
Servo drive fault.	If all the above have been checked, repeatedly connect power, check if the fault still exists.	Replace the servo drive.

Error code	Main	Sub	**Display:** “Er101”
	10	1	**Content: Drive Overload**

Cause	Diagnosis	Solution
Servo driver UVW output phase missing, broken wire, wrong phase sequence connection	Perform a trial run of the motor without a load to confirm that the error still exists; Check that the motor winding wires UVW and drive terminal wiring phase sequence is correct	Confirm the phase sequence of the motor winding wiring, UVW corresponding connection, to ensure that the wiring is correct.
Mismatch between servo drive and motor	Check that the actual matching motor rated current is greater than the drive rated current. The actual	The rated current of the motor is higher than the rated current of the drive, replace the drive with a high power

power, small drive with large motor	load is larger, resulting in the motor current being larger than the drive rated current, but not reaching the motor rated current	one that matches the motor.
P04.20 Overload level set too low.	Check whether the P04.20 overload level setting has been manually modified to be too small by mistake; overload is easily reported when it is less than 100%.	Change P04.20 to the default value.
Motor average load ratio too high.	You can check via status monitoring channel 23 whether the servo drive average load ratio is close to or reaches 100% for a long time.	Change P04.20 to 115; when setting this parameter value, ensure that the motor heat dissipation environment is good and the motor will not overheat.
Servo drive fault.	If all the above have been checked, repeatedly connect power, check if the fault still exists.	Replace the servo drive.

Error code	Main	Sub	**Display:** "Er 102"
	10	2	**Content: Motor rotor blocked**

Cause	Diagnosis	Solution
U/V/W output phase loss, open, or wrong sequence.	Perform a motor trial run without load to confirm whether the error still exists; check whether the phase sequence of the motor winding wires U/V/W and the drive terminals is correct.	Confirm the wiring phase sequence of the motor winding wires; connect U, V, and W one-to-one to ensure correct wiring.
Motor locked rotor due to mechanical issue.	Verify if the load is stuck or hitting a hard limit. Use the software oscilloscope to confirm if the motor speed remains 0 during active commands, and if the current feedback reaches the Parameter P04.23 torque threshold for the duration of Parameter P04.24.	Confirm that the load has not hit a hard limit or is stuck
Locked rotor alarm parameters unreasonable.	Check whether locked-rotor parameters P04.23 and P04.24 are set too small.	Set the locked-rotor torque P04.23 and locked-rotor time P04.24 parameters reasonably.
Incorrect motor parameters (Pole pairs) or ENC tuning needed.	Confirm whether the PA1.10 encoder automatic ROM read setting in PA1 group parameters is 0x0, and whether the PA0.01 pole pair number is correct; if the above parameters are correct, perform	Set the motor parameters correctly.

	angle identification on the motor multiple times, and confirm whether the PA1.08 angle compensation is consistent.		
Error code	Main	Sub	**Display:** "Er 103"
	10	3	**Content: Motor collision faults**
Cause	Diagnosis		Solution
Motor collision during operation.	When the motor speed is less than the P47.03 threshold, the current is greater than P47.01/P47.02. Confirm whether the setting values are reasonable, and whether a collision occurred or it is a false alarm.		Set P47.03 and P47.01/P47.02 reasonably to ensure normal operation without false alarms.
Error code	Main	Sub	**Display:** "Er 104"
	10	4	**Content: Drive output overload at low speeds**
Cause	Diagnosis		Solution
Excessive current at low speed or locked rotor.	Check if speed < 20rpm and limits P04.28/P04.29 are exceeded. Determine if this operation is intended or abnormal.		Upgrade to a larger servo if low-speed/locked-rotor use is required. Otherwise, no action is needed; the alarm acts as a protective measure.
Drive/Motor power mismatch (Undersized drive).	Check whether the rated current of the actual matching motor is greater than the rated current of the drive, and if the actual load is large, causing the motor current to be greater than the drive low-speed overload current under low-speed operation conditions.		If the motor rated current is greater than the drive rated current, replace with a high-power drive that matches the motor.
Error code	Main	Sub	**Display:** "Er 111"
	11	1	**Content: Cooling fan failure**
Cause		Diagnosis	Solution
Cooling fan damaged.		Check if the fan is running during operation.	Replace the drive
Error code	Main	Sub	**Display:** "Er 120"
	12	0	**Content: Regenerative resistor overvoltage**
Cause		Diagnosis	Solution
Accel/Decel too fast; frequent regenerative discharge.		Check if short accel/decel times or intense motion are causing frequent resistor discharge.	Ensure input voltage meets specifications. Increase accel/decel, reduce speed/inertia, or upgrade the regenerative resistor.

Main circuit voltage too high causes unstable.		Check whether the main circuit input voltage is too high, causing continuous discharge.	Ensure the input voltage is stable and within the rated input range.
PA2.52=0 (Resistor used) but not connected.		Confirm whether the drive parameter PA2.52 is set to 0, but no discharge resistor is connected.	Correctly connect a discharge resistor of appropriate specifications.
Resistor too small or P00.21/P00.22 resistance/power settings too low.		Verify resistor sizing and ensure P00.21/P00.22 match the actual hardware specifications.	Install a compliant regenerative resistor and set P00.21/P00.22 to match the actual specifications.
Discharge resistor wiring poor, loose, or open.		Confirm that the regenerative discharge resistor wiring at P+/BR(B2) is reliably connected.	Correctly wire the discharge resistor.
Discharge resistor damaged.		The braking resistor is open circuit; measure the external regenerative resistor resistance value and confirm if the resistance is infinite.	Replace the regenerative resistor.
Discharge circuit damaged.		If all the above have been checked, and the fault is still reported after powering on again for no-load operation following multiple power-offs.	Replace with a new drive.
Error code	Main 12	Sub 1	**Display:** "Er 121" **Content: Regeneration transistor failure**
Cause		Diagnosis	Solution
Braking IGBT damaged.		If all the above have been checked, and the fault is still reported after powering on again for no-load operation following multiple power-offs.	Replace with a new drive.
Error code	Main 12	Sub 2	**Display:** "Er 122" **Content: Regenerative resistor value too low**
Cause		Diagnosis	Solution

P00.21 Regenerative resistor value below minimum allowed.	Confirm whether the P00.21 regenerative resistor resistance setting is too small, and whether it is less than the minimum value.	Use a compliant regenerative resistor and set P00.21/P00.22 to match actual hardware specifications.

Error code	Main	Sub	**Display:** "Er 123"
	12	3	**Content: Regenerative resistor overcurrent**

Cause	Diagnosis	Solution
External regenerative resistor too small	External regenerative resistor resistance is too small, resulting in excessive bleeder current	Replace the external regenerative resistor with one that meets the specifications, the resistance value needs to be greater than the minimum value

Error code	Main	Sub	**Display:** "Er 150"
	15	0	**Content: Encoder disconnected**

Cause	Diagnosis	Solution
Encoder cable open/short or impedance too high.	Confirm whether the encoder cable is normal; whether the definition of the self-made cable is correct; whether the cable is reliably connected. If the fault no longer occurs after replacing with a normally usable encoder cable, it indicates the original cable is damaged.	Replace with Leadshine original factory cable; Secure the encoder cable wiring.
Encoder port poor contact or wiring error on drive side.	Confirm the status of the encoder connection port and whether there is poor contact.	Re-insert the encoder plug and confirm the encoder wiring.
Connector contact poor due to environment (moisture/vibration).	Determine whether there is excessive water vapor, oil pollution, or vibration in the usage environment.	Improve the usage environment and replace with original factory cable. If the fault is still reported, replace the servo drive or motor.
Encoder damaged.	If the fault is still reported after checking all the above, replacing with another normally usable motor, and powering on again does not report the fault.	Replace with a new motor.
Encoder measurement circuit damaged.	If the fault is still reported after checking all the above, replacing with another normally usable servo drive, and powering on again does not report the fault.	Replace with a new drive.

Error code	Main	Sub	Display: "Er 151"	
	15	1	Content: Encoder communication error	
Cause			Diagnosis	Solution
Encoder cable shield missing.			Check whether the encoder is a shielded twisted pair cable. Monitor D30 count increase, proving that interference exists.	Change the cable type to a shielded twisted pair encoder cable.
Encoder port poor contact or wiring error on drive side.			Confirm the status of the encoder connection port and whether there is poor contact.	Re-insert the encoder plug and confirm the encoder wiring.
Encoder cable open/short or impedance too high.			Confirm whether the encoder cable is normal; whether the definition of the self-made cable is correct; whether the cable is reliably connected. If the fault no longer occurs after replacing with a normally usable encoder cable, it indicates the original cable is damaged.	Replace with Leadshine original factory cable; Secure the encoder cable wiring.
Excessive interference on encoder cable.			Ensure encoder cables are separated from power lines and kept away from interference sources like welding machines.	Enhance encoder cable noise immunity using shielded twisted pairs with proper grounding. Route cables separately from high-power lines.
Encoder damaged.			If the fault is still reported after checking all the above, replacing with another normally usable motor, and powering on again does not report the fault.	Replace with a new motor.

Error code	Main	Sub	Display: "Er 152"	
	15	2	Content: Encoder match error	
Cause			Diagnosis	Solution
Motor encoder type not supported.			Check whether the motor model is a matching motor for this servo model.	For third-party motors, please contact the manufacturer's technical support to ask if it is supported.
Error code	Main	Sub	**Display:** "Er 153"	
	15	3	**Content: Multiturn encoder battery error**	
Cause			Diagnosis	Solution
First-time use			Check if it's the first-time use of the	Execute homing and calibrate the origin. Set P10.09 to 9 to clear multi-turn data and reset

	multi-turn function without performing multi-turn clearing and encoder alarm reset.	alarms.
Multi-turn encoder battery low or cable disconnected.	Check whether the battery voltage in the battery box is lower than 2.5V; check whether the multi-turn data is lost or changed.	Replace the battery; after replacing the battery, perform multi-turn clearing and reset the multi-turn alarm, then restart the drive; perform reset of the multi-turn alarm.
Multi-turn function enabled but motor not supported.	Check whether the motor model used has multi-turn absolute value function.	Replace with a multi-turn absolute encoder motor； Set Parameter PA0.15 to 0 to disable the multi-turn absolute value function.
Encoder battery disconnected during power off.	Confirm whether the encoder battery might have been disconnected during the drive power-off period.	Ensure the battery connection is reliable；Set Parameter P10.10 to 9 to perform multi-turn clearing and reset multi-turn alarms.
Encoder overtemperature (Tamagawa encoder).	Check the motor temperature; verify if it is caused by motor heat conduction; exceeding 90°C will cause an encoder overheat alarm.	Improve the motor heat dissipation environment and reduce the motor temperature.
Multi-turn data error/loss.	If there are no abnormalities in the above error causes, confirm whether the alarm occurred during operation.	The encoder cable needs to be routed separately from the power line

Error code	Main	Sub	**Display:** “Er 154”	
	15	4	**Content: Encoder parameter download failure**	
Cause			Diagnosis	Solution
Multi-turn mode set but motor lacks support.			Check if the motor possesses multi-turn absolute value function.	Replace with a multi-turn absolute encoder motor

Error code	Main	Sub	**Display:** “Er 155”
	15	5	**Content: Multiturn Encoder Multiturn Data Count Jumps**

Cause	Diagnosis	Solution
Encoder multi-turn data overflow.	When the servo drive works in P10.10=1 absolute linear mode, check whether the P05.08 multi-turn value exceeds 32767; check if the motor encoder is damaged.	Clear the multi-turn data and power on again.
Absolute mode setting error for unidirectional rotation.	-	Adjust the P10.10 absolute value application mode；Set to 2 - Multi-turn rotation mode.
Encoder damaged.	If the fault is still reported after checking all the above and re-running, replacing with another normally usable motor, and powering on again does not report the fault.	Replace with a new motor.

Error code	Main	Sub	**Display:** “Er 156”
	15	6	**Content: Encoder overheated**

Cause	Diagnosis	Solution
Encoder overtemperature (Tamagawa encoder).	Check the motor temperature; verify if it is caused by motor heat conduction; exceeding 90°C will cause an encoder overheat alarm.	Improve the motor heat dissipation environment and reduce the motor temperature.

Error code	Main	Sub	**Display:** “Er 157”
	15	7	**Content: Multiturn Encoder Multiturn Data Count Overflow**

Cause	Diagnosis	Solution
Encoder multi-turn data overflow.	When the servo drive works in P10.10=1 absolute linear mode, check whether the P05.08 multi-turn value exceeds 32767; check if the motor encoder is damaged.	Clear the multi-turn data and power on again.
Absolute mode setting error for unidirectional rotation.	-	Adjust the P10.10 absolute value application mode；Set to 2 - Multi-turn rotation mode.
Encoder damaged.	If the fault is still reported after checking all the above and re-running, replacing with another normally usable motor, and powering on again does not report the fault.	Replace with a new motor.

Error code	Main	Sub	Display: "Er 158"	
	15	8	**Content: SPI magnetic encoder status alarms (demagnetisation, under-voltage, over-voltage, etc.)**	
Cause			Diagnosis	Solution
Encoder power supply abnormal			Use meter test encoder power supply voltage	Undervoltage: Replace the encoder cable or reduce the cable length Overvoltage: Check for high-voltage interference
Error code	Main	Sub	**Display:** "Er 15d"	
	15	d	**Content: Encoder phase UVW disconnected**	
Cause			Diagnosis	Solution
Hall signal disconnected.			Check Hall wiring.	Ensure that the Hall signal wiring is correct without disconnection or breakage.

Error code	Main	Sub	Display: "Er 15E"	
	15	E	**Content: Encoder single-revolution reset fault**	
Cause			Diagnosis	Solution
The drive sends a total of six (default) single-revolution clear commands to the encoder			Re-power check whether error still exist.	Contact the manufacturer.

Error code	Main	Sub	Display: "Er 15F"	
	15	F	**Content: Encoder single-revolution reset fault**	
Cause			Diagnosis	Solution
The drive detects that the encoder has received a total of six (default) single-revolution clear commands.			Re-power check whether error still exist.	Contact the manufacturer.

Error code	Main	Sub	Display: “Er 170”
	17	0	Content: Encoder data error

Cause	Diagnosis	Solution
Communication data abnormality.	Ensure encoder voltage is DC5V±5%. Inspect cables for damage, verify proper grounding, and maintain separation from power lines.	Verify 5V supply and cable integrity. Ensure proper FG grounding and separate routing from power lines.
Encoder protocol parameter setting error.	Confirm whether PA0 group parameters have been modified; restore factory settings and check if the fault recovers.	Restore factory settings.
Motor encoder type not supported.	Check whether the motor model is a matching motor for this servo model.	For third-party motors, please contact the manufacturer's technical support to ask if it is supported.
Encoder damaged.	If the fault is still reported after checking all the above, replacing with another normally usable motor, and powering on again does not report the fault.	Replace with a new motor.
Encoder measurement circuit damaged.	If all the above have been checked, replacing with another normally usable servo drive, and powering on again does not report the fault.	Replace with a new drive.

Error code	Main	Sub	Display: "Er 171"
	17	1	**Content: Encoder parameter initialization error**

Cause	Diagnosis	Solution
Motor not initialized or Drive/Motor mismatch.	Check whether it is our company's drive and motor.	Replace the motor or manually input parameters.
Encoder protocol parameter error or mismatch.	Confirm whether PA0 group parameters have been modified; restore factory settings and check if the fault recovers.	Restore factory settings.
Error fetching parameters from encoder.	Check whether it is our company's standard encoder cable. Check for broken skin, broken wires, or poor contact at terminals on both sides.	Use our company's standard encoder cable；Ensure that the encoder connections on both the drive side and the motor side are tightened; replace with a new encoder cable if necessary.
Encoder damaged.	If the fault is still reported after checking all the above, replacing with another normally usable motor, and powering on again does not report the fault.	Replace with a new motor.

Error code	Main	Sub	Display: "Er 180"
	18	0	Content: Excessive position deviation

Cause	Diagnosis	Solution
U/V/W output phase loss, open, or wrong sequence.	Perform a motor trial run without load and check the wiring.	Rewire; the servo motor power cable and the servo drive power cable U, V, W must correspond one-to-one. Replace with a brand new cable if necessary and ensure reliable connection.
Position error due to mechanical locked rotor.	Check whether there is a mechanical collision or jam causing the motor to lock rotor.	Troubleshoot mechanical factors to ensure no locked rotor occurs.
External load too high.	Check if the load is too large and the motor rated torque cannot guarantee normal following.	Reduce the load.
Position error threshold parameter setting unreasonable.	Check whether the parameter P04.02 position deviation excessive threshold is too small.	Increase the setting value of parameter P04.02.
Drive gain set too low.	Check if the servo drive stiffness P21.02 is set too low; in manual mode, check the position loop gain and speed loop gain: First gain: P20.00~20.01, Second gain: P20.05~20.06.	Increase P21.02 stiffness or perform manual gain adjustment;Using after One-click tuning
Torque limit too low.	Check whether the values of parameters P12.01 and P12.02 are too small, leading to insufficient output and inability to follow normally.	Increase the values of parameters P12.01 and P12.02.
Position command increment too large.	Check whether the acceleration/deceleration time is too small or the rotation speed is too fast, causing the position error generated per unit time to be greater than P04.02.	Increase acceleration/deceleration time or reduce rotation speed
Servo drive or motor fault.	Monitor the position command speed and speed feedback via the debugging software oscilloscope function.	If the position command speed is not 0 but the speed feedback is always 0, please replace the servo drive/motor.

Error code	Main	Sub	Display: "Er 181"
	18	1	Content: Excessive velocity deviation

Cause	Diagnosis	Solution
Deviation between set velocity and actual velocity is too great	Verify if value of P06.02 is too low	1. Increase value of P06.02; 2. Set P06.02 to 0, position error detection off.
Acceleration and deceleration duration time for set velocity is too low	Verify if value of P03.12 and P03.13 are too low	1. Increase value of P03.12, P03.13; 2. Adjust velocity gain to reduce velocity lag error

Error code	Main	Sub	Display: "Er 190"
	19	0	Content: Motor vibration too strong

Cause	Diagnosis	Solution
System resonance; torque ripple exceeds P21.27.	Judge whether there is abnormal noise during operation or if the current feedback collected by the debugging software oscilloscope fluctuates greatly: 1. Gain is too large, producing resonance; 2. Machinery has a resonance point.	1.Set appropriate inertia ratio and reduce stiffness 2.Set P22.00 = 2 to enable adaptive notch filtering or configure the notch filter settings in the software's mechanical characteristics analysis
Current loop gain too high.	View the current loop gain value PA2.19.	Decrease the current loop gain.

Error code	Main	Sub	Display: "Er 1A0"
	1A	0	Content: Overspeed

Cause	Diagnosis	Solution
Motor cable U/V/W phase sequence error.	Check whether the connections of the servo drive power cable ends correspond one-to-one with the motor cable U V W ends and the servo drive U V W ends.	Wire according to the correct U, V, W phase sequence.
Motor speed exceeds P04.07 overspeed threshold.	Use the debugging software oscilloscope to capture the speed feedback waveform or check the alarm record to see if the speed feedback exceeds the overspeed fault threshold.	Reduce the speed command, adjust the servo gain, or adjust the operating conditions.
Input command exceeds P04.07 overspeed threshold.	Check if the motor speed command is too large: Check if the analog speed command voltage is too large; check if parameter P04.07 is too small; for pulse drives, check the input frequency of command pulses and convert to given speed to see if it is too large.	Adjust the input speed command magnitude
P04.07 Overspeed level	Check whether the P04.07 overspeed alarm threshold is less than the actual maximum	Reset the overspeed alarm threshold according to

setting error.	motor speed required for operation: Overspeed alarm threshold = 1.2 times motor maximum speed (P04.07=0); Overspeed fault threshold = P04.07 (P04.07≠0, and P04.07 < motor maximum speed).	mechanical requirements.
Encoder dirty/damaged causing abnormal speed feedback (32767 RPM).	Check the alarm record to see if the gap between speed reference and feedback is large, and if speed feedback reaches 32767RPM; you can also turn the motor shaft when disabled to check if the single-turn encoder position data jumps.	Replace with a new motor.
Internal drive fault.	If all the above have been checked, repeatedly connect power, check if the fault still exists.	Replace with a new drive.

Error code	Main	Sub	**Display:** "Er 1A1"
	1A	1	**Content: Velocity out of control**

Cause	Diagnosis	Solution
Motor cable U/V/W phase sequence error.	Check whether the connections of the servo drive power cable ends correspond one-to-one with the motor cable U V W ends and the servo drive U V W ends.	Wire according to the correct U, V, W phase sequence.
Encoder wiring error, corrosion, or interference causing communication error	Check wiring, monitor if D30 encoder error count increases, or check if the alarm record encoder error count has a value.	Anti-interference processing / Replace motor (Encoder fault).
Gravity load too high (Vertical axis).	Check whether the vertical axis load is too large, causing the speed direction to be inconsistent with the current direction or speed reference; this can be analyzed by capturing waveforms with the debugging software oscilloscope.	Reduce the vertical axis load, or increase stiffness, or mask this fault without affecting safety and use.
Special application	The actual motion direction of the servo motor is opposite to the motor output direction or the speed reference direction.	Evaluate the particularity of the actual application; without affecting safety and use, set P04.04 to 0X4 to mask the ER1A1 alarm.
Improper gain causing vibration/runaway.	Check if the stiffness level is too large causing excessive servo operation vibration.	Set appropriate inertia ratio and reduce stiffness

Error code	Main	Sub	Display: "Er 1b0"	
	1b	0	**Content: Pulse input frequency error/Bus input signal dithering**	
Cause			Diagnosis	Solution
Controller Synchronisation vibration too large.			Check whether the master station side synchronization offset setting is relatively large.	Decrease synchronization jitter. Try setting the master station side synchronization offset to 0.
			Check if the number of slave axes is too large while the synchronization cycle time setting is small.	Set the synchronization cycle time reasonably.
			The synchronization jitter range needs adjustment.	Increase P60.02, P60.03 or increase the P60.05 allowable jitter threshold.
			The synchronization mode command delay cycle number needs adjustment.	Set P60.04 to 2 to increase the delay.
Interference on pulse signal.			Verify pulse input uses shielded twisted pairs with proper grounding. Ensure cables are routed away from motor power lines and interference sources.	Apply EMC measures: use shielded twisted pairs with proper grounding. Route pulse lines away from power lines and interference.

Error code	Main	Sub	Display: "Er 1b1"	
	1b	1	**Content: Incorrect electronic gear ratio**	
Cause			Diagnosis	Solution
Values out of range			Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

Error code	Main	Sub	Display: "Er 1b2"	
	1b	2	Content: Single-turn absolute position exceeds upper/lower limits	
Cause			Diagnosis	Solution
Position change exceeds single turn (in Mode P10.10=3).			Check if P10.10 is in single-turn mode and verify if the motor stroke exceeds the single-turn position limits.	Verify that the PPR and electronic gear ratio are reasonable and the command stroke stays within single-turn limits; if single-turn mode was a mistake, set P10.10=1 for multi-turn linear absolute mode.

Error code	Main	Sub	Display: "Er 1b7"	
	1b	7	Content: command overflow	
Cause			Diagnosis	Solution
Position command overflow (32-bit limit) during limit signal.			Confirm whether the host computer continues to send commands after the servo limit warning occurs.	After the host computer recognizes that the servo limit signal is valid, stop sending commands in the limit direction.
Error code	Main	Sub	**Display:** "Er 1b8"	
	1b	8	**Content: Absolute multiturn data setting out of limits**	
Cause			Diagnosis	Solution
Rotation range exceeds limit (Multi-turn Mode P10.10=2).			In multi-turn rotation mode, if the electronic gear ratio, P10.11, or P10.12 is modified such that the feedback position (command unit) operation upper limit exceeds 2^31, an alarm occurs.	Modify the electronic gear ratio so that the upper limit of the rotation range is less than 2^31.
Error code	Main	Sub	**Display:** "Er 1b9"	
	1b	A	**Content: Electronic gear ratio numerator error**	
Cause			Diagnosis	Solution
Electronic gear ratio calculation overflow (>2^31).			Check whether the electronic gear ratio numerator setting exceeds the range: Electronic gear ratio numerator * 2^26 / Encoder lines < 2^31.	Correctly set the electronic gear ratio.
Error code	Main	Sub	**Display:** "Er 1c0"	
	1c	0	**Content: Both STO failed**	
Cause			Diagnosis	Solution

Both STO input signals valid			Check whether the STO function is enabled, and if the 24V input is disconnected normally.	Use normally, no processing required; after the STO terminal recovers, the 1C0 alarm will automatically reset the fault.
			Check if the STO power supply is normal.	Measure whether the 24V STO power supply is stable
			The switch or wiring connected to STO is disconnected abnormally.	Troubleshoot wiring and switches to ensure reliable connection and restore the switch to the closed state.
			Confirm that after the above three points, the fault still occurs.	Replace the servo drive.
Error code	Main	Sub	**Display:** "Er 1c1"	
	1c	1	**Content: 1st STO failed**	
Cause			Diagnosis	Solution
1st STO input signal valid			Check whether the STO function is enabled, and if the 1st STO 24V input is disconnected normally.	Use normally, no processing required; after the STO terminal recovers, use the fault reset function to clear the fault.
			Check if the 1st STO power supply is normal.	Measure whether the 24V STO power supply is stable
			The switch or wiring connected to the 1st STO is disconnected abnormally.	Troubleshoot wiring and switches to ensure reliable connection and restore the switch to the closed state.
			Confirm that after the above three points, the fault still occurs.	Replace the servo drive.
Error code	Main	Sub	**Display:** "Er 1c2"	
	1c	2	**Content: 2nd STO failed**	
Cause			Diagnosis	Solution
2nd STO input signal valid			Check whether the STO function is enabled, and if the 1st STO 24V input is disconnected normally.	Use normally, no processing required; after the STO terminal recovers, use the fault reset function to clear the fault.
			Check if the 1st STO power supply is normal.	Measure whether the 24V STO power supply is stable
			The switch or wiring connected to the 1st STO is disconnected abnormally.	Troubleshoot wiring and switches to ensure reliable connection and restore the switch to the closed state.
			Confirm that after the above three points, the fault still occurs.	Replace the servo drive.
Error code	Main	Sub	**Display:** "Er 1c3"	
	1c	3	**Content: STO power supply 1 anomaly**	

Cause			Diagnosis	Solution
STO circuit internal power supply 1 abnormal.			Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.
Error code	Main	Sub	**Display:** "Er 1c4"	
	1c	4	**Content: STO power supply 2 anomaly**	
Cause			Diagnosis	Solution
STO circuit internal power supply 2 abnormal.			Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.
Error code	Main	Sub	**Display:** "Er 1c5"	
	1c	5	**Content: STO input circuit 1 anomaly**	
Cause			Diagnosis	Solution
STO circuit optocoupler 1 abnormal.			Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.
Error code	Main	Sub	**Display:** "Er 1c6"	
	1c	6	**Content: STO input circuit 2 anomaly**	
Cause			Diagnosis	Solution
STO circuit optocoupler 2 abnormal.			Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.
Error code	Main	Sub	**Display:** "Er 1c7"	
	1c	7	**Content: STO circuit BUFFER 1 anomaly**	
Cause			Diagnosis	Solution
STO circuit BUFFER 1 anomaly			Verify issue by restarting for a few times	Please contact manufacturer.
Error code	Main	Sub	**Display:** "Er 1c8"	
	1c	8	**Content: STO circuit BUFFER 2 anomaly**	
Cause			Diagnosis	Solution
STO circuit BUFFER 2 anomaly			Verify issue by restarting for a few times	Please contact manufacturer.

Error code	Main	Sub	Display: "Er 1c9"	
	1c	9	Content: STO Software Process Monitoring Abnormalities	
Cause			Diagnosis	Solution
STO Count Abnormal			Whether the fault can be automatically eliminated after power failure and restart, if not, please contact the manufacturer's personnel	Please contact manufacturer.

Error code	Main	Sub	Display: "Er 210"	
	21	0	Content: I/O input interface assignment error	
Cause			Diagnosis	Solution
Duplicate function assignment to multiple DI terminals.			Check if parameters P01.00~P01.09 or virtual DI are repeatedly set.	Ensure parameters P01.00~P01.09 are set correctly or verify virtual DI is not repeatedly set; if there is duplicate assignment, reassign functions, then power cycle to reset the fault.

Error code	Main	Sub	Display: "Er 211"	
	21	1	Content: I/O input interface function assignment error	
Cause			Diagnosis	Solution
Unsupported function code assigned to DI.			Check whether parameters P01.00~P01.09 or virtual DI are set with function codes supported by the current drive.	Ensure parameters P01.00~P01.09 are set correctly
Error code	Main	Sub	**Display:** "Er 212"	
	21	2	**Content: I/O output interface function assignment error**	
Cause			Diagnosis	Solution
Unsupported function code assigned to DO.			Check whether parameters P01.10~P01.15 or virtual DO are set with function codes supported by the current drive.	Ensure parameters P01.10~P01.15 are set correctly
Error code	Main	Sub	**Display:** "Er 240"	
	24	0	**Content: EEPROM parameters initialization CRC check error**	
Cause			Diagnosis	Solution
Servo dirver control power unstable, low, or lost.			1. Check for control power cutoff (L1/L2 or L1C/L2C) or momentary failures. 2. Verify input voltage at terminals meets specs: 220V drives (198V–264V) or 380V drives (342V–484V).	Power cycle the drive. If the fault persists, ensure the supply is stable and verify that L1/L2 or L1C/L2C input voltages meet the rated specifications.
Parameter save error.			Resave parameters, repower,	Resave parameters once.

		and confirm whether the fault can be cleared.	
Power loss during parameter save.		Resave parameters or restore factory settings, repower, and confirm whether the fault can be cleared.	Resave parameters once and wait for the save to complete before powering off
Drive software update.		Confirm whether there has been a recent drive software upgrade.	Restore the parameter table / object dictionary to factory settings and power on again.
Firmware mismatch during update.		Confirm whether there has been a recent drive software upgrade, and whether the firmware version matches.	Re-burn the matching drive software firmware
Error code	Main	Sub	**Display:** "Er 241"
	24	1	**Content: EEPROM hardware error**
Cause		Diagnosis	Solution
EEPROM parameter read error.		Resave parameters or restore factory settings, disconnect the USB debugging cable, completely power down the drive and then repower, and confirm whether the fault can be cleared.	Resave parameters or restore factory settings, disconnect the USB debugging cable, completely power down the drive and then repower, and confirm whether the fault can be cleared.
Error code	Main	Sub	**Display:** "Er 24"
	24	2	**Content: EEPROM write frequency too high**
Cause		Diagnosis	Solution
EEPROM write frequency too high.		Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.
EEPROM damaged		Restart driver for a few times	Restart driver for a few times
Error code	Main	Sub	**Display:** "Er 24E"
	24	E	**Error description:**
Cause		Diagnosis	Solution
Hardware information parameter validation error		Clear the fault storage, repower and confirm whether the fault disappears.	Contact manufacturer personnel.
Error code	Main	Sub	**Display:** "Er 24F"
	24	F	**Error description: EEPROM power parameter error**
Cause		Diagnosis	Solution
Drive EEPROM hardware power info error.		Check if PE0.06 is set to 0, and PE0.07 read power is	Restore factory settings and power on again; if the alarm persists,

			inconsistent with the actual drive (220 represents 22kW).	contact manufacturer personnel.
Error code	Main	Sub	**Display:** “Er 260”	
	26	0	**Error description: Positive/negative out-of-range input valid**	
Cause			Diagnosis	Solution
Positive/Negative limit DI/VDI active (Non-homing mode).			Check if P01 group has set DI input positive/negative limit input signals. Check via IO settings if the positive/negative limit input signal logic is in the active state.	Check whether the limit trigger triggers normally; for abnormal triggering, confirm if wiring and parameter setting values are incorrect.

Error code	Main	Sub	**Display:** “Er 280”	
	28	0	**Error description: Pulse regeneration limit protection**	
Cause			Diagnosis	Solution
Divided pulse output frequency exceeds limit.(L7/L6:1MHz L8:2MHz 2L6P:4.4MHz)			Calculate the output pulse frequency:f(Hz)=Speed(rpm)÷60×P00.11.Verify if the motor speed and pulse frequency exceed drive limits when the fault occurs.	Lower P00.11 or reduce speed to ensure output pulse frequency remains within hardware limits throughout the entire motion.

Error code	Mai	Sub	Display: " Er 410"
	41	0	**Error description: The number of encoder lines detected don't match the set value**

Cause	Diagnosis	Solution
Incorrect encoder resolution or motor pole pitch setting, resulting in encoder identification failure.	Check whether the encoder wiring is correct and whether the motor is mechanically jammed.	Check the encoder wiring and ensure that the motor is not mechanically jammed.

Error code	Mai	Sub	Display: " Er 420"
	42	0	**Error description: Motor parameter identification error**

Cause	Diagnosis	Solution
An error other than D01–D05 occurred during the motor identification process.	An error other than D01–D05 occurred during the motor identification process.	An error other than D01–D05 occurred during the motor identification process.

Error code	Mai	Sub	Display: " Er 421"
	42	1	**Error description: Motor parameter identification error (motor not at standstill)**

Cause	Diagnosis	Solution
The motor is not at a standstill.	Check whether the motor has stopped completely.	Ensure that the motor has come to a complete stop.

Error code	Mai	Sub	Display: " Er 422"
	42	2	**Error description: Motor parameter identification error (resistance out of range)**

Cause	Diagnosis	Solution
The identified resistance value is greater than 100 or less than 0.01.	The identified resistance value is greater than 100 or less than 0.01.	The identified resistance value is greater than 100 or less than 0.01.

Error code	Mai	Sub	Display: " Er 423"
	42	3	**Error description: Motor parameter identification error (inductance out of range)**

Cause	Diagnosis	Solution
The identified inductance value is greater than 100 or less than 0.01.	The identified inductance value is greater than 100 or less than 0.01.	The identified inductance value is greater than 100 or less than 0.01.

Error code	Mai	Sub	Display: " Er 424"
	42	4	**Error description: Motor parameter identification error (back EMF out of range)**
Cause		Diagnosis	Solution
The identified back EMF value is greater than 500 or less than 1.		The identified back EMF value is greater than 500 or less than 1.	The identified back EMF value is greater than 500 or less than 1.

Error code	Mai	Sub	Display: " Er 425"
	42	5	**Error description: Motor parameter identification error (travel distance too short)**
Cause		Diagnosis	Solution
The travel distance is too short.		The travel distance is too short.	The travel distance is too short.

Error code	Mai	Sub	Display: " Er 436"
	43	6	**Error description: Relative continuous mode not supported**
Cause		Diagnosis	Solution
Relative continuous mode is not supported.		Relative continuous mode is not supported.	Relative continuous mode is not supported.

Error code	Mai	Sub	Display: " Er 570"
	57	0	**Error description: Forced alarm input valid**
Cause		Diagnosis	Solution
E-STOP forced alarm input active.		Check whether the forced alarm input signal is conducting or if the logic is set to normally closed.	Ensure correct parameter settings for input signal wiring and corresponding DI input.

Error code	Main	Sub	Display: "Er 5F1"
	57	1	**Error description: PC forced alarm input active**
Cause		Diagnosis	Solution
E-STOP forced alarm input active.		Check whether the host computer emergency stop input signal is enabled.	Turn off the host computer emergency stop input signal.

Error code	Main	Sub	Display: "Er 580"
	59	0	**Error description: Push travel load detection failed**
Cause			Diagnosis	Solution
1. No load is detected within the push travel distance. 2. The push travel distance reaches the set torque limit threshold or fails to reach the push holding time.			1. Check whether there is a load within the target travel distance. 2. Check whether the push-related parameters are set correctly.	1. Correctly set the load (workpiece) within the push range. 2. Ensure that the torque limit value and push holding time are set correctly.
Error code	Main	Sub	**Display:** "Er 5F0"
	5F	0	**Error description: Motor code error**
Cause			Diagnosis	Solution
PA0.11 Motor code error or mismatch.			Check if the motor model code PA0.11 is correct.	Restore factory settings and power on again or set the correct motor code PA0.11.
Error code	Main	Sub	**Display:** "Er 5F1"
	5F	1	**Error description: Driver chip select recognition abnormality**
Cause			Diagnosis	Solution
Drive Chip Select (CS) ID error during initiation			Check if the fault is still reported after powering off and restarting.	Contact the manufacturer for handling.
Error code	Main	Sub	**Display:** "Er 5F3"
	5F	3	**Error description: Drive power selection fault**
Cause			Diagnosis	Solution
Drive power rating out of range during initiation			Check if the fault is still reported after powering off and restarting.	Contact the manufacturer for handling.
Error code	Main	Sub	**Display:** "Er 5F4"
	5F	4	**Error description: Motor voltage level mismatch fault**
Cause			Diagnosis	Solution
PA0.13 Motor voltage mismatch with PA2.06 Drive voltage.			Check if the motor voltage level and drive voltage level can match normally; confirm if the read PA0.13 motor voltage parameter is correct.	Replace with a motor or drive where the voltage level matches correctly.
Error code	Main	Sub	**Display:** "Er 5F6"
	5F	6	**Error description: Abnormal matching of drive model and motor model**
Cause			Diagnosis	Solution
Drive model and motor model mismatch.			Please confirm whether the drive and motor are the matching relationship recommended by the	If models do not match, replace with a motor or drive that can match each other. If models match, please

		manufacturer; if the matching relationship is confirmed correct, power off and restart to observe if the fault is still reported.	contact the manufacturer for handling.
Error code	Main	Sub	**Display:** "Er 600"
	60	0	**Error description: internal error**
Cause		Diagnosis	Solution
Current loop interrupt timeout.		Check if the fault is still reported after powering off and restarting.	Contact the manufacturer for handling.

Error code	Main	Sub	**Display:** "Er 601"
	60	1	**Error description: Internal timing error**
Cause		Diagnosis	Solution
Speed loop interrupt timeout.		Check if the fault is still reported after powering off and restarting.	Contact the manufacturer for handling.

Error code	Main	Sub	**Display:** "Er 602"
	60	2	**Error description: interrupt timeout fault**
Cause		Diagnosis	Solution
Main interrupt timeout.		Check if the fault is still reported after powering off and restarting.	Contact the manufacturer for handling.
Resource overload alarm (Gantry + Full-closed + Position comparison).		Power off and restart, do not enable any functions, and check if the fault is still reported during operation.	Contact the manufacturer for handling.
Error code	Main	Sub	**Display:** "Er 603"
	60	3	**Error description: Loss of interruptions for dual-core interactions**
Cause		Diagnosis	Solution
Loss of interruptions for dual-core interactions		Whether power failure and restart still report faults	Please contact our technical support
Error code	Main	Sub	**Display:** "Er 604"
	60	4	**Error description: Internal storage anomaly**
Cause		Diagnosis	Solution
stack overflow		Whether power failure and restart still report faults	Please contact our technical support
Error code	Main	Sub	**Display:** "Er 604"
	60	5	**Error description: Timing configuration error**
Cause		Diagnosis	Solution
Feedback delay too large.		Check if the fault is still reported after powering off and restarting.	Contact the manufacturer for handling.

Error code	Main	Sub	Display: "Er 606"	
	60	6	**Error description: Chip self-test error**	
Cause			Diagnosis	Solution
Self-test fault during chip power-on initialization.			Whether power failure and restart still report faults	Please contact our technical support

Error code	Main	Sub	Display: "Er 700"	
	70	0	**Error description: Encryption error**	
Cause			Diagnosis	Solution
Encryption error during initialization upon power-on.			Restart driver	Please contact our technical support

Error code	Main	Sub	Display: "Er 72b"	
	72	b	**Error description: PLC control error**	
Cause			Diagnosis	Solution
A falling edge of the PLC control signal (STW1 bit 10) is detected.			A falling edge of the PLC control signal (STW1 bit 10) is detected.	A falling edge of the PLC control signal (STW1 bit 10) is detected.

Error code	Main	Sub	Display: "Er 72c"	
	72	c	**Error description: Node guarding or heartbeat timeout**	
Cause			Diagnosis	Solution
The slave reaches the configured heartbeat consumer timeout or node guarding timeout.			The slave reaches the configured heartbeat consumer timeout or node guarding timeout.	The slave reaches the configured heartbeat consumer timeout or node guarding timeout.

Error code	Main	Sub	**Display:** “Er 890”	
	89	0	**Error description: Homing error**	
Cause			Diagnosis	Solution
Homing speed too high; sensor signal missed.			Check if the homing high speed is set too large or homing acceleration is set too small.	Decrease the homing high speed or increase the homing acceleration.
Homing method conflicts with sensor logic.			Check if the sensor input signal logic required by the homing method is the same as the actual input.	Adjust the homing method or adjust the sensor input signal logic.
Selected homing method not supported.			Check if object dictionary 6098h has selected an unsupported homing method.	Reselect a supported homing method.
Sensor signal edge unstable.			Check via debugging software if the corresponding DI input port change is normal.	Ensure sensor edges are stable.
Persistently unstable at home position.			Acceleration/deceleration setting is too small; electronic gear ratio setting is too small causing acceleration/deceleration to be too small.	Set appropriate 609A if the electronic gear ratio cannot be changed

7.5 Alarm clearing

For alarm can be cleared，There are 3 method.

Method 1：

1、By setting bit 7 of 6040h to 1, switches state machine from fault to initialization completion , No fault(Switch on disabled).

Method 2：

Use auxiliary function “AF_ACL”

1、Press M to select auxiliary function , Press SET to enter into “AF_ACL” , Press and hold to clear the alarm

Method 3：

Set IO input function as Alarm clear input “ (A-CLR)”，refer to switch input interface connection to clear the alarm.

Communication Alarm Clearing

All communication-related alarms of the EL7-PNS can be cleared and will not be saved in the alarm history.

Communication alarms are mainly cleared through the master's registers. First, clear the alarm on the drive, and then switch to the 402 state. Follow the procedure below:

Step 1: Set bit 4 (Error Acknowledge Bit) of the EL7-PNS ESC control register 0x120 to 1 through the master.

Step 2: Wait until the feedback value of the EL7-PNS ESC status registers 0x134–0x135 becomes 0. The communication alarm can then be cleared.

Then, similar to Step 2 of clearing drive alarms, switch bit 7 of the 6040h object from 0 → 1 to change from the Fault state to the Ready to Switch On state (402 state).

When a network fault occurs on the EL7-PNS, the operation panel will display the fault code, and the ERR status indicator will also provide the corresponding indication.

Chapter 8 STO Safety Function

8.1 Safety Notes

1、When using the STO function, perform risk assessment for the equipment to ensure the whole system meets safety requirements.
2、STO cuts power to the motor only, not the driver. Disconnect driver power before maintenance or repair to avoid electric shock.
3、After STO is triggered, external force (such as gravity on vertical shafts) may spin the motor. Use an external brake if the shaft must stay locked.
4、Only qualified personnel are allowed to install, commission, operate and service this equipment. Safety engineers are required for its setup and operation.
5、Before using STO, follow this chapter for installation, wiring and validation. Proper completion of these steps ensures STO works correctly.
6、Power cycle the driver or run the STO validation test every 3 months (check fault Er1C0/Er1C1/Er1C2 and reset; see Section 10.6 for test procedures) to verify normal STO operation.
7、The effective pulse width should be >=30ms in order to reliably trigger the STO function.

8.2 Overview

8.2.1 Document Purpose

This chapter describes operation procedures and precautions for installing, using and maintaining the STO safety function of the driver. Read this chapter carefully before using the STO function to avoid equipment damage and personal injury.

8.2.2 Terms & Abbreviations

Abbreviation	Definition
Category	Categories according to ISO 13849-1: 2023, including Cat. B, 1, 2, 3 and 4
CCF	Common Cause Failure
DCavg	Average Diagnostic Coverage (%)
DTI	Diagnostic Test Interval (h)
SFF	Safe Failure Fraction
HFT	Hardware Fault Tolerance
PFH	Average Frequency of Dangerous Failure per Hour (/h)
PL	Performance Level

Abbreviation	Definition
SC	System Capability
SIL	Safety Integrity Level
MTTFd	Mean Time to Dangerous Failure
STO	Safe Torque Off

8.2.3 Safety Standards

Standard
IEC 61800-5-2:2016
ISO 13849-1: 2023
IEC 60204-1:2016 (in extract)
IEC 61508:2010, parts 1-7
EN 61800-5-2:2017
EN ISO 13849-1:2023
EN IEC 62061:2021
EN 61508:2010, parts 1-7

8.2.4 Safety Performance

Complies with IEC 61508 series / IEC 62061 / IEC 61800-5-2:

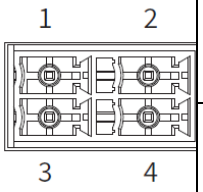
Item	Value	Description
SIL	SIL3	
SC	SC3	
PFH	＜0.1×10^{-7}	Driver
System PFH	＜1×10^{-7}	
SFF	≥90%	
DCavg	Medium	
HFT	1	
Operating Mode	High-demand mode	
Service Life	20 years	
STO Response Time	＜30ms (Typ.)	

2, Complies with ISO13849-1:

Item	Value	Description
PL	e	
DCavg of system	Medium	
Category	3	
MTTFd	High	
CCF	>65	
Useful lifetime/mission time	20 years	
STO reaction time	<30ms	

8.3 Terminal Introduction

8.3.1 I/O Signal Description

Terminal No.	Diagram (Driver Side)	Pin No.	Signal	Name	Description
CN6		1	COM(0V)	STO Reference Ground (0V)	The power supply is output port, and only used to bypass the STO1/STO2 inputs to prevent alarms when the STO safety function is not in use; it cannot be used to trigger the normal STO safety function; it cannot be used to power other devices.
		2	24V	24V Power Supply	
		3	STO1	STO Control Signal Input 1	STO activates if STO1=OFF, STO2=OFF, or both OFF.
		4	STO2	STO Control Signal Input 2	

8.3.2 Electrical Specifications

Item	Characteristic	Description
STO Input Voltage Range	24VDC (±15%)	External power must be SELV/PELV.
Input Current	3.4mA (Typ.)	Current per channel at 24V supply
Input Impedance	7.0kΩ	-
Input Logic	0: ≤3V; 1: ≥12V	-
STO Response Time (from	＜30ms (Typ.)	Time from low STO input to PWM

Item	Characteristic	Description
terminal trigger)		shutdown.
Fault Response Time	＜100ms	Time for controller to detect fault and switch to safe state.
Fault Recovery Time	＜200ms	Time to restore STO active state after fault cleared.

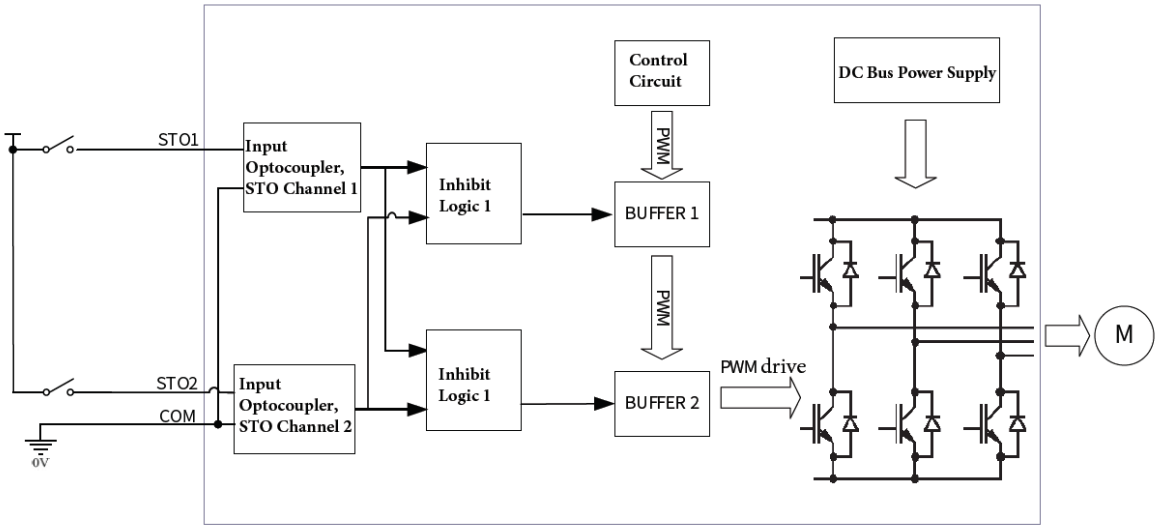
8.4 Instructions for Use

8.4.1 Working Principle

The driver integrates the STO (Safe Torque Off) safety function, fully compliant with IEC 61800-5-2:2016.

It adopts a dual-channel hardware redundant structure. External trigger signals STO1 and STO2 turn off PWM drive signals for power devices and cut off current to the motor, achieving Safe Torque Off.

The function block diagram is shown below:



8.4.2 Control Logic

STO1 Input	STO2 Input	Motor Status
ON	ON	Normal Operation
OFF	ON	Motor Current Cut Off
ON	OFF	Motor Current Cut Off
OFF	OFF	Motor Current Cut Off

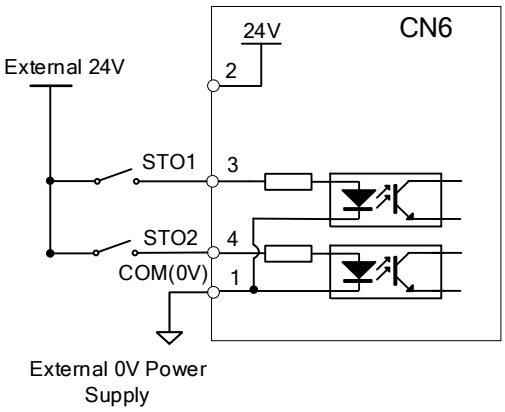
8.4.3 Related Parameters

P50.00	**Label**	STO error sign					
	Range	-2147483648~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RW		**PNU**	18000
STO fault detection flag, used to indicate the specific fault point.							
P50.01	**Label**	STO Buffer Diagnosis & Filter Time					
	Range	1~10		**Default**	2	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	18001
STO diagnosis and filter time. Adjust this value for heavy signal interference.							
P50.02	**Label**	STO diagnosis and filtering tim					
	Range	1~2		**Default**	1	**Unit**	ms
	Activation	Immediate	**Attribute**	RW		**PNU**	18002
STO diagnosis and filtering time. This parameter can be adjusted if the input signal is subject to significant interference.							
P50.04	**Label**	STO Version					
	Range	0~32767		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	18004
Displays the STO version							
P50.05	**Label**	STO real-time running timestamp					
	Range	-2147483648~2147483647		**Default**	0	**Unit**	
	Activation	Immediate	**Attribute**	RO		**PNU**	18005
STO real-time running timestamp display.							

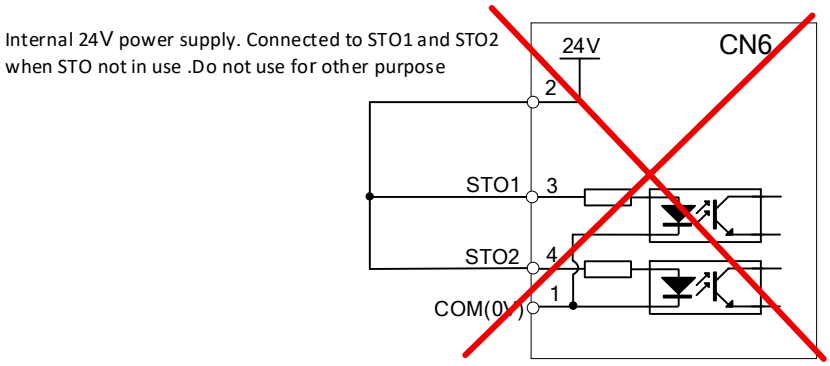
8.4.4 Wiring

When the STO safety function is not used, insert the STO shorting plug directly into terminal CN6 to prevent the drive from falsely triggering an STO alarm.
This 24V power supply is an internal power supply dedicated to disabling the STO function. Do not use it for other purposes.

STO in use （external 24V power）



STO not in use



Note:
1. To avoid cable faults, the two channels must use two separate lines; otherwise, the ca ble must be protected with a double shielding method.
2. The total length of the input signal cable should be less than 30 meters.

8.5 Alarm Handling

8.5.1 Alarm Codes

List of Alarm Codes

Error code		Content	Attribute			object dictionary
Main	Sub		Save	Type	Clearable	603F
1c	0	Both STO failed	●	1	●	0x8313
	1	1st STO failed	●	1	●	0x8314
	2	2nd STO failed	●	1	●	0x8315
	3	STO power supply 1 anomaly	●	1	●	0x8316
	4	STO power supply 2 anomaly	●	1	●	0x8317
	5	STO input circuit 1 anomaly	●	1	●	0x8318
	6	STO input circuit 2 anomaly	●	1	●	0x8319
	7	STO circuit BUFFER 1 anomaly	●	1	●	0x831A
	8	STO circuit BUFFER 2 anomaly	●	1	●	0x831B
	9	STO Software Process Monitoring Abnormalities	●	1	●	0x831C
60	4	**Internal storage anomaly**	●	2	●	0x6205
	6	Chip self-test error	●	2	●	0x6206

Alarm Cause / Handling Method

Error code	Main	Sub	**Display:** “Er 1c0”	
	1c	0	**Content: Both STO failed**	
Cause			Diagnosis	Solution
Both STO input signals valid			Check whether the STO function is enabled, and if the 24V input is disconnected normally.	Use normally, no processing required; after the STO terminal recovers, the 1C0 alarm will automatically reset the fault.
			Check if the STO power supply is normal.	Measure whether the 24V STO power supply is stable
			The switch or wiring connected to STO is disconnected abnormally.	Troubleshoot wiring and switches to ensure reliable connection and restore the switch to the closed state.
			Confirm that after the above three points, the fault still	Replace the servo drive.

			occurs.	
Error code	Main	Sub	**Display:** "Er 1c1"	
	1c	1	**Content: 1st STO failed**	
Cause			Diagnosis	Solution
1st STO input signal valid			Check whether the STO function is enabled, and if the 1st STO 24V input is disconnected normally.	Use normally, no processing required; after the STO terminal recovers, use the fault reset function to clear the fault.
			Check if the 1st STO power supply is normal.	Measure whether the 24V STO power supply is stable
			The switch or wiring connected to the 1st STO is disconnected abnormally.	Troubleshoot wiring and switches to ensure reliable connection and restore the switch to the closed state.
			Confirm that after the above three points, the fault still occurs.	Replace the servo drive.
Error code	Main	Sub	**Display:** "Er 1c2"	
	1c	2	**Content: 2nd STO failed**	
Cause			Diagnosis	Solution
2nd STO input signal valid			Check whether the STO function is enabled, and if the 1st STO 24V input is disconnected normally.	Use normally, no processing required; after the STO terminal recovers, use the fault reset function to clear the fault.
			Check if the 1st STO power supply is normal.	Measure whether the 24V STO power supply is stable
			The switch or wiring connected to the 1st STO is disconnected abnormally.	Troubleshoot wiring and switches to ensure reliable connection and restore the switch to the closed state.
			Confirm that after the above three points, the fault still occurs.	Replace the servo drive.
Error code	Main	Sub	**Display:** "Er 1c3"	
	1c	3	**Content: STO power supply 1 anomaly**	
Cause			Diagnosis	Solution
STO circuit internal power supply 1 abnormal.			Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.

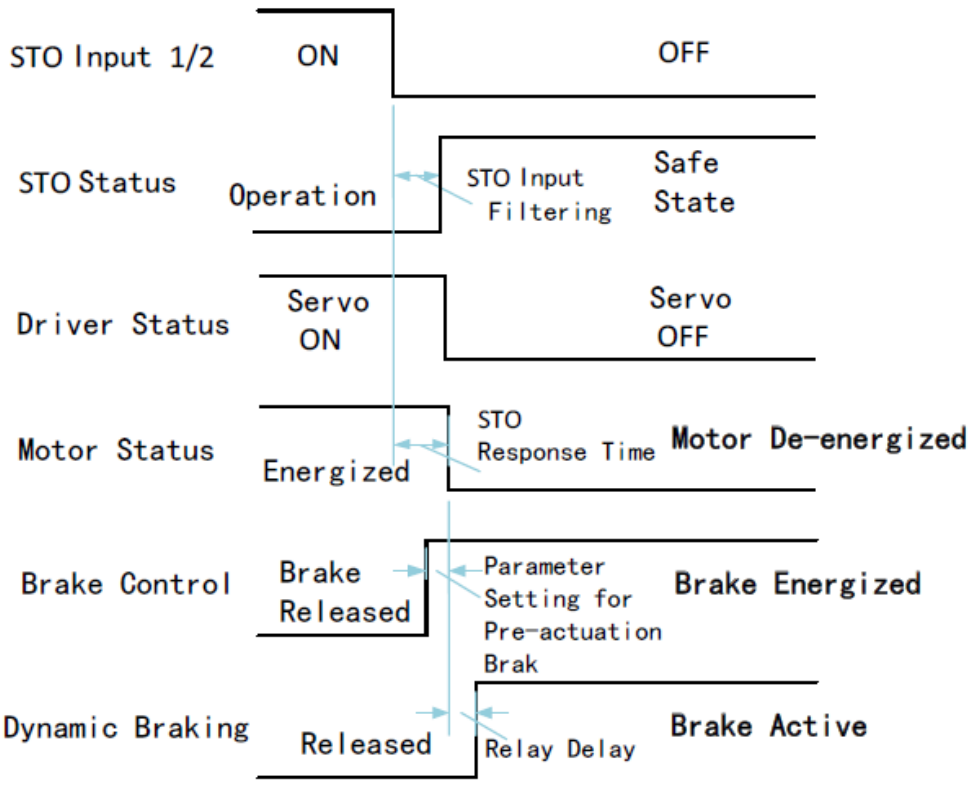
Error code	Main	Sub	Display: "Er 1c4"	
	1c	4	**Content: STO power supply 2 anomaly**	
Cause			Diagnosis	Solution
STO circuit internal power supply 2 abnormal.			Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.
Error code	Main	Sub	**Display:** "Er 1c5"	
	1c	5	**Content: STO input circuit 1 anomaly**	
Cause			Diagnosis	Solution
STO circuit optocoupler 1 abnormal.			Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.
Error code	Main	Sub	**Display:** "Er 1c6"	
	1c	6	**Content: STO input circuit 2 anomaly**	
Cause			Diagnosis	Solution
STO circuit optocoupler 2 abnormal.			Check if the fault can be automatically eliminated after powering off and restarting; if it cannot be eliminated, please contact the manufacturer personnel.	Contact manufacturer personnel.
Error code	Main	Sub	**Display:** "Er 1c7"	
	1c	7	**Content: STO circuit BUFFER 1 anomaly**	
Cause			Diagnosis	Solution
STO circuit BUFFER 1 anomaly			Verify issue by restarting for a few times	Please contact manufacturer.
Error code	Main	Sub	**Display:** "Er 1c8"	
	1c	8	**Content: STO circuit BUFFER 2 anomaly**	
Cause			Diagnosis	Solution
STO circuit BUFFER 2 anomaly			Verify issue by restarting for a few times	Please contact manufacturer.

Error code	Main	Sub	Display: "Er 1c9"	
	1c	9	**Content: STO Software Process Monitoring Abnormalities**	
Cause			Diagnosis	Solution
STO Count Abnormal			Whether the fault can be automatically eliminated after power failure and restart, if not, please contact the manufacturer's personnel	Please contact manufacturer.

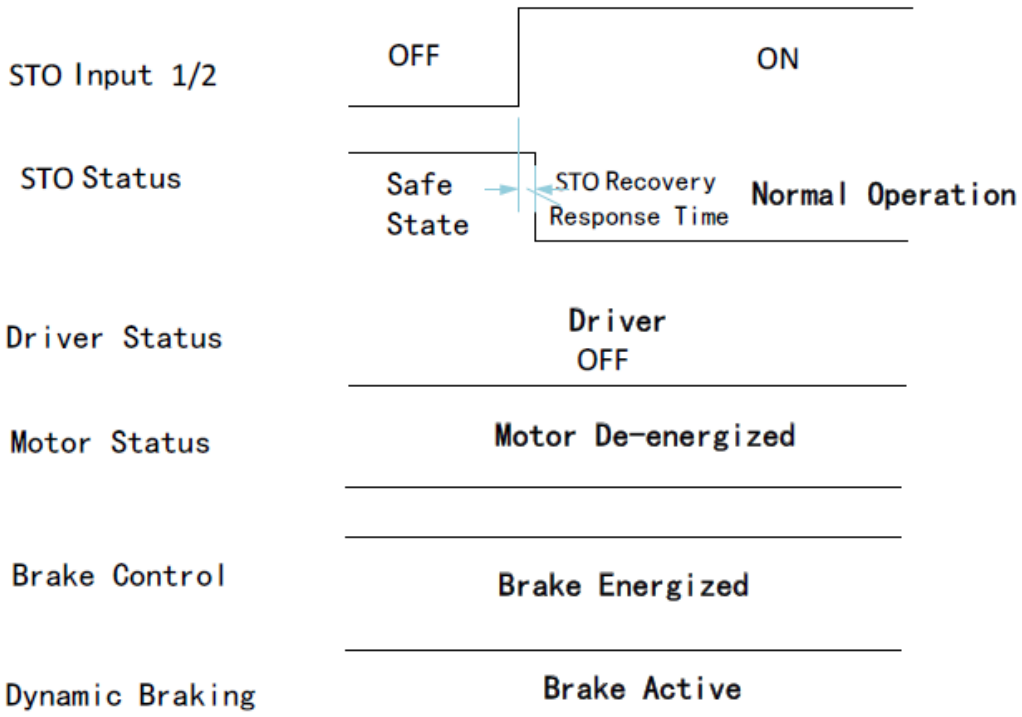
Error code	Main	Sub	Display: "Er 604"	
	60	4	**Content: Internal storage anomaly**	
Cause			Diagnosis	Solution
stack overflow			Whether power failure and restart still report faults	Please contact our technical support

Error code	Main	Sub	Display: "Er 606"	
	60	6	**Content: Chip self-test error**	
Cause			Diagnosis	Solution
Self-test fault during chip power-on initialization.			Whether power failure and restart still report faults	Please contact our technical support

8.5.2 Alarm Trigger Timing



8.5.3 Alarm Recovery Timing



8.5.4 STO Response Time

■ STO Ready Time at Power-up The delay from power-on until the STO safety function is ready varies by driver model, with a maximum delay of less than 5s.

■ STO Trigger Time If either STO input turns OFF, the driver triggers alarm Er1C1/Er1C2. The PWM signals of power devices and motor current will be cut off within 30ms (Typ.). If both STO inputs turn OFF simultaneously, the driver triggers alarm Er1C0. The PWM signals of power devices and motor current will be cut off within 30ms (Typ.).

■ STO fault Recovery Time After alarm conditions are cleared, the driver cannot automatically recover from Er1C1/Er1C2. Recovery requires power cycle or restart. After alarm conditions are cleared, the driver can automatically recover from Er1C0 and switch to Servo OFF automatically, with a typical recovery response time of 200ms (Typ.).

8.6 Verification and Confirmation

1. Before testing, ensure correct driver wiring and normal motor operation.
2. Prepare: 1× external DC24V power supply, 3× safety switches, 1× STO test cable. Connect the STO test cable to safety terminal CN6. Install SW1/SW2 to control STO1/STO2 DC24V input separately; install SW3 to control STO1 and STO2 DC24V input together.
3. Test under driver standby (Servo OFF):
   Close SW1/SW2/SW3 then power on; no alarm shall occur. Open SW1: alarm Er1C1 triggers, motor stays static. Reclose SW1: Er1C1 remains, motor stays static.
   Close SW1/SW2/SW3 then power on; no alarm shall occur. Open SW2: alarm Er1C2 triggers, motor stays static. Reclose SW2: Er1C2 remains, motor stays static.
   Close SW1/SW2/SW3 then power on; no alarm shall occur. Open SW3: alarm Er1C0 triggers, motor stays static. Reclose SW3: alarm resets, motor stays static.
4. Test under Servo ON (speed mode, 300rpm):
   Close SW1/SW2/SW3 then power on; no alarm, motor runs normally. Open SW1: Er1C1 triggers, motor stops. Reclose SW1: Er1C1 remains, motor stays static.
   Close SW1/SW2/SW3 then power on; no alarm, motor runs normally. Open SW2: Er1C2 triggers, motor stops. Reclose SW2: Er1C2 remains, motor stays static.
   Close SW1/SW2/SW3 then power on; no alarm, motor runs normally. Open SW3: Er1C0 triggers, motor stops. Reclose SW3: alarm resets, motor stays static.
5. Record Step 3 & 4 results in acceptance test report. Stop operation and troubleshoot if any abnormality appears.

8.7 STO Certificate



About Us

Leadshine Technology Co., Ltd.

Headquarters

Address:
15-20/F, Block B, Nanshan I Valley, No.3157, Nanshan District, Shenzhen City, Guangdong Province, China
Tel:
+86 755 26411692
Fax:
+86 755 26402718
Website:
www.leadshine.com
Emails:
sales@leadshine.com

Leadshine Global Retailers Network



Get in touch with us or any of your local Leadshine certified retailers by visiting our global website.

Technical Support
Tel: 86-755-2641-8447
86-755-2641-8774 (Asia, Australia, Africa)
86-755-2665-5136 (North and South America)
86-755-8654-2465 (Europe)
Fax: 86-755-2640-2718
Email: tech@leadshine.com

Sales Hot Line
Tel: 86-755-2641-7674 (Asia, Australia, Africa)
86-755-2641-7617 (North and South America)
86-755-2640-9254 (Europe)
Email: sales@leadshine.com

Leadshine Overseas



Leadshine America, Inc.

North America Office
Address:
26050 Towne Centre Dr. Foothill Ranch California United States
Tel:
1-949-608-7270
Fax:
1-949-638-7298
Website:
www.leadshineusa.com
Emails:
sales@leadshineusa.com