MiSUMi

# AC Servo Driver
# E-DFAS□□P Series (Pulse Type)

# User Manual

Ver1.1

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# Preface

Thank you for purchasing the E-DFAS□□P Series AC Servo Driver!

This product series comes standard with dynamic braking, supports pulse input frequencies up to 4 MHz, and includes black box functionality. It is suitable for automated equipment in industries such as electronics manufacturing, packaging, robotics, and machine tools. With high-performance solutions, it helps upgrade equipment and improve efficiency.

This manual serves as the product manual for the E-DFAS□□P series servo drivers. It provides essential knowledge and precautions for using the system, mechanical and electrical installation instructions, basic debugging and maintenance methods, function descriptions, and parameter details.
For first-time users, please read this manual carefully.
If you have any questions regarding functions or performance, please contact our technical support team for assistance.
Thank you for your use!

How to Obtain the Manual
This manual is not included with the product shipment.
To obtain the PDF electronic version, please visit the official MISUMI website:
Vietnam: *http://vn.misumi-ec.com*
Thailand: *https://th.misumi-ec.com*
Malaysia: *https://my.misumi-ec.com*
India: *https://in.misumi-ec.com*
Singapore: *https://sg.misumi-ec.com*
Indonesia: *https://id.misumi-ec.com*
and download it from the corresponding product series page.

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Caution!
Improper operation may cause unexpected accidents. Please read this manual carefully before using the system.
Due to product improvements, the contents of this manual are subject to change without prior notice.
Our factory will not be responsible for any changes made by the user to the product, and the product warranty will be invalidated.

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

# About This Manual

## Purpose and Scope

This manual provides the information required to safely install, wire, configure, commission, operate, maintain, and troubleshoot the Servo Drive and Servo Motor system.
It is intended to help users achieve reliable operation while minimizing commissioning time and preventing equipment damage caused by incorrect installation or parameter settings.

This manual covers the following topics:

- Product overview and system configuration
- Installation requirements
- Electrical wiring
- Connector descriptions
- Control modes and operating principles
- Parameter configuration
- Commissioning procedures
- EDrive software operation
- Communication setup
- Built-in functions
- Maintenance
- Alarm diagnosis and troubleshooting

## Intended Readers and Required Competence

This manual is intended for:

- Machine builders
- System integrators
- Electrical design engineers
- Mechanical engineers
- Commissioning engineers
- Maintenance engineers
- Technical support personnel

Readers should have basic knowledge of:

- Industrial electrical systems
- Servo motors and motion control
- AC power distribution
- Industrial wiring practices

Installation, commissioning, and maintenance shall be performed only by qualified personnel familiar with applicable electrical safety regulations.

## How to Use This Manual

This manual is organized according to the typical engineering workflow, from product selection through commissioning and maintenance.
For first-time users, it is recommended to follow the chapters in sequence.
Experienced users may refer directly to the relevant chapters using the table of contents or index.
Important safety information should always be read before performing installation or commissioning.
Whenever a parameter or function is referenced, the corresponding chapter provides detailed descriptions, operating limitations, and related settings.

# Safety Precautions

In order to prevent personal injury and property damage, the following statements are made for matters that must be followed. When reading this manual, please pay special attention to the following warning signs:

⚠Warning: “Warning” Incorrect operation may cause death or serious injury.
⚠Caution: “Caution” Incorrect operation may cause injury or equipment damage.
⚠Notice: “Notice” Improper use may damage the product or equipment.

| Safety Rules |
|---|
| ⚠Warning<br>This product is not intended for safety-critical machinery or systems.<br>Users must implement proper safety measures to prevent accidents. |
| Inspection |
| ⚠Caution<br>Do not install if the product or accessories are damaged or rusted upon unpacking.<br>Do not install if there is water inside, missing parts, or damaged components.<br>Check the packing list carefully; do not install if it does not match the product. |
| ⚠Notice<br>Do not forcibly remove packaging or handle roughly to avoid damage to components.<br>Do not use damaged or faulty products. |
| Storage and Transportation |
| ⚠Caution<br>Store and transport the product according to specified environmental conditions.<br>Do not stack too high to prevent falls.<br>Ensure proper packaging during transit.<br>Do not drag cables, motor shafts, or encoders when handling servo motors.<br>Avoid applying external force or impacts to servo drivers and motors. |
| ⚠Notice<br>Handle the product with care, lift and place gently, and watch your footing to prevent trips or drops, which may cause injury or damage.<br>During storage or transport, avoid direct contact with terminals or driver circuits without electrostatic protection to prevent damage.<br>Avoid storing or transporting in places exposed to water, rain, direct sunlight, strong electric or magnetic fields, or severe vibration.<br>Do not store the product for more than 3 months; if stored longer, apply stricter protection and inspections.<br>Do not mix-pack this product with items that could affect or damage it during transport. |
| Installation |
| ⚠Warning<br>Only trained professionals with electrical knowledge are allowed to operate. Operation by unqualified personnel is strictly prohibited |

⚠Caution
Servo Driver and Servo Motor:
Do not install on or near flammable materials to prevent fire.
Avoid vibration and strictly prohibit impacts.
Do not install if the unit is damaged or has missing parts.
Discharge static electricity before operating buttons or switches on the driver, or equipment damage may occur.
Servo Driver:
Must be installed inside a control cabinet with sufficient protection rating.
Maintain adequate clearance from other devices.
Ensure proper heat dissipation. If installed in a sealed environment, use cooling devices (fans or air conditioners) to meet environmental requirements, or overheating/fire may result.
Prevent the entry of dust, corrosive gases, conductive materials, liquids, and flammable or explosive substances.
Servo Motor：
Must be mounted securely to prevent loosening due to vibration.
Prevent liquid ingress to avoid motor or encoder damage.
Do not strike the motor or shaft to avoid encoder damage.
The motor shaft must not be subjected to loads beyond its rated limits.

| Wiring |
|---|
| ⚠Caution<br>Only qualified personnel may perform wiring or inspection.<br>Wait at least 10 minutes after power-off before starting.<br>Properly ground the servo driver and motor to avoid electric shock.<br>Incorrect voltage or polarity may cause accidents or explosions.<br>Connect wires only after installation is complete.<br>Ensure wire insulation and avoid pinching to prevent shock.<br>Never wire, open covers, or touch circuits with power on. |
| ⚠Caution<br>Wiring must be correct and secure to avoid malfunction or damage<br>Do not reverse U/V/W motor terminals or connect to AC power<br>Connect motor directly to the servo driver—no capacitors, inductors, or filters<br>Prevent conductive parts or wire ends from entering the driver<br>Keep wires and heat-sensitive parts away from heatsinks and motors<br>Do not reverse the flyback diode on output signal relays<br>Use cables with proper gauge and shielding; ground shield at one end<br>Follow ESD precautions and wear an anti-static wrist strap<br>For control circuits, use twisted shielded wire and ground the shield to the terminal |

| Power-On |
|---|
| ⚠Warning<br>Before power-on, ensure proper installation and secure wiring of control, main power, and motor output circuits.<br>Do not touch any terminals while the product is powered on. |
| Debugging Operation |
| ⚠Caution<br>Before power-on, confirm proper installation, secure wiring, and correct power within rating.<br>During setup, run motor unloaded first; verify settings before load testing to avoid damage. |
| Usage |

| |
|---|
| ⚠Caution<br>An emergency stop circuit must be installed to immediately stop operation and cut power in case of an accident.<br>Before resetting an alarm, ensure the run signal is off to prevent sudden restart.<br>Use the servo driver only with the specified servo motor.<br>Avoid frequently turning the servo system power on and off to prevent damage.<br>The servo driver and motor may become hot during and shortly after operation; do not touch the heatsink or motor.<br>Do not modify the servo system. |
| Troubleshooting |
| ⚠Caution<br>High voltage may remain in the servo driver for some time after power off; do not disconnect wires or touch terminals within 5 minutes.<br>Only qualified personnel with proper knowledge should perform disassembly and maintenance. |
| ⚠Caution<br>After an alarm, troubleshoot and clear the cause, then reset the alarm before restarting.<br>Keep away from the machine when power returns after a blackout, as it may start unexpectedly (the design should prevent hazards on restart). |
| System Matching |
| ⚠Notice<br>The servo motor's rated torque must exceed the effective continuous load torque.<br>The load inertia to servo motor inertia ratio should be below the recommended value.<br>The servo driver and motor must be used as a matched pair. |

Other Notes **Dynamic brake**

- The dynamic brake should only be used for emergency stops during faults or sudden power loss. Do not trigger faults or power loss frequently.
- At high speeds, ensure the dynamic brake has at least a 5-minute interval between activations to prevent damage to the internal brake circuit.
- In rotating machinery, after dynamic braking stops the motor, the motor may be driven by the load on the shaft and act as a generator. Continuous external rotation for a long time can cause short-circuit current in the dynamic brake, potentially leading to smoke, fire, or motor damage.

Safety Signs To ensure safe operation, always follow the safety signs on the equipment. The safety signs are explained as follows:



# Warranty Terms

For products purchased from MISUMI (the “Company”) via official product catalogs or MISUMI’s official websites (including all global/regional domains, affiliated platforms, apps, and mini-programs—collectively, the “Official Website”), the warranty is governed by the usage guidelines and warranty terms stated on the Official Website or in the catalogs (“Warranty Terms”).
These Warranty Terms do not apply to custom-made products. Placing an order or using a product implies acceptance of the Warranty Terms.
If the product includes a manufacturer’s warranty, that warranty shall take precedence over these Warranty Terms.
Warranty Scope and Period
The warranty covers defects such as damage, deformation, or faults (collectively “defects”) attributable to the Company. The customer must document and notify the Company in writing within the warranty period (defined below). If the Company confirms the defect is its responsibility, it will repair or replace the defective product partially or fully at no cost.
However, if any of the following conditions apply, or if the Company’s website or product catalog states that repair or replacement is not authorized, the warranty will not apply.

1) Defects from use outside general industrial applications, excluding transport vehicles, medical devices, and household electronics.
2) Defects from use in aerospace, nuclear, military, or weapons applications.
3) Defects caused by customer’s careless or incorrect handling.
4) Defects caused by natural disasters (e.g., earthquakes, floods, fires).
5) Defects from not following specifications, usage instructions, or related documents on the website or catalog.
6) Defects caused by customer’s modification, repair, or disassembly.
7) Defects caused by other equipment.
8) Defects from use outside purchased Misumi Subsidiary and the areas it handles.
9) Defects due to inexperience or use beyond intended purpose or method.
10) Defects caused by customer violating usage rules or contracts.
11) Defects discovered or occurring after resale to third parties.
12) Other cases where repair or replacement is not accepted as stated on the website or catalog.

The warranty period for this product is one year from the date of shipment by the Company.
Minor scratches, stains, dents, or discoloration that do not affect use are not considered defects. However, if these are deemed severe by the Company, they will be treated as defects.
Customers must verify the product name, model, quantity, and condition within one week of receipt, and check against specifications on the website or catalog. Any defects must be reported in writing to MISUMI Customer Service within this period. If no notification is received, the product is considered accepted and free of defects.
Repairs or replacements after the warranty period or outside the warranty scope will be charged.
Depending on the product’s nature, production date, or specifications, repairs or replacements may not be possible
Disclaimer
Except as required by usage rules or product quality laws, the Company is not liable for any damages, losses, or costs caused by product defects, including defects in products made with it, recalls, or production stoppages.
If the customer violates usage precautions, they lose all rights to compensation from the Company.
Compensation for damages caused by product defects is limited to the purchase price of the damaged product.
Orders will not be accepted without the customer’s agreement to this limit.
If the Company is not the manufacturer as defined by product quality laws, the customer may seek liability directly from the actual manufacturer.
For damages caused by or related to the following reasons, the customer has no right to claim any compensation or reimbursement from the Company:

1) Damages caused by using defective products or resulting production line stoppages.
2) Damages caused by violating usage rules, product catalogs, or warranty terms.
3) Damages resulting from the customer’s intentional or negligent actions.
4) Damages caused by force majeure events beyond control.
5) Damages arising from intellectual property disputes related to product use.
6) Damages caused by export delays or prohibitions due to laws or regulations.
7) Losses resulting from defects found after the product is resold to third parties.

Precautions
Repairs or replacements must be done by returning the product; no on-site service.
Product discontinuation may prevent replacement with the same item.
The Company may update warranty terms; continued orders mean acceptance.

# Chapter 1 Introduction

## 1.1 Incoming Inspection

Upon receipt, the following inspections must be performed:
The packaging box is intact, and the goods are not damaged during transportation.
Verify the nameplates on the servo driver and servo motor to ensure the received goods match the order.
Check the packing list to confirm all accessories are included.
Note:
Do not install any servo system that is damaged or has missing parts.
The servo driver must be used with a servo motor matching specifications.
If you have any questions after receiving the goods, please contact the supplier or our company.

## 1.2 Model Number Structure

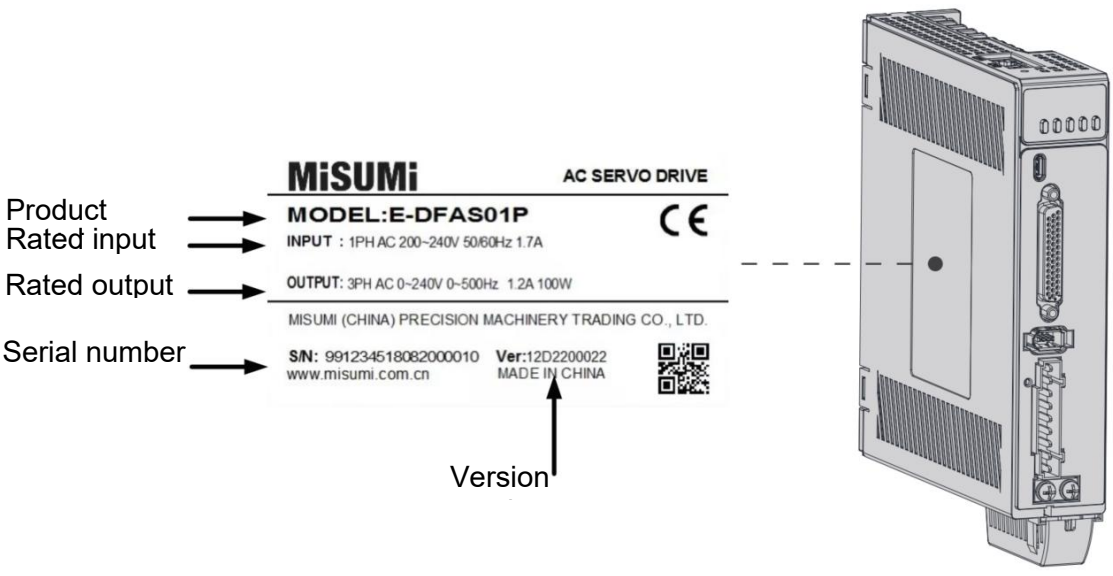
### 1.2.1 Servo Driver

Servo Driver Model Identification Method

E-DFAS ① 01 ② P ③ □ ④

| | | |
|---|---|---|
| ① Product Series<br>E-DFAS: Economy AC Servo Driver | ② Power Rating (W)<br>01：100W<br>04：400W<br>08：750W<br>10：1000W | ③ Product Type<br>P: Pulse Train + RS485<br>E: EtherCAT |
| | | ④ Voltage Level (V)<br>Blank: 220V |

Driver Nameplate



### 1.2.2 Servo Motor

E-MAS Series Servo Motor Model Identification

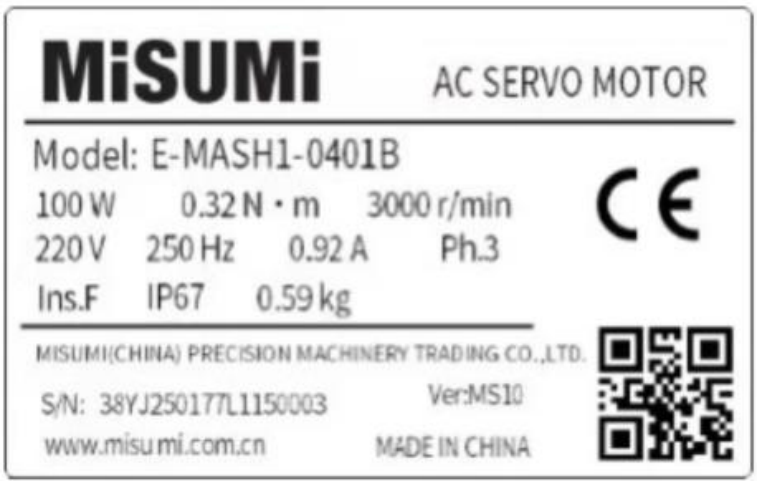
E-MAS H 2 - 04 01 □ B □

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

| | | |
|---|---|---|
| ① Product Category<br>E-MAS: MISUMI E-MAS series Servo Motor | ④ Frame Size (mm)<br>04: 40mm<br>06: 60mm<br>08: 80mm | ⑦ Brake Type<br>Blank: No brake<br>B: With brake |
| ② Inertia Type<br>S: Low Inertia<br>H: High Inertia | ⑤ Power Rating (W)<br>01 : 100W<br>02 : 200W<br>04 : 400W<br>08 : 750W<br>10 : 1000W | ⑧ Connector Type<br>Blank: Straight plug |
| ③ Product Series<br>1: 23-bit magnetic encoder<br>2: 23-bit optical encoder | ⑥ Voltage Level (V)<br>Blank: 220V | |

Servo Motor Nameplate Overview

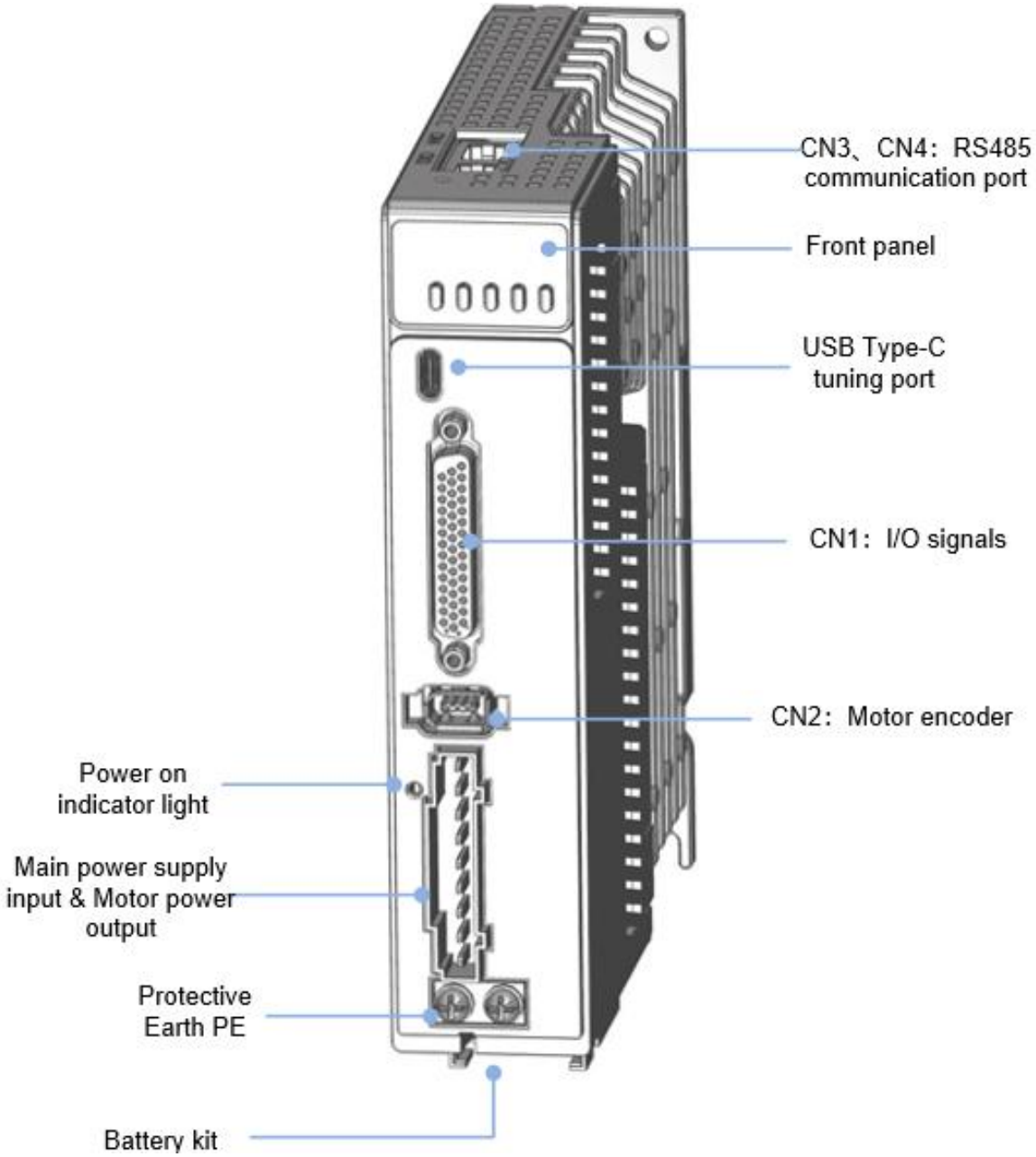




## 1.3 Component Description

### 1.3.1 Servo Driver Ports and Connectors

E-DFAS□□P Series Servo Driver 220V Models



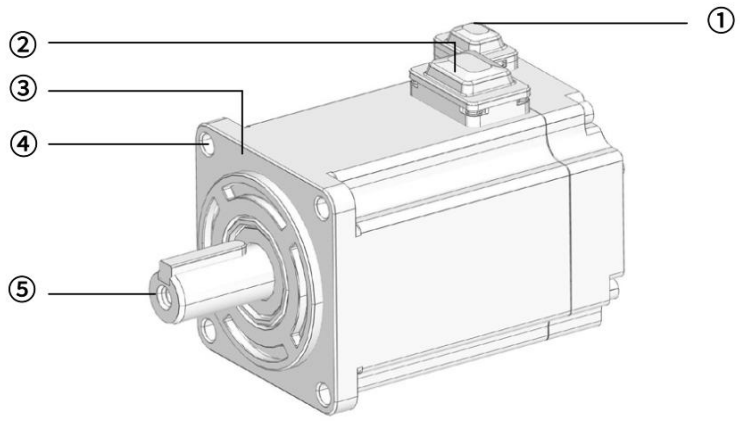
| Parts & Connectors | Description |
|---|---|
| Front Panel | Including an LED display and 5 buttons. LED display is used to display servo driver status and parameter settings.<br>5 buttons：<br>**M** ： *To switch between different modes and parameters*<br>◀ ： *Switch between values*<br>▲ ： *Switch between sub-menus/Increase*<br>▼ ： *Switch between sub-menus/Decrease*<br>**S** : *Enter* |
| USB Type-C Tuning Port | Connect to computer for tuning of servo driver. Parameters of the servo driver can be modified without connecting to main power supply. |
| CN1 I/O signal | Probe input signal & other I/O signals terminals |
| CN3/CN4 RS485 communication port | Connect to master device or next/P0Evious slave station |
| CN2 Encoder | Connect to motor encoder |
| Power-on indicator light | Lights up when servo driver is connected to main power supply.<br>*Please do not touch the power terminal immediately after power off as the capacitor might require some time to discharge.* |
| 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 |

## 1.3.2 Motor Ports and Connectors

Servo motor appearance and components description

Motor (40&60&80 Frame size)

Direct plug-in servo motor (40&60&80 Frame size)




| No. | Component Name |
|---|---|
| ① | Encoder connector |
| ② | Power connector |
| ③ | Motor flange |
| ④ | Mounting hole |
| ⑤ | Motor shaft |

# 1.4 Driver Technical Specification

## 1.4.1 Electrical Specification

| E-DFAS□□P series | | E-DFAS01P | E-DFAS04P | E-DFAS08P | E-DFAS10P |
|---|---|---|---|---|---|
| Rated power (W) | | 100 | 400 | 750 | 1000 |
| Rated Current (Arms) | | 1.2 | 3.5 | 5.5 | 7.0 |
| Peak Current (Arms) | | 3.4 | 10.1 | 16.9 | 21.0 |
| Control Circuit Power Supply | | Single phase AC 200V~240V, -10%~+10%, 50/60Hz | | | |
| Main Power Supply | | Busbar power supply, shared power input and rectification | | | |
| regenerative resistor | Resistance (Ω) | - | | 50 | 50 |
| | Power (W) | | | 75 | 75 |
| Cooling method | | Natural cooling | | Fan cooling | |
| Dimension H*L*W (mm) | | 175*156*40 | | 175*156*50 | |

## 1.4.2 General Specification

| Interface Configuration | | |
|---|---|---|
| Debug Port | TYPE-C debug port, supports USB power only for parameter modification and export | |
| Low-speed pulse input | 5V differential signal, 0-500kHz<br>24V single-ended signal, 0-200kHz | |
| Low-speed pulse input | 5V differential signal, 0~4MHz (high speed) | |
| Frequency division output | Supports A phase / B phase / Z phase differential division output (max output pulse frequency after frequency division is 1MHz)<br>Supports Z phase open collector division output | |
| Digital Inputs | 8 points (supports common cathode and common anode) DI1~DI8 | |
| Digital Outputs | 5 points (5 dual-ended outputs DO1~DO5)<br>LDO with load capacity of 50mA, voltage range of 5V~30V | |
| Control Mode | | |
| Control Mode | • External pulse position control<br>• Speed control<br>• Torque control<br>• JOG control<br>• Mixed control: position/torque, position/speed, speed/torque | |
| Position control | Max Input Pulse Frequency | • 4MHz (5V differential input)<br>• 500kHz (5V differential input)<br>• 200kHz (24V single-ended input) |
| | Electronic Gear Ratio (Numerator/Denominator) | 1~8388608 / 1~8388608 |
| | Rotation Limit | Set via parameter |
| Control Characteristics | | |
| Control Method | IGBT SVPWM sine wave control | |
| Feedback Method | Bus-type encoder using RS485 protocol | |
| Normalized Servo Parameters | PC debugging tool supports quick servo tuning using parameters like rigidity | |

| | |
|---|---|
| Ease-of-Use Features | Auto tuning, Single-parameter tuning, Super-following function |
| Notch Filters | Suppress mechanical resonance, supports 3 notch filters, frequency range: 50Hz ~ 4000Hz |
| Oscillation Suppression | End-point vibration suppression |
| DI/DO Configuration | Digital input/output functions can be freely assigned |
| Alarm Functions | Overvoltage, Undervoltage, Overcurrent, Overload, Overheating, Overspeed, Missing main power phase, Regenerative braking fault, Excessive position deviation, Encoder feedback error, Excessive braking rate, Travel limit exceeded, EEPROM error, etc. |
| Operation & Display | 5 buttons, 5 digits LED with decimal point |
| Debugging Software | Using MISUMI EDrive software to adjust current loop, position loop, and speed loop parameters, modify input/output signal logic levels, import/export motor and driver parameters via file, monitor waveform data such as speed and position error during trapezoidal test runs |
| Communication Functions | USB Support: Based on Modbus protocol (USB 2.0 spec), allows PC connection for parameter setting and status monitoring. |
| | E-DFAS□□P model supports RS384 bus communication via RJ45 interface, based on Modbus protocol, up to 32 axes. |
| Dynamic Brake | Built-in dynamic brake |
| Black Box | Supports black box data capture. Records data before and after preset conditions. Compatible with MISUMI EDrive software for data reading and analysis. |
| Applicable Load Inertia | Recommended for loads with inertia less than 30× motor inertia |
| Digital Input | |
| Digital Input | 8 points (supports both sinking and sourcing types) DI1, DI2, DI3, DI6.<br>Configurable input signals:<br>1. Servo enabled (SRV-ON)<br>2. Positive limit switch (POT)<br>3. Negative limit switch (NOT)<br>4. Gain switching (GAIN)<br>5. Emergency stop (E-Stop)<br>6. Deviation counter clearing (CL)<br>7. Control mode switching (C-MODE)<br>8. Torque limit switching (TL-SEL)<br>9. Vibration supP0Ession 1(VS-SEL1)<br>10. Vibration supP0Ession 2(VS-SEL2)<br>11. Command prohibition (INH)<br>12. Internal command velocity 1(INTSPD1)<br>13. Internal command velocity 2(INTSPD2)<br>14. Internal command velocity 3(INTSPD3)<br>15. Internal command velocity 4(INTSPD4)<br>16.Crossover frequency input (DIV1)<br>17. Zero speed clamp (ZEROSPD)<br>18.Velocity sign (VC-SIGN)<br>19.Torque sign (TC-SIGN)<br>20. Clear Alarm （A-CLR |
| PR Mode Only | Configurable input signals under PR mode:<br>1. Path trigger (CTRG)<br>2. Home switch (HOME) |

| | |
|---|---|
| | 3. Emergency stop trigger (STP)<br>4. Path 0-3 (ADD0-ADD3)<br>5. Positive JOG (PJOG)<br>6. Negative JOG(NJOG)<br>7. Positive limit switch (PL)<br>8. Negative limit switch (NL)<br>9. Origin point switch (ORG) |
| Digital Output | |
| Digital Output | 5 points (dual-ended)<br>Configurable input signals:<br>1. Alarm (ALARM)<br>2. Servo ready (SRDY)<br>3. External brake off (BRK-OFF)<br>4. Positioning completed (INP1)<br>5. Velocity at arrival (AT-SPEED)<br>6. Zero speed position (ZSP)<br>7. Velocity coincidence (V-COIN)<br>8. Position command (P-CMD)<br>9. Velocity limit (V-LIMIT)<br>10. Velocity command (V-CMD)<br>11. Servo enabled (SRV-ST)<br>12. Positive limit switch (POT-OUT)<br>13. Negative limit switch (NOT-OUT) |
| PR Mode Only | Configurable output signals under PR mode:<br>1. Command completed (CMD-OK)<br>2. Path completed (PR-OK)<br>3. Homing done (HOME-OK) |
| Environment | |
| Temperature | Operating Temperature: 0°C to 55°C (non-freezing). If temperature exceeds 45°C, apply derating[1]. Reduce by 2% for every 1°C above 45°C<br>Storage Temperature: -40°C to 80°C (no condensation). If storage temperature exceeds 65°C, do not store for more than 72 hours! |
| Humidity | Under 90%RH (Condensation free) |
| Altitude | Maximum altitude: 2000 meters<br>No derating required below 1000 meters<br>Above 1000 meters, derate by 1% for every 100 meters<br>For usage above 2000 meters, please contact the manufacturer |
| Vibration | Less than 0.5G (4.9m/s2) 10-60Hz (non-continuous working) |
| IP ratings | IP20 |

Note
[1] Please install the servo driver within the specified ambient temperature range. If stored inside an electrical cabinet, ensure that the internal cabinet temperature does not exceed this specified range.

# 1.5 Motor General Specifications

## 1.5.1 Mechanical Characteristic Specifications

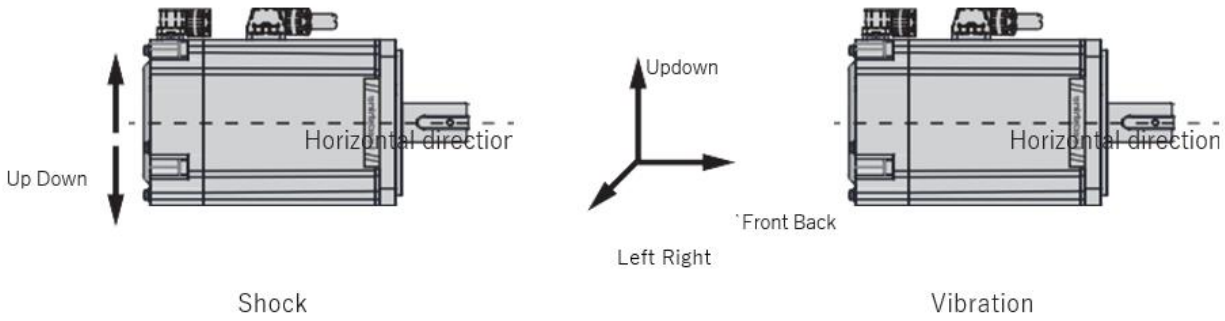
| Item | | Description |
|---|---|---|
| Duty Cycle | | Continuous |
| Vibration Class | | V15 |
| Insulation Resistance | | DC500V, over 100 MΩ |
| Excitation Method | | Permanent Magnet |
| Mounting Method | | Flange Type |
| Thermal Class | | Class F |
| Insulation Voltage | | AC1500V for 1 minute |
| Enclosure Protection | | IP67 (excluding shaft end and cable outlet) |
| Rotation Direction | | CCW (counterclockwise) when viewed from the load side under forward command |
| Environmental Conditions | Temperature | 0℃ ~40℃（No Freezing） |
| | Humidity | 20%~80%（No condensation） |
| | Installation Location | • Indoor, free from corrosive or explosive gases<br>• Well-ventilated, minimal dust, debris, or humidity<br>• Easy to inspect and clean<br>• Operate normally below 1000m; derate above 1000m<br>• Free from strong magnetic fields<br>• Away from heat sources such as furnaces<br>• For environments with grinding fluid, oil mist, iron dust, or cutting debris, select models with oil seal |
| | Storage Environment | When storing the motor unpowered, comply with the following:<br>• Storage temperature: -20°C ~ +60°C (non-freezing)<br>• Storage humidity: 20% ~ 80% RH (non-condensing) |
| Shock Resistance [1] | Shock acceleration (measured at flange face): | $490 m/s^2$ |
| Vibration Resistance [2] | Vibration acceleration (measured at flange face) | $49 m/s^2$ |

Note

[1] Shock resistance applies in the vertical direction when the motor is mounted horizontally.

[2] Vibration resistance applies in all three directions (up/down, left/right, front/back) for horizontal mounting.

Actual vibration levels vary by application; verify with real-world use.



### 1.5.2 Electrical Specifications of Motor's Brake

| Motor Model | Holding Torque (N·m) | Supply Voltage (VDC)±10 % | Closing Voltage (V) | Release Voltage (V) | Release Time (ms) | Closing time (ms) | Rotary clearance (° ) |
|---|---|---|---|---|---|---|---|
| E-MASH1-0401B | ≥ 0.4 | 24 | ≤ 16 | ≥ 1 | ≤ 20 | ≤ 40 | ＜ 1.5 |
| E-MASH1-0602B | ≥ 1.5 | | ≤ 16 | ≥ 1 | ≤ 20 | ≤ 50 | ≤ 1 |
| E-MASH1-0604B | ≥ 1.5 | | ≤ 16 | ≥ 1 | ≤ 20 | ≤ 50 | ≤ 1 |
| E-MASH1-0808B | ≥ 3.2 | | ≤ 16 | ≥ 1 | ≤ 40 | ≤ 60 | ≤ 1 |
| E-MASH1-0810B | ≥ 3.2 | | ≤ 16 | ≥ 1 | ≤ 40 | ≤ 60 | ≤ 1 |

### 1.5.3 Load Moment of Inertia

Load inertia is the inertia of the load. Larger load inertia reduces responsiveness and may cause instability. Servo motors have limits on allowable load inertia, which vary by drive conditions.
Exceeding this limit can trigger an overvoltage alarm during deceleration or an overload alarm if the servo has a built-in braking resistor.
If alarms occur, take appropriate corrective actions:

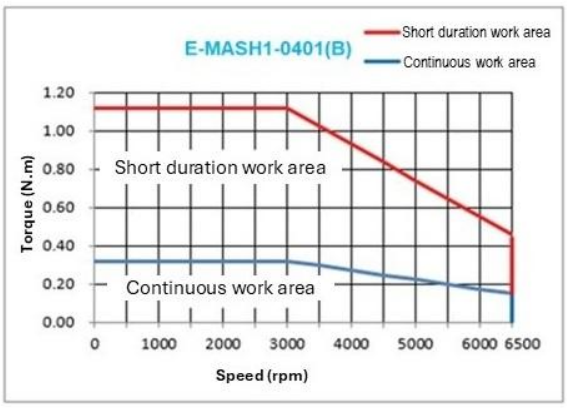
- Reduce the torque limit.
- Decrease the deceleration rate.
- Lower the maximum speed.

If alarms persist after these measures, use an external braking resistor.
⚠Caution
Even when using a built-in braking resistor, under certain regenerative drive conditions, the generated energy may exceed the allowable dissipation capacity (W) of the built-in resistor. In such cases, an external braking resistor is required.

## 1.6 Motor Specifications

| Motor Model | Power (W) | Rated torque (N·m) | Rated speed (rpm) | Maximum speed (rpm) | Moment of inertia ($kgm^2 \times 10^{-4}$) | Voltage (V) |
|---|---|---|---|---|---|---|
| E-MASH1-0401 | 100 | 0.32 | 3000 | 6000 | 0.062 | 220 |
| E-MASH1-0401B (With Brake) | | | | | 0.072 | |
| E-MASH1-0602 | 200 | 0.64 | | | 0.28 | |
| E-MASH1-0602B (With Brake) | | | | | 0.3 | |
| E-MASH1-0604 | 400 | 1.27 | | | 0.56 | |
| E-MASH1-0604B (With Brake) | | | | | 0.58 | |
| E-MASH1-0808 | 750 | 2.39 | | | 1.5 | |
| E-MASH1-0808B (With Brake) | | | | | 1.65 | |
| E-MASH1-0810 | 1 | 3.18 | | | 2 | |
| E-MASH1-0810B (With Brake) | | | | | 2.15 | |

## E-MASH1-0401(B)

| Motor Specifications | | | Torque-speed characteristics |
|---|---|---|---|
| Frame size(mm) | 40 | |  |
| Inertia | High inertia | | |
| Rated power (kW) | 0.1 | | |
| Rated voltage (V) | 220 | | |
| Rated torque (N·m) | 0.32 | | |
| Maximum torque (N·m) | 1.11 | | |
| Rated current (A) | 0.92 | | |
| Maximum current (A) | 3.36 | | |
| Rated speed (rpm) | 3000 | | |
| Maximum speed (rpm) | 6000 | | |
| Torque coefficient | 0.383 | | |
| (Nm/A (rms)) | Without brake | 0.062 | |
| | With brake | 0.072 | |



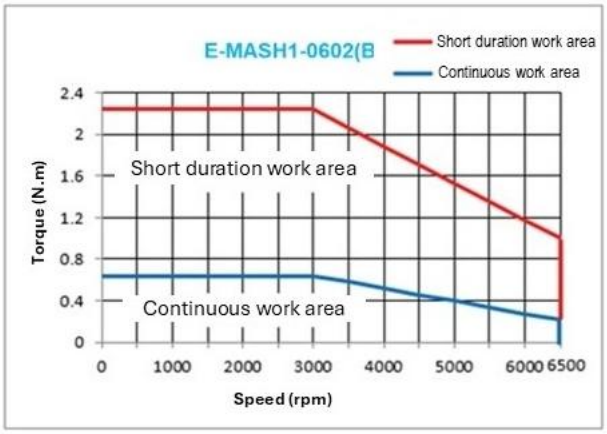
Brake specifications

| Holding Torque (N·m) | Supply Voltage (VDC) | Rated Power (W) | Excitation current (A) | Release Time (ms) | Closing time (ms) | Rotary clearance (° ) |
|---|---|---|---|---|---|---|
| > 0.4 | 24 | 6.9 | 0.25 | ≤ 40 | ≤ 20 | < 1.5° |

Allowable load

| Shaft length (mm) | Radial allowable load (N) | Axial allowable load (N) |
|---|---|---|
| 25 | 78 | 54 |

## E-MASH2-0602(B)

| Motor Specifications | | | Torque-speed characteristics |
|---|---|---|---|
| Frame size(mm) | 60 | |  |
| Inertia | High inertia | | |
| Rated power (kW) | 0.2 | | |
| Rated voltage (V) | 220 | | |
| Rated torque (N·m) | 0.64 | | |
| Maximum torque (N·m) | 2.23 | | |
| Rated current (A) | 1.5 | | |
| Maximum current (A) | 5.4 | | |
| Rated speed (rpm) | 3000 | | |
| Maximum speed (rpm) | 6000 | | |
| Torque coefficient | 0.447 | | |
| (Nm/A (rms)) | Without brake | 0.28 | |
| | With brake | 0.30 | |



Brake specifications

| Holding Torque (N·m) | Supply Voltage (VDC) | Rated Power (W) | Excitation current (A) | Release Time (ms) | Closing time (ms) | Rotary clearance (° ) |
|---|---|---|---|---|---|---|
| > 1.5 | 24 | 8.3 | 0.31 | ≤ 50 | ≤ 20 | < 1° |

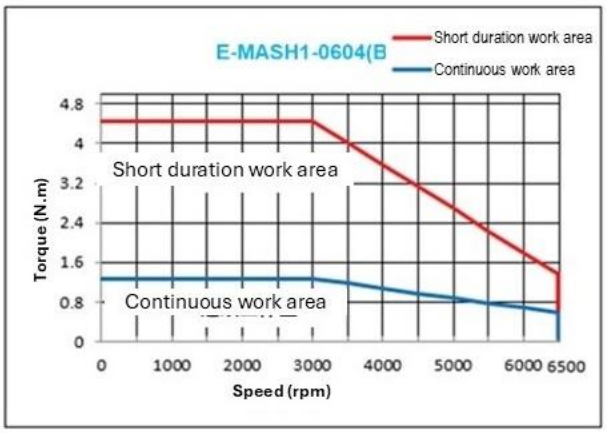
Allowable load

| Shaft length (mm) | Radial allowable load (N) | Axial allowable load (N) |
|---|---|---|
| 30 | 245 | 74 |

## E-MASH2-0604(B)

| Motor Specifications | | |
|---|---|---|
| Frame size(mm) | 60 | |
| Inertia | High inertia | |
| Rated power (kW) | 0.4 | |
| Rated voltage (V) | 220 | |
| Rated torque (N·m) | 1.27 | |
| Maximum torque (N·m) | 4.46 | |
| Rated current (A) | 2.1 | |
| Maximum current (A) | 7.6 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient | 0.645 | |
| (Nm/A (rms)) | Without brake | 0.56 |
| | With brake | 0.58 |

Torque-speed characteristics




Brake specifications

| Holding Torque (N·m) | Supply Voltage (VDC) | Rated Power (W) | Excitation current (A) | Release Time (ms) | Closing time (ms) | Rotary clearance (° ) |
|---|---|---|---|---|---|---|
| > 1.5 | 24 | 8.3 | 0.31 | ≤ 50 | ≤ 20 | ≤ 1° |

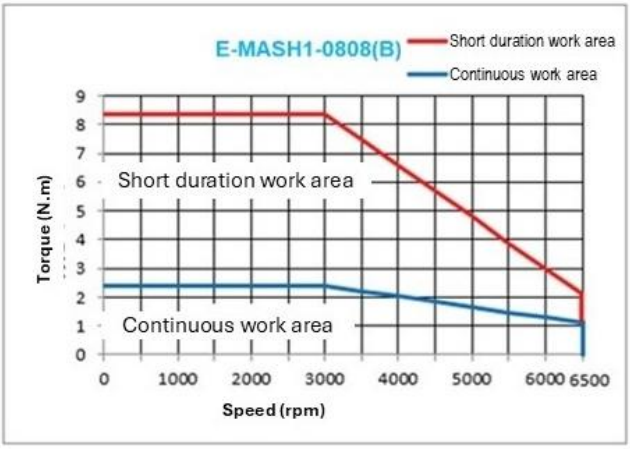
Allowable load

| Shaft length (mm) | Radial allowable load (N) | Axial allowable load (N) |
|---|---|---|
| 30 | 245 | 74 |

## E-MASH2-0808(B)

| Motor Specifications | | |
|---|---|---|
| Frame size(mm) | 80 | |
| Inertia | High inertia | |
| Rated power (kW) | 0.75 | |
| Rated voltage (V) | 220 | |
| Rated torque (N·m) | 2.39 | |
| Maximum torque (N·m) | 8.36 | |
| Rated current (A) | 4.1 | |
| Maximum current (A) | 15.4 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient | 0.645 | |
| (Nm/A (rms)) | Without brake | 1.5 |
| | With brake | 1.65 |

Torque-speed characteristics



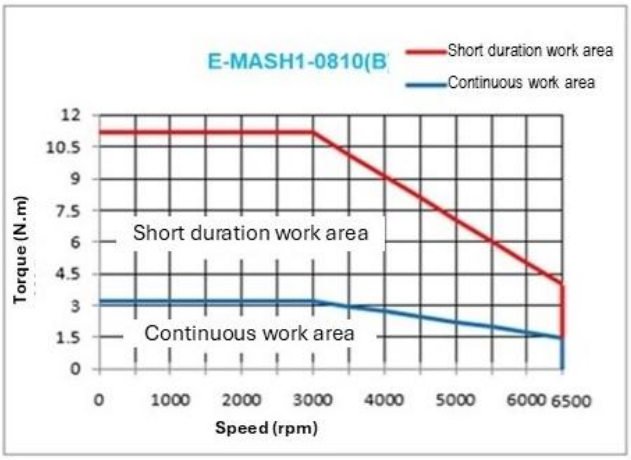

Brake specifications

| Holding Torque (N·m) | Supply Voltage (VDC) | Rated Power (W) | Excitation current (A) | Release Time (ms) | Closing time (ms) | Rotary clearance (° ) |
|---|---|---|---|---|---|---|
| > 3.2 | 24 | 11.5 | 0.48 | ≤ 60 | < 40 | < 1° |

Allowable load

| Shaft length (mm) | Radial allowable load (N) | Axial allowable load (N) |
|---|---|---|
| 35 | 392 | 147 |

## E-MASH2-0810(B)

| Motor Specifications | | | Torque-speed characteristics |
|---|---|---|---|
| Frame size(mm) | 80 | |  |
| Inertia | High inertia | | |
| Rated power (kW) | 1 | | |
| Rated voltage (V) | 220 | | |
| Rated torque (N·m) | 3.18 | | |
| Maximum torque (N·m) | 11.2 | | |
| Rated current (A) | 5.7 | | |
| Maximum current (A) | 21 | | |
| Rated speed (rpm) | 3000 | | |
| Maximum speed (rpm) | 6000 | | |
| Torque coefficient | 0.634 | | |
| (Nm/A (rms)) | Without brake | 2 | |
| | With brake | 2.13 | |



### Brake specifications

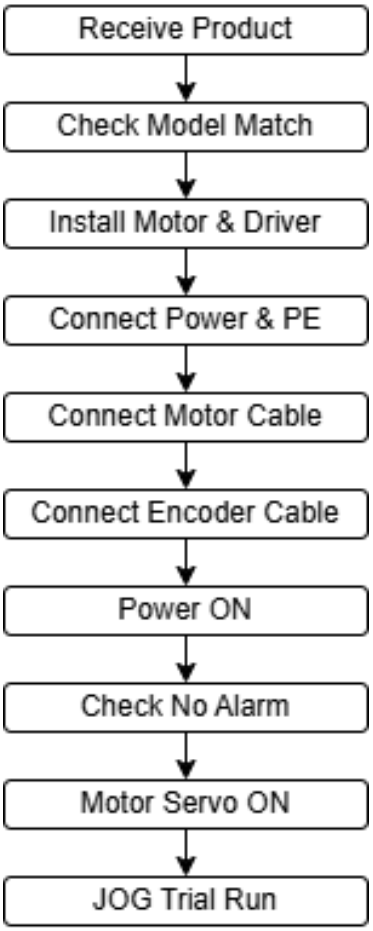
| Holding Torque (N·m) | Supply Voltage (VDC) | Rated Power (W) | Excitation current (A) | Release Time (ms) | Closing time (ms) | Rotary clearance (° ) |
|---|---|---|---|---|---|---|
| ➢ 3.2 | 24 | 11.5 | 0.48 | ≤ 60 | ≤ 40 | < 1 |

### Allowable load

| Shaft length (mm) | Radial allowable load (N) | Axial allowable load (N) |
|---|---|---|
| 35 | 392 | 147 |

# Chapter 2 Quick Start Guide

## 2.1 Commissioning Workflow




## 2.2 Unpacking Checklist

| Check | Status |
|---|---|
| Driver model matches order | □ |
| Motor model matches order | □ |
| No physical damage | □ |
| Connectors included | □ |
| Motor and driver are matched pair | □ |

## 2.3 Installation Checklist

**Driver:**

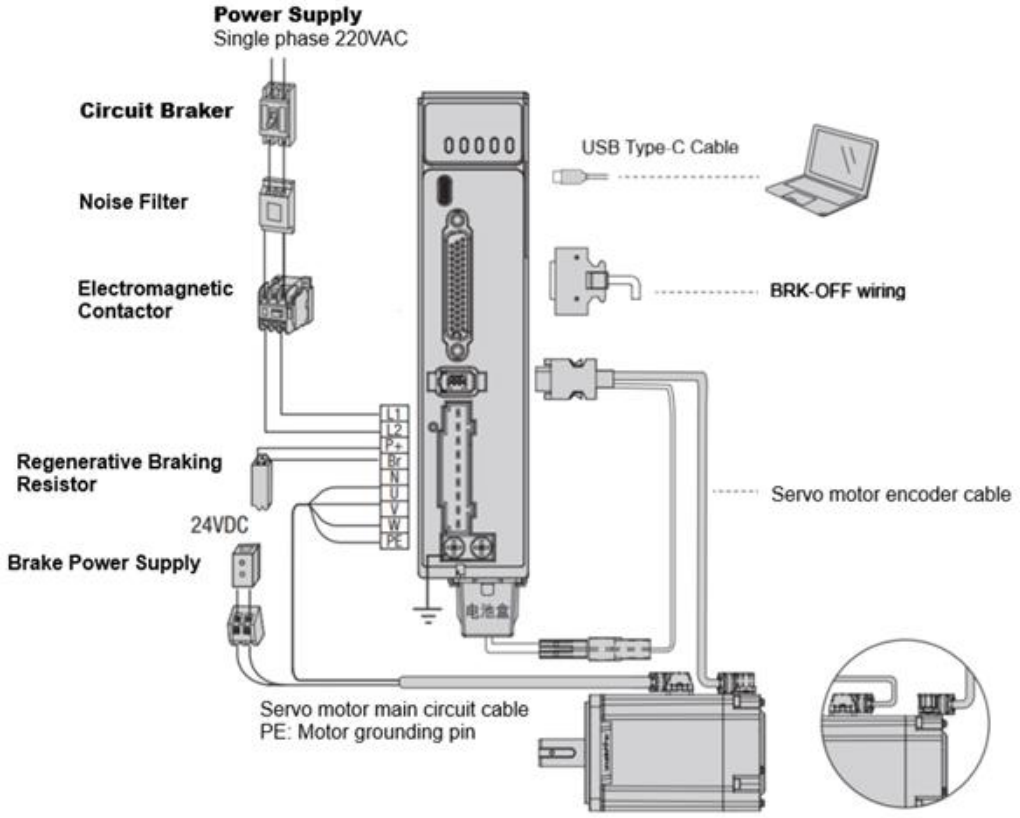
☐ Installed vertically
☐ Ventilation space available
☐ Cabinet temperature below specification
☐ PE grounded

**Motor:**

☐ Securely mounted
☐ Flexible coupling used
☐ Shaft not overloaded

## 2.4 Wiring Checklist

Minimum wiring that needs to perform trial run as below:




☐ AC Power (L1/L2/L3)
☐ Control Power (L1C/L2C)
☐ PE Ground
☐ Motor U/V/W Cable
☐ Encoder Cable
☐ USB cable to PC
☐ Brake wiring (if brake motor)
☐ Battery box wiring (if absolute encoder)

Note: For first trial run, external controller wiring is not required.

## 2.5 First Power-On

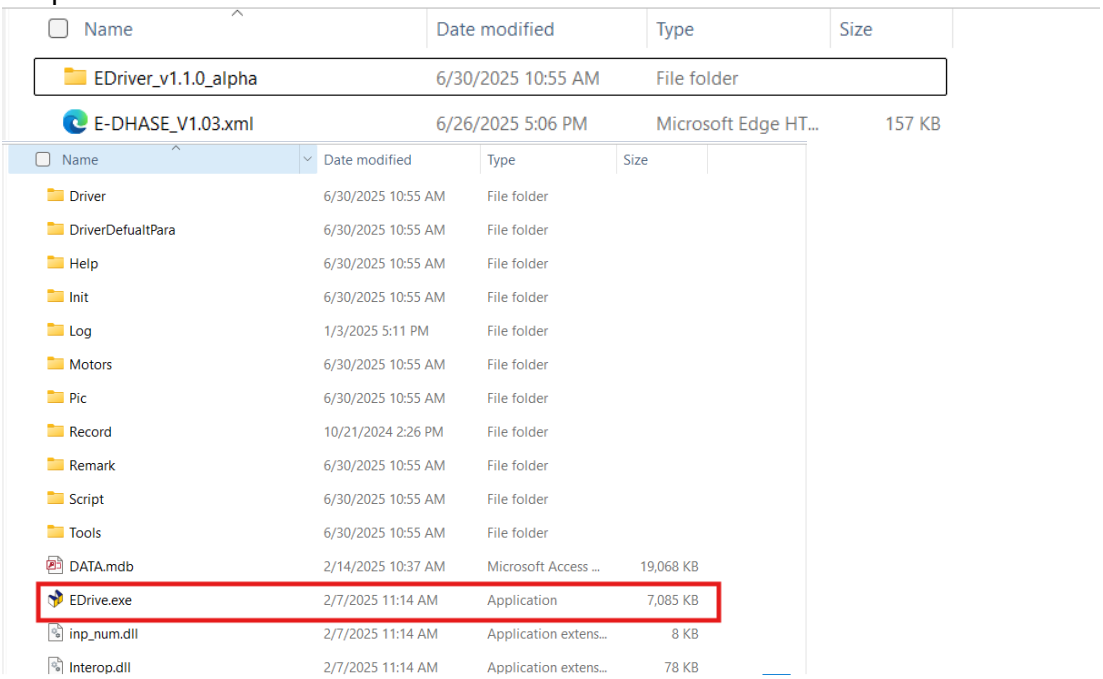
Apply control power and main power.
Expected:

- 'Charge' LED ON
- Front panel active
- No alarm displayed

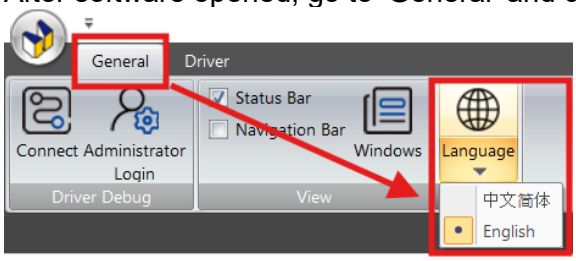
## 2.6 Servo ON and Trial Run

The EDrive software can be downloaded from the link below:
https://sg.misumi-ec.com/linked/material/mech/MSM1/CAD/3D/10311229039/E-DHAS.zip

After unzip or pull the 'EDriver_v1.2.0_alpha' folder to the desktop, double click 'EDrive.exe' to open the software.



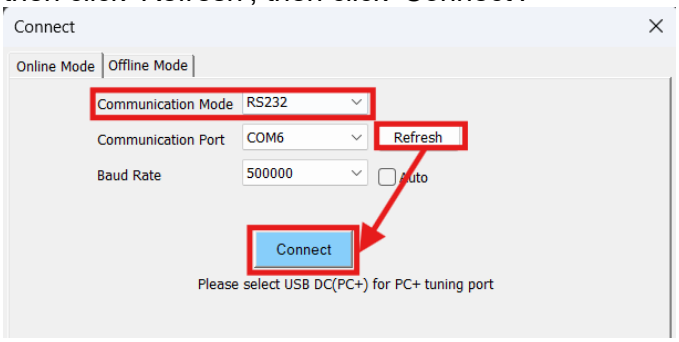

After software opened, go to 'General' and change language to 'English'.



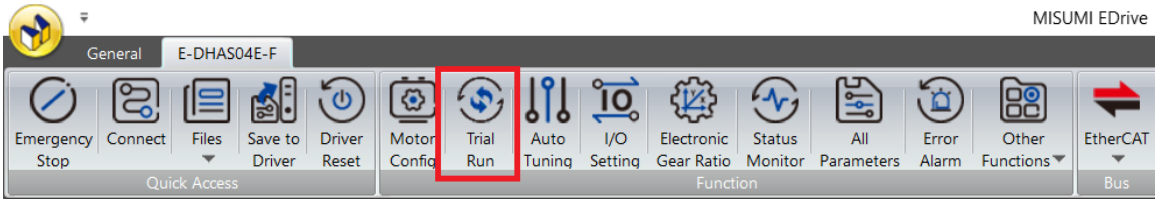

Please use cable with one side USB type-A and the other side USB type-C.



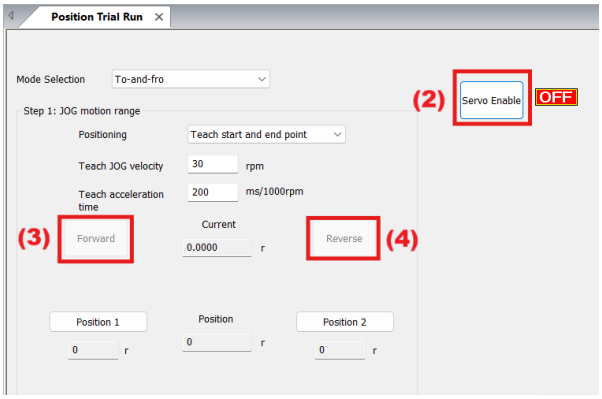
Open EDrive software and start connection. ‘Communication Mode’ please choose ‘RS232’, then click ‘Refresh’, then click ‘Connect’.




Click ‘Trial Run’.




Click (2) ‘Servo Enable’, then click (3) ‘Forward’ or (4) ‘Reverse’, to move the motor.




## 2.7 Commissioning Completion Checklist

☐ Driver power ON normally
☐ No alarm present
☐ Servo ON successful
☐ Forward rotation verified
☐ Reverse rotation verified
☐ Brake function verified

## 2.8 Troubleshooting Quick Check

| **Symptom** | **Check** |
|---|---|
| No display | Control power wiring |
| Alarm after power ON | Encoder / motor cable |
| Servo ON impossible | DI assignment / SRV-ON |
| Motor vibrates | U/V/W wiring |
| Wrong direction | Motor direction parameter |
| Brake not releasing | CN1 BRK-OFF wiring |

# Chapter 3 Installation

## 3.1 Servo Driver Installation

2.1.1 Installation Location

1. Install the servo driver indoors, inside a control cabinet, away from rain and direct sunlight. Do not place flammable materials nearby. The unit is not waterproof.
2. Do not use the product in environments containing corrosive gases such as Hydrogen sulfide, Sulfur dioxide, Chlorine, Ammonia, Chlorinated gases, Acids, alkalis, salts, or in areas with flammable gases or combustible materials.
3. Avoid installing in environments that are Hot, humid, dusty or contain metal dust.
4. Install in a location with minimal vibration.
5. Preferably install in a well-ventilated, dry, and dust-free area. Ensure no oil, metal dust, or water enters the product.

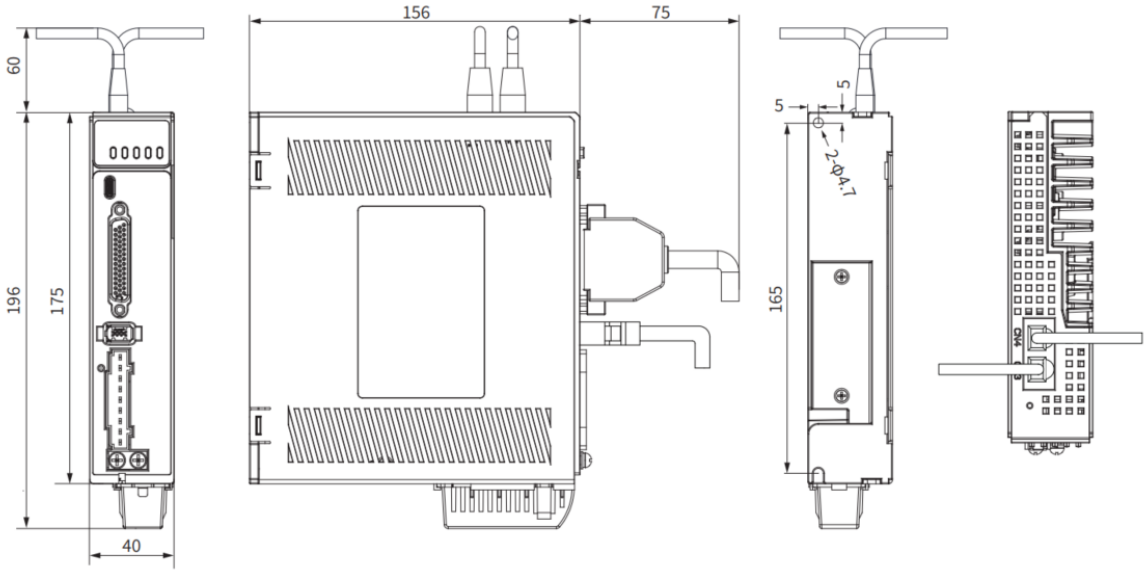
### 3.1.1 Servo Driver Installation Environment

| Item | E-DFAS□□P series driver |
|---|---|
| Operating Temperature | 0~+55℃ (no derating is required from 0℃ to +45℃, derating is required when the temperature exceeds 45℃) (Condensation is more likely to occur when the temperature drops and the humidity rises) [1] |
| Operating Humidity | Below 90% RH, non-condensing |
| Storage Temperature | -40°C to +80°C (non-freezing) |
| Storage Humidity | Below 90% RH, non-condensing |
| Atmospheric Conditions | Indoor use only (No direct sunlight)<br>No corrosive gases, flammable gases, oil, or dust |
| Altitude | Maximum altitude: 2000 meters<br>No derating required below 1000 meters<br>Above 1000 meters, derate by 1% for every 100 meters<br>For usage above 2000 meters, please contact the manufacturer |
| Vibration Resistance | Less than 0.5G (4.9m/s2) 10-60Hz (non-continuous working) |
| Protection Rating | IP20 (except terminals, which are IP00) |

Note
[1] Please install the servo driver within the specified ambient temperature range. If stored inside an electrical cabinet, ensure that the internal cabinet temperature does not exceed this specified range.

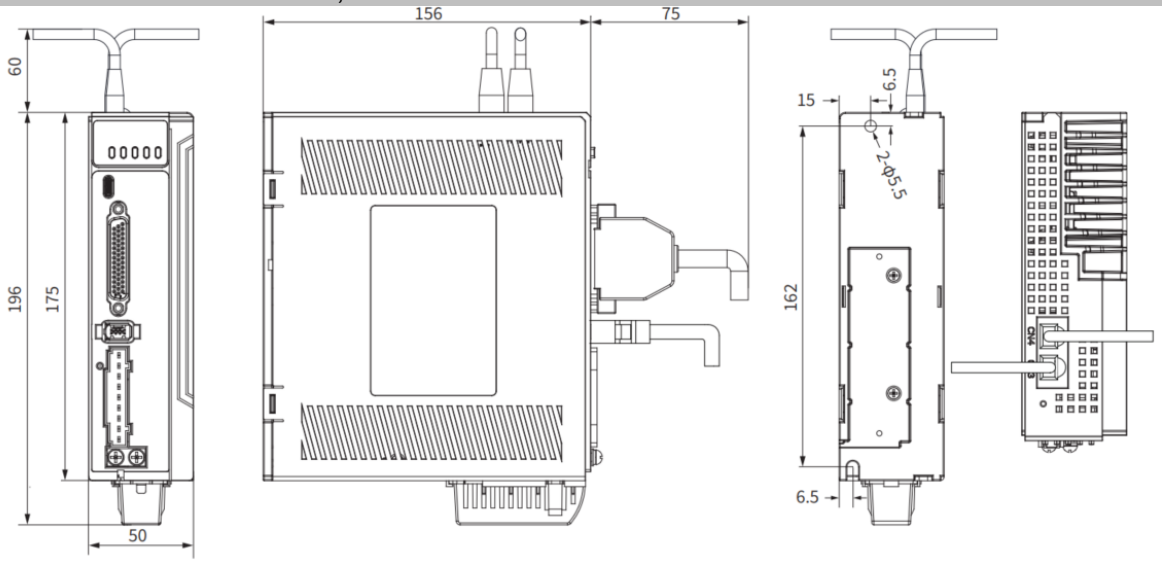
### 3.1.2 Servo Driver Dimension

**Dimension 1： E-DFAS01P, E-DFAS04P**




40mm x 175mm x 156mm

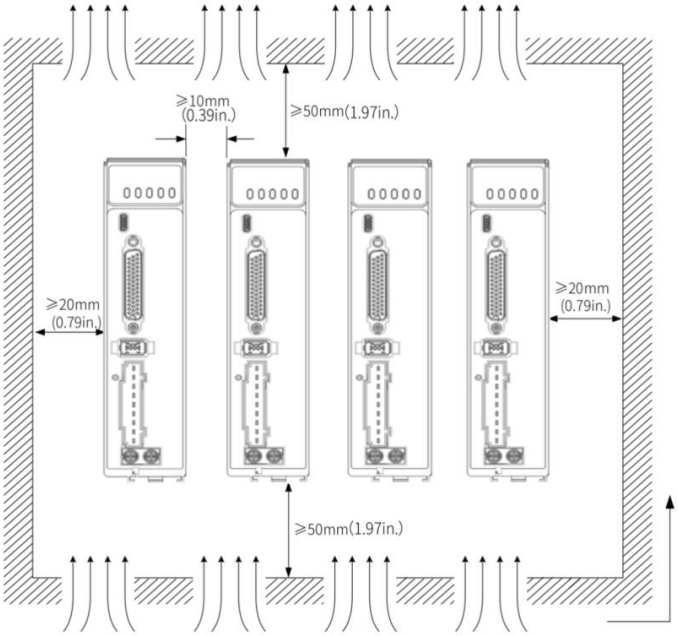
**Dimension 2： E-DFAS08P, E-DFAS10P**



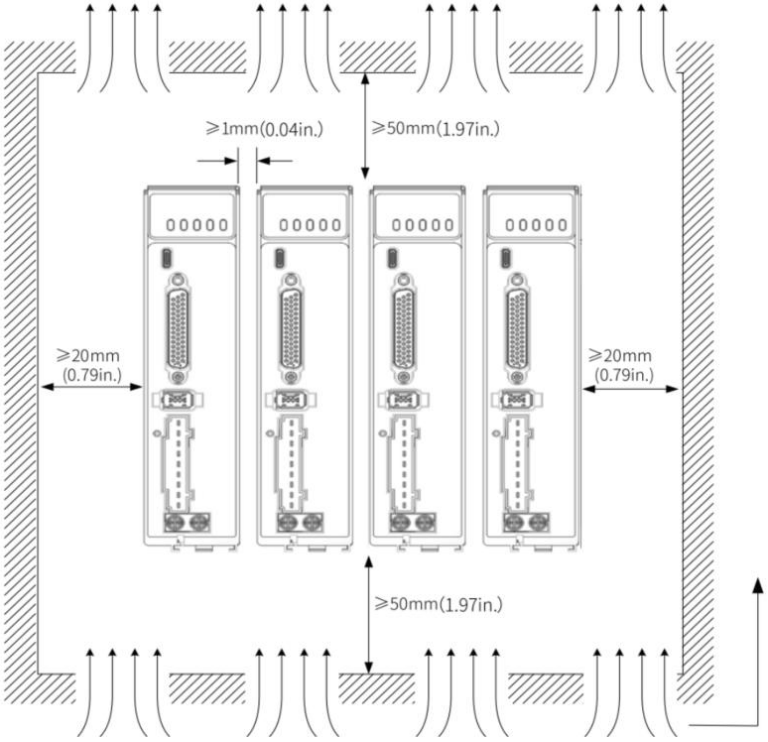

50mm x 175mm x 156mm

### 3.1.3 Space Requirement for Installation

The servo driver can be installed using either base mounting or panel mounting. The installation orientation must be vertically upward, perpendicular to the mounting surface. To ensure proper heat dissipation:
Leave at least 10 mm of clearance around the unit.
Leave at least 50 mm of clearance on both vertical sides.




For compact installations, allow at least 1 mm of spacing between each pair of drivers to account for installation tolerances. In this case, operate the drivers at no more than 75% actual load rate.



## Installation Precautions

1. Installation Method

   Ensure the installation direction is perpendicular to the wall, with the product mounted vertically upward to allow heat to dissipate effectively. If multiple units are installed inside a cabinet, arrange them side by side. For vertical stacking, install a heat insulation and airflow guide plate between units.

   Use natural convection or fans to cool the servo driver.

   Fix the servo driver to the mounting surface using the mounting holes on the unit. During installation, the front panel of the servo driver should face the operator, and the unit should be vertically aligned with the wall.

2. Cooling

   To ensure effective cooling via fans or natural airflow, leave sufficient space around the servo driver and consider the heat dissipation of other components in the cabinet. Install a cooling fan above the servo driver. Maintain uniform temperature inside the cabinet to avoid localized overheating.

3. Grounding

   Be sure to ground the grounding terminal. Failure to do so may result in electric shock, interference, or malfunction.

4. Wiring Requirements

   When wiring the servo driver, route cables downward. This prevents liquids from flowing along the cables into the driver, which could cause damage or accidents.

5. Ethernet Port Dust Protection

   For CN3 and CN4 communication ports, if they are not in use, appropriate dust protection measures must be taken. Insert dust caps into the ports to prevent foreign objects (such as solids or liquids) from entering and potentially damaging the product.

6. Absolute Encoder Battery Box

   If using a battery box, reserve installation space for it inside the cabinet.

## 3.2 Servo Motor Installation

### 3.2.1 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 motors are used in enclosed environments without heat dissipation, motor lifespan will be short.
- Please check and clean the installation spot before installation.

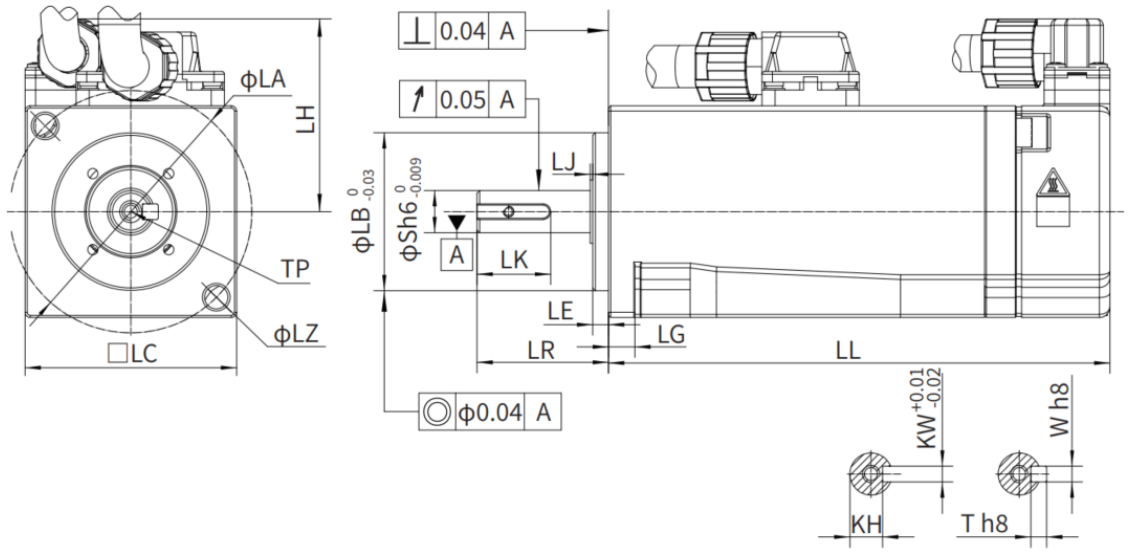
### 3.2.2 Installation Environment

| Item | Condition |
|---|---|
| Operating Temperature | 0°C to +40°C (up to +60°C with derating; non-freezing) |
| Operating Humidity | Below 90% RH (no condensation or icing) |
| Storage Temperature | -20°C to +60°C (max 85°C for up to 72 hours) |
| Storage Humidity | Below 90% RH (no condensation or icing) |
| Atmosphere | Indoor (no direct sunlight), free of corrosive or flammable gases |
| Altitude | Below 1000m for normal use; derating required above 1000m (up to 2000m) |
| Vibration Grade | Less than 5G (49 m/s²) |
| Shock Resistance | Less than 50G (490 m/s²) |
| Protection Rating | IP65 (E-MASH2 series motors up to IP67) |

Note:
Operating temperature: 0 to +60 °C. Derating is required when operating above 40 °C.
When temperature decreases and humidity increases, condensation is likely to occur.
If storage temperature exceeds +60 °C, do not store continuously at this temperature for more than 72 hours.

### 3.2.3 Motor Dimensions

#### 40 Motor Frame (Unit: mm)



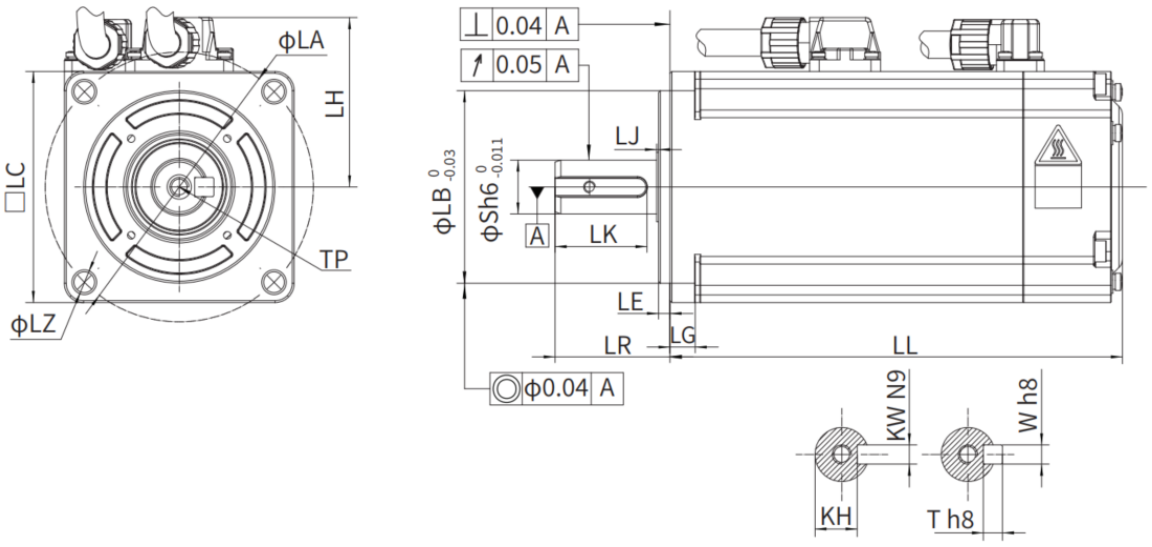

Shaft End Shaft End with Key

The above diagrams are for reference only. Please refer to the actual dimensions for installation.

| Motor Model | LL | LC | LR | LA | LZ | LH | LG | LE | LJ | S | LB | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-MASH1-0401 | 67.7 | 40 | 25 | 46 | 4.5 | 38MAX | 5 | 3 | 3 | 8 | 30 | M3X8 | 14 | 6.2 | 3 | 3 | 3 | 0.46 |
| E-MASH1-0401B | 95 | 40 | 25 | 46 | 4.5 | 38MAX | 5 | 3 | 3 | 8 | 30 | M3X8 | 14 | 6.2 | 3 | 3 | 3 | 0.68 |

Note: In the motor model, “B” indicates a brake-equipped motor.

#### 60/80 Motor Frame (Unit: mm)




Shaft End Shaft End with Key

The above diagrams are for reference only. Please refer to the actual dimensions for installation.

| Motor Model | LL | LC | LR | LA | LZ | LH | LG | LE | LJ | S | LB | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-MASH1-0602 | 71.8 | 60 | 30 | 70 | 5.5 | 37.5MAX | 6.6 | 3 | 3 | 14 | 50 | M5X12 | 22.5 | 11 | 5 | 5 | 5 | 0.9 |
| E-MASH1-0602B | 101.1 | 60 | 30 | 70 | 5.5 | 37.5MAX | 6.6 | 3 | 3 | 14 | 50 | M5X12 | 22.5 | 11 | 5 | 5 | 5 | 1.3 |
| E-MASH1-0604 | 88.8 | 60 | 30 | 70 | 5.5 | 37.5MAX | 6.6 | 3 | 3 | 14 | 50 | M5X12 | 22.5 | 11 | 5 | 5 | 5 | 1.3 |
| E-MASH1-0604B | 118.1 | 60 | 30 | 70 | 5.5 | 37.5MAX | 6.6 | 3 | 3 | 14 | 50 | M5X12 | 22.5 | 11 | 5 | 5 | 5 | 1.55 |
| E-MASH1-0808 | 90.9 | 80 | 35 | 90 | 6.5 | 57.5MAX | 8.1 | 3 | 3 | 19 | 70 | M5X15 | 25 | 15.5 | 6 | 6 | 6 | 2.12 |
| E-MASH1-0808B | 121.9 | 80 | 35 | 90 | 6.5 | 57.5MAX | 8.1 | 3 | 3 | 19 | 70 | M5X15 | 25 | 15.5 | 6 | 6 | 6 | 2.7 |
| E-MASH1-0810 | 103.9 | 80 | 35 | 90 | 6.5 | 57.5MAX | 8.1 | 3 | 3 | 19 | 70 | M5X15 | 25 | 15.5 | 6 | 6 | 6 | 2.7 |
| E-MASH1-0810B | 134.9 | 80 | 35 | 90 | 6.5 | 57.5MAX | 8.1 | 3 | 3 | 19 | 70 | M5X15 | 25 | 15.5 | 6 | 6 | 6 | 3.2 |

Note: In the motor model, “B” indicates a brake-equipped motor.

### 3.2.4 Installation Method and Precautions

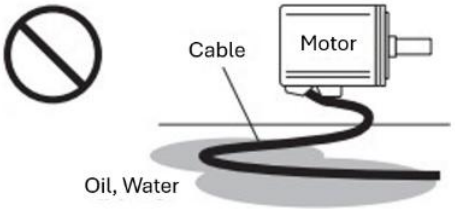
#### Installation Method

The motor can be installed vertically or horizontally, but the following requirements must be observed:

- Horizontal Installation
- Position the cable outlet facing downward to prevent oil or water from entering the motor.
- Vertical Installation
- When installing a motor with a reducer in the axial direction, use a motor with an oil seal to prevent reducer oil from leaking into the motor.

#### Oil- and waterproofing

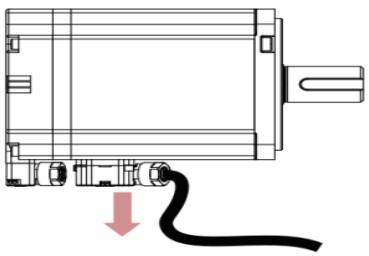
- Do not submerge motor/cable under oil/water
- Please use a motor with oil seal when paired with a reducer to prevent reducer oil from leaking into the motor.




Conditions for use of servo motors with oil seals:
— Make sure the oil level is below the lip of the oil seal during use.
— When installing the servo motor vertically upward, do not allow oil to enter the lip of the oil seal.

- When using in places with water dripping, please use it after confirming the protection level of the servo motor.
- In applications with liquid, please install the motor with the wiring port facing downward
- Do not use in an environment where oil and water often splash onto the motor body.

(As shown below), prevent liquid from flowing along the cable to the motor body.



### Cable stress

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

### Connectors

Please 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 are within the limits specified as it might affect the lifespan of the motor or cause damage to it.

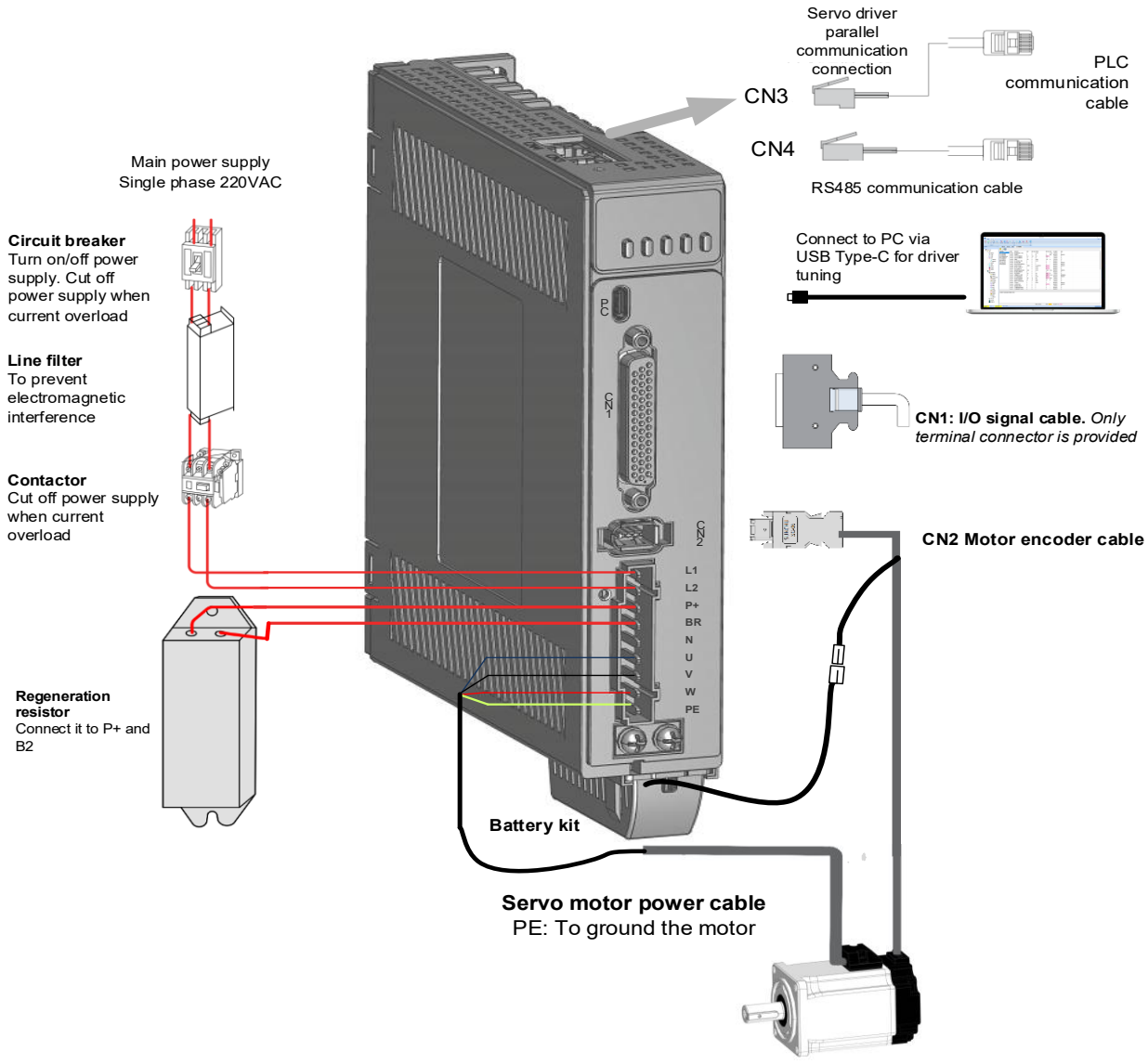
### Motor brake cable connection precautions

For motors with a brake and a magnetic encoder, brake wiring must respect polarity to avoid interference that can cause alarms, accuracy loss, or vibrations. For motors with a photoelectric encoder, polarity in brake wiring doesn’t matter

# Chapter 4 Wiring

## 4.1 E-DFAS□□P Wiring Diagram

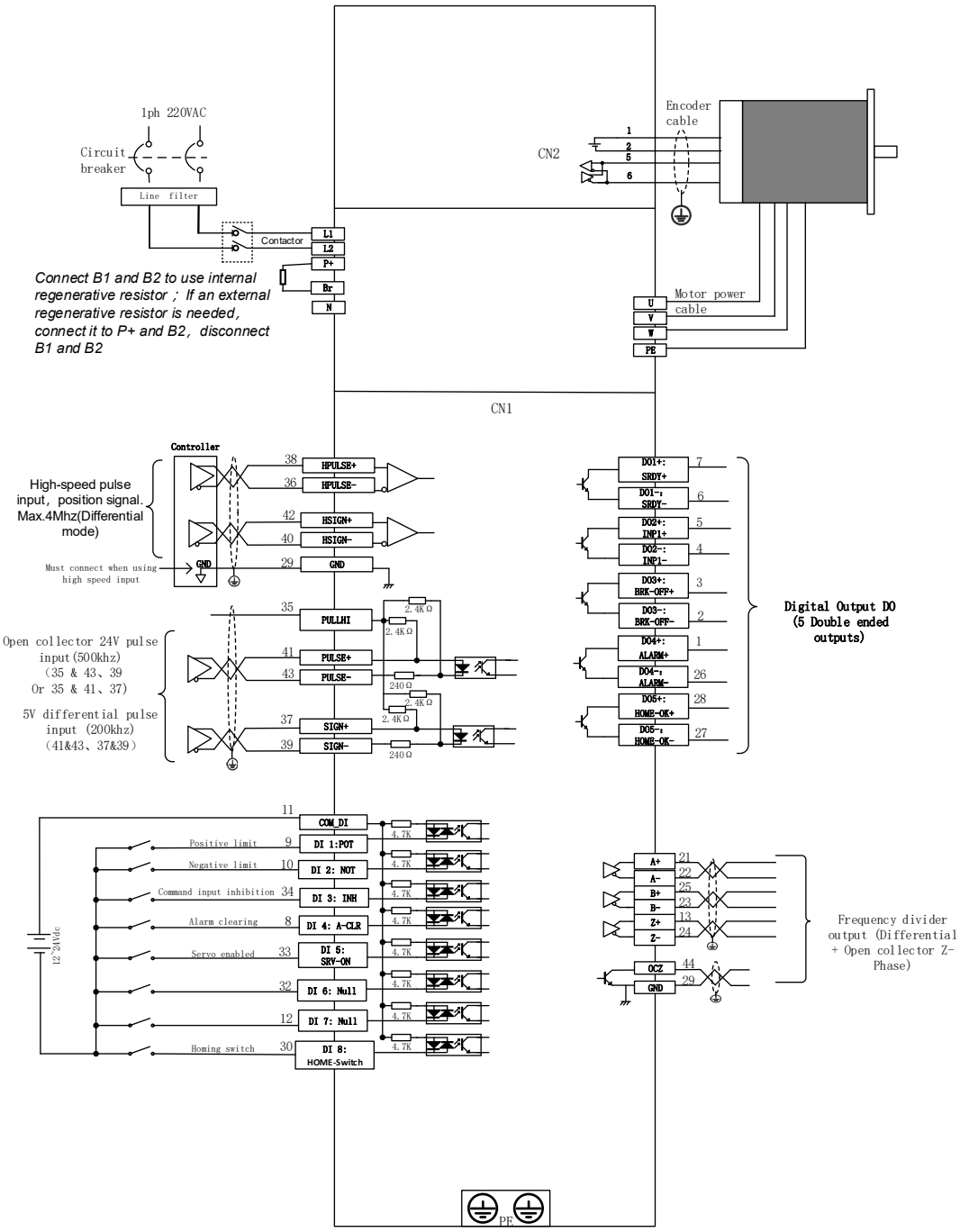
### E-DFAS□□P 220VAC Wiring Diagram




- E-DFAS□□P series servo driver supports single phase 220VAC.
- Please use a circuit breaker for the main power supply to P0Event damage to the product or machine.
- Please do not use a contactor in connection to servo motor as it may not withstand a sudden surge of operating voltage.
- Please take note of the capacity when connect to a 24VDC switching power supply, especially if power supply is shared between multiple components. Insufficient supply current will cause failure in holding brake functions.

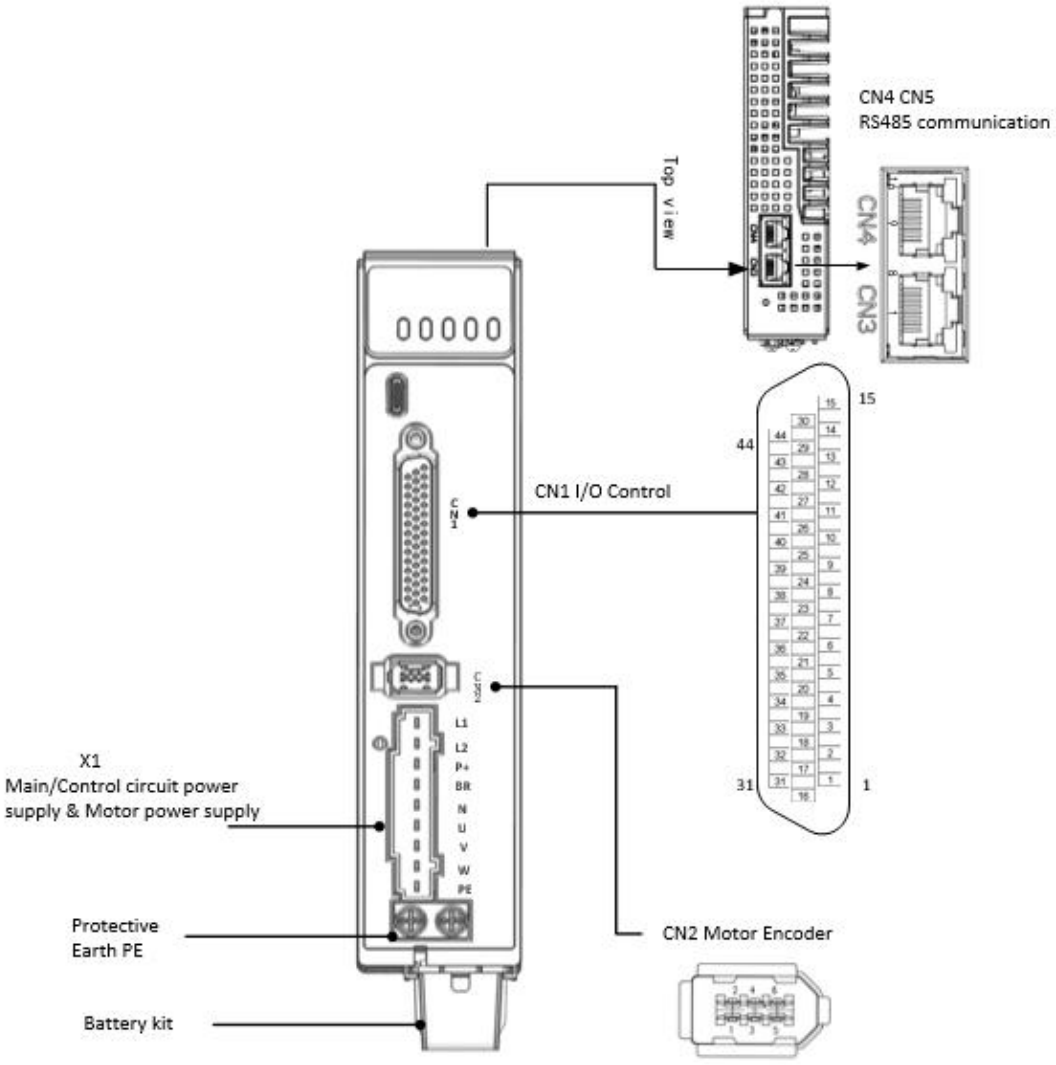
# 4.2 Electrical Wiring Diagram

## Position control mode wiring diagram



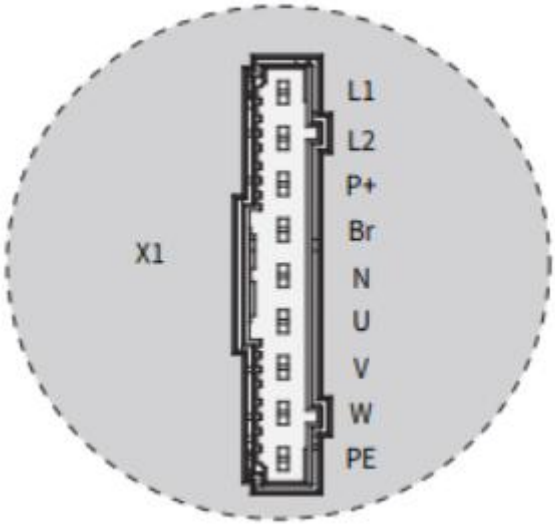

*Note: Please set **P00.05 to 1** when using high speed pulse command (max. 4 MHz)*

## 4.3 Servo Driver Ports




| Connector | Label |
|---|---|
| CN1 | I/O signal connector（DB 44PIN） |
| CN2 | Motor encoder feedback |
| CN3 | RS485 Communication port IN |
| CN4 | RS485 Communication port OUT |
| X1 | Main circuit power supply/ Motor power output |
| PC | USB type C tuning port |
| PE | Protective Earth for grounding |

## 4.4 Main Circuit Connection




| Port | Pin | Functions | Remarks |
|---|---|---|---|
| X1 | L1 | Single phase 220VAC, +10～-15%, 50/60Hz | ① Optional isolation transformer<br>② Do not connect to 380VAC directly to P0Event damage to driver.<br>③ In case of serious interference, it is recommended to connect a line filter to main power supply.<br>*It is recommended to install a fuseless circuit breaker to cut off power supply in time when the driver fails.* |
| | L2 | | |
| | P + | ① Internal DC bus positive terminal<br>② External regenerative resistor P terminal | *Please refer to 2.10 Regenerative resistor selection and connections* |
| | Br | External regenerative resistor terminal | |
| | N | | 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 |

## 4.4.1 Recommended Wiring Specifications for Main Circuit

### Main Power Supply Cable

| Driver | Wire diameter ($mm^2$/AWG) | | | | |
|---|---|---|---|---|---|
| | Rated input current (A) | L1, L2, L3 | P+, (B2) Br | U, V, W | PE |
| Single phase 220V | | | | | |
| E-DFAS01P | 2 | 1.3/AWG16 | 2.1/AWG14 | 0.52/AWG14 | 0.52/AWG14 |
| E-DFAS04P | 5 | 1.3/AWG16 | 2.1/AWG14 | 0.52/AWG14 | 0.52/AWG14 |
| E-DFAS08P | 7.9 | 1.3/AWG16 | 2.1/AWG14 | 0.52/AWG14 | 0.52/AWG14 |
| E-DFAS10P | 9.6 | 2.1/AWG14 | 2.1/AWG14 | 0.52/AWG14 | 0.52/AWG14 |

The CN1 is used for control signal wiring, CN2 is encoder feedback signal wiring.

■ Wire Gauge

Use shielded cables (preferably twisted shielded cables). CN1: ≥ 0.14 mm², CN2: ≥ 0.25 mm². The shield layer must be grounded.

■ Cable Length

Keep cables as short as possible. CN1 (Control Signals): ≤ 3 meters, CN2 (Encoder Feedback): ≤ 20 meters.

■ Routing

Route cables away from power lines to prevent signal interference.

■ Surge Protection

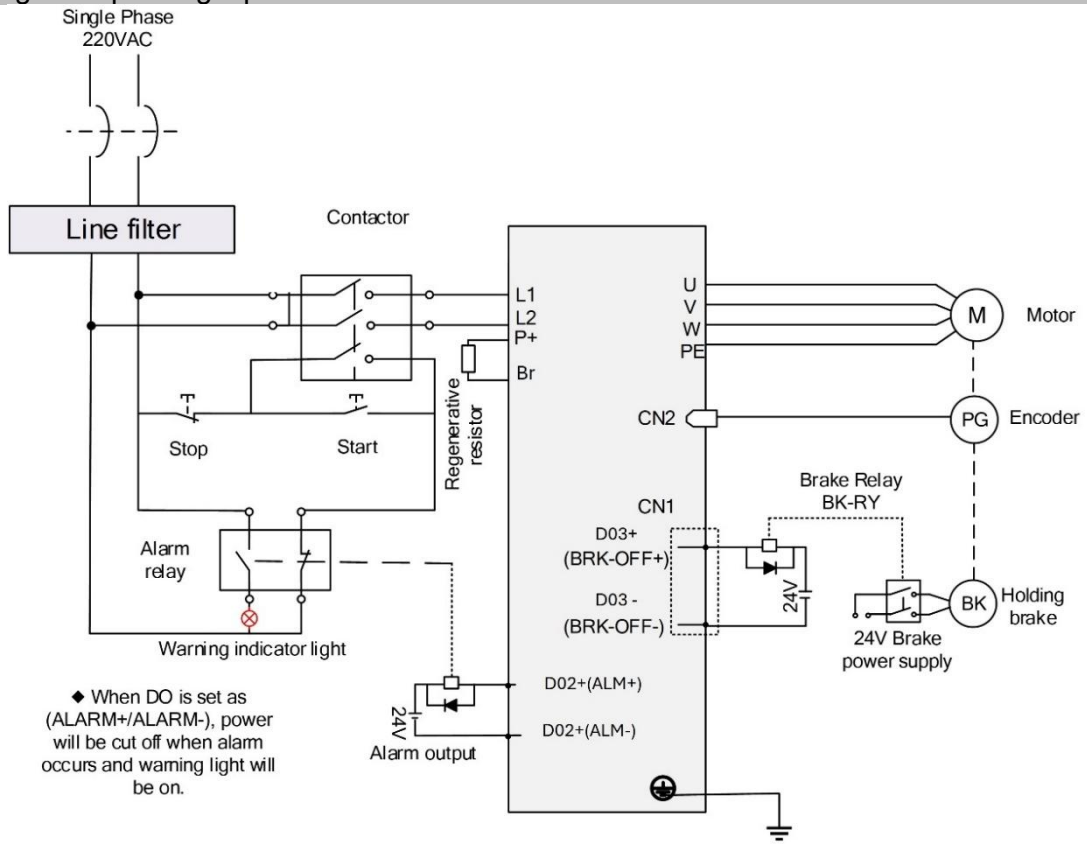
Install surge suppression components for inductive elements (e.g., coils).
For DC coils: connect a flyback diode in reverse parallel.
For AC coils: use an RC snubber circuit.

Notes

- U, V, W must be connected to the motor windings in the correct order — do not reverse the connections.
- Secure all cables and wires properly, and avoid placing them near the driver's heat sink or motor, as heat may degrade insulation performance.
- The servo driver contains large electrolytic capacitors. Even after power is turned off, high voltage remains — do not touch the driver or motor within 5 minutes after power-off.

## 4.4.2 Main Circuit Power Wiring Examples

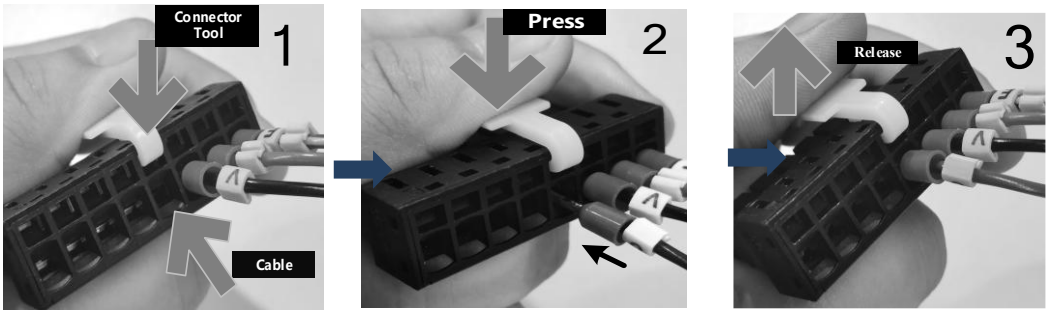
### Wiring example single phase 220VAC : E-DFAS01P~E-DFAS10P




- E-DFAS□□P series servo driver 220VAC models support single phase and three phase 220VAC. Only driver with power rating above 1500W supports three phase 220VAC.

### To fix wire cables into connector

An operating lever is provided on the main circuit terminal connector for wiring:




1. Select the terminal hole and insert the lever into its slot.
2. Press the lever vertically to open the spring, then insert the cable conductor fully.
3. Release the lever to lock the cable in place.

**Notes:**

- To remove the cable, press the lever the same way.
- Only one wire per terminal hole is allowed.
- Keep the lever properly after use for future needs.

## 4.4.3 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 reaches the maximum capacity, a regenerative resistor is required the excessive energy to P0Event over-voltage.

### Selection of regenerative resistor

In the E-DFAS□□P series, models below 400W do not include built-in regenerative braking resistors. If external braking is required, customers must independently configure an external braking resistor. To connect an external resistor, wire it between terminals P+ and Br.

| Model no. | Internal resistance (Ω) | Internal resistor power rating (W) | Minimum resistance (Ω) | Minimum power rating (W) |
|---|---|---|---|---|
| E-DFAS01P | - | - | 50 | 50 |
| E-DFAS04P | - | - | 50 | 50 |
| E-DFAS08P | 50 | 75 | 30 | 50 |
| E-DFAS10P | 50 | 75 | 30 | 75 |

If detailed motion parameters such as acceleration/deceleration time, torque, and load inertia are not available on-site, you can skip the detailed selection steps and use the recommended method below to choose a suitable regenerative braking resistor.

### Calculation of regenerative resistance under normal operation

Steps:

1. Determine if driver comes with a regenerative resistor. If not, please P0Epare 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 P0Ecautions 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 regenerative resistor circuit. Please refer to the table above.

## Theoretical selection of regenerative resistor

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

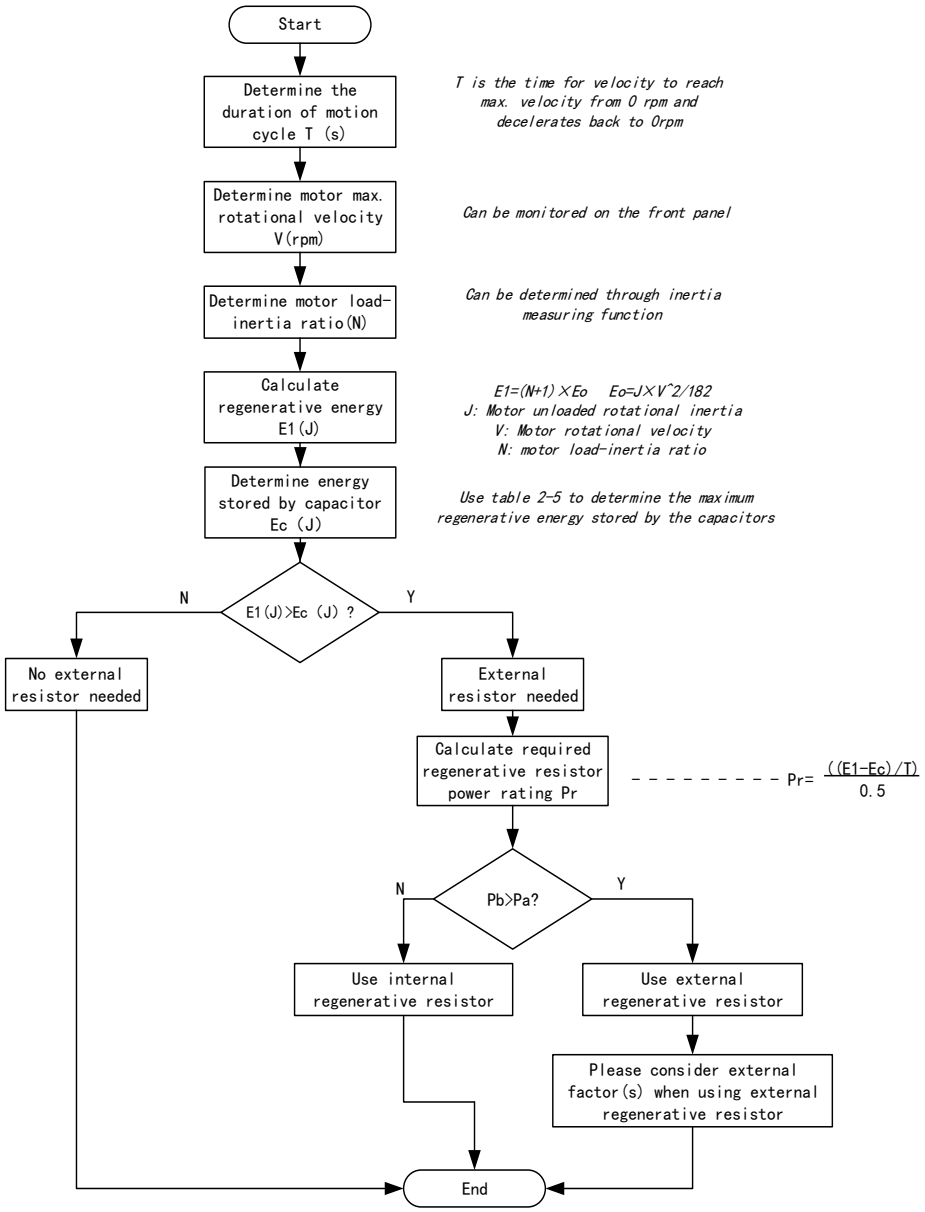
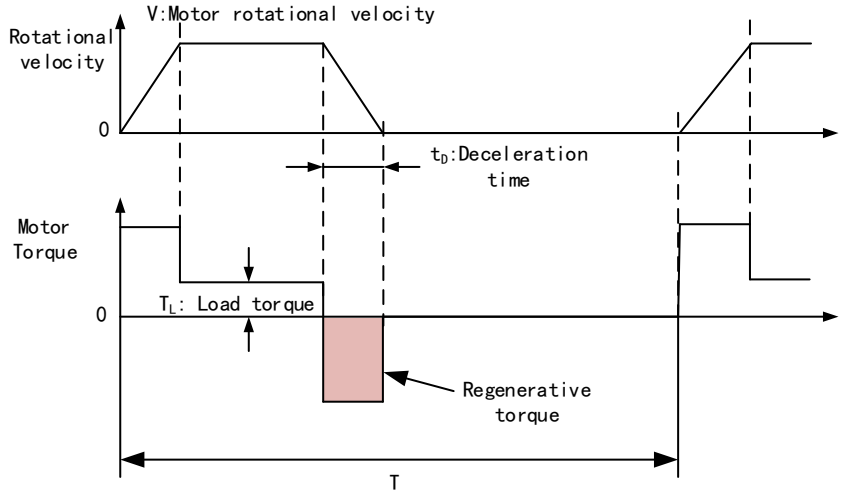


Diagram below shows the acceleration and deceleration cycle periods and the regenerative torque that occurs during the process.




**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 | $E_L$ | $E_L = (\pi/60)\ V\times T_L\times tD$<br>*If loss is not determined, please assume $E_L = 0$.* |
| 3 | Depleted energy due to motor coil resistance. | $E_M$ | $E_M=(U^2/R)\times tD$<br>R= coil resistance, U = operating voltage<br>*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 | $E_K$ | $E_K=E1-(EL+EM+EC)$,<br>If loss is ignored, EK=E1-EC |
| 6 | Required power rating of regenerative resistor | Pr | $Pr=E_K/(0.5\times T)$ |

Theoretical selection of regenerative resistor

Internal capacitor capacity and rotor inertia

| E-DFAS□□P | Servo Motor | Rotor Inertia (× 10-4kg.m$^2$) | Max. regenerative energy stored in capacitor Ec(J) |
|---|---|---|---|
| E-DFAS01P | E-MASH1-0401 | 0.048 | 13.46 |
| E-DFAS04P | E-MASH1-0604 | 0.58 | 13.47 |
| E-DFAS08P | E-MASH1-0808 | 1.66 | 22.85 |
| E-DFAS10P | E-MASH1-0810 | 2.03 | 27.74 |

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

Calculation examples:

Servo driver: E-DFAS□□P750P, Servo Motor: E-MASH1-0808. When T = 2s, rotational velocity = 3000rpm, load inertia is 5 times of motor inertia.

| E-DFAS□□P Drivers | Servo motor | Rotor Inertia （× $10^{-4}$kg.$m^2$） | Max. regenerative energy stored in capacitor Ec(J) |
|---|---|---|---|
| 750W | E-MASH1-0808 | 1.66 | 22.85 |

Regenerative energy produced:

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

If E1<Ec, internal capacitors can't take in excessive regenerative energy, regenerative resistor is required.
Required regenerative resistor power rating Pr:

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

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=69Ω

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 regenerative resistance is not as accurate as calculations done under normal operation.*

With external load torque:

There is an external load torque, and the servo motor does negative work. When the motor does positive work, the motor torque output direction is the same as the rotation direction. However, in some special occasions, the torque output of the motor is opposite to the direction of rotation. At this time, the motor performs negative work, and the external energy is returned to the driver through the electric energy generated by the motor.

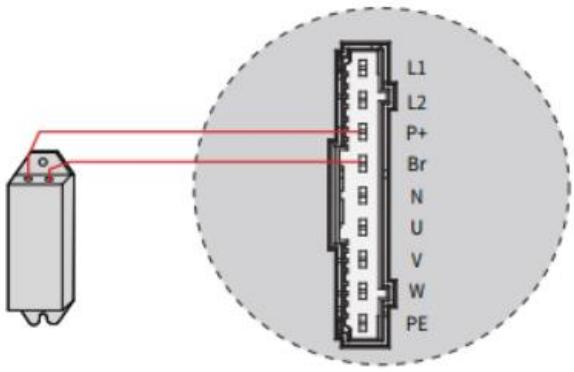
For example, when the output force of the external load is the same as the rotation direction (for example, when the vertical installation mechanism moves downward), in order to meet the speed of the control command, the servo system must produce reverse force to offset the external force of the excessive load (its own gravity), and a large amount of energy will return to the driver. When the bus capacitor is full and cannot absorb the regenerative energy, this energy will be consumed by the guide regenerative resistor, in general, the external resistor capacity in this case will be very large.

Calculation example: using 750W motor E-MASH1-0808, when the external load torque is + 70% of the rated torque (2.39Nm)
At a speed of 3000rpm, the required external regenerating resistor power is:

[(0.7*2.39)*(3000*2π)/60]/0.5=1051w

The resistance value refers to the minimum resistance value of the 750W driver regeneration resistor of 30Ω, so an external regeneration resistor of 30Ω and 1000W is selected. If the external resistor environment is harsh, derating needs to be considered.

## Regenerative resistor connection




- If B1 and B2 are connected, internal regenerative resistor is now functional; if an external regenerative resistor is required, please disconnect B1 and B2 and connect P+ to B1 to P0Event overcurrent.
- Please do not connect external regenerative resistor directly to N or it might cause fire hazard.
- Please refer to the section above to select minimum allowable resistance for the external regenerative resistor or it might damage the driver.
- Please confirm P00.16 and P00.17 before using any regenerative resistor.
- Do not set the regenerative resistor near any flammable object.

## 4.5 X2 Motor Power Supply

The power cable from the driver is labeled with U, V, W, PE. Please connect the wires accordingly to the power cable extending from the servo motor.

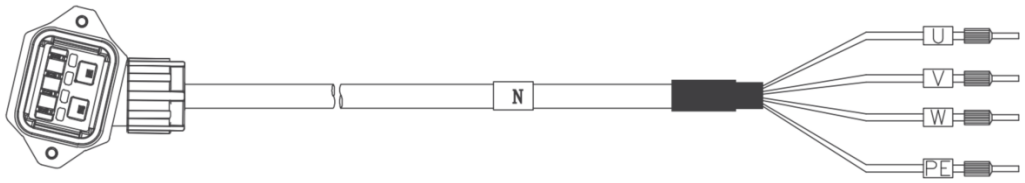
Motor power cable selection

**Motor winding power cable**

- Wire length available: 1.5m, 3m and 5m
- Connectors type available: Direct connectors
- Please contact Misumi sales team or any Misumi certified local retailers for any customized needs.

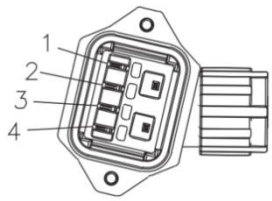
**M*: Length of the cable*

**Direct connector E-CASP*M*-N without holding brake**



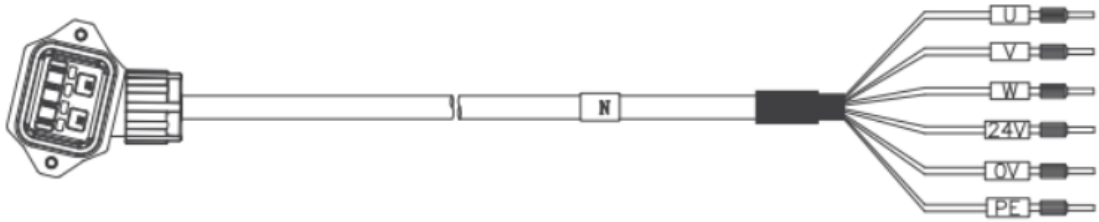

Motor side Driver side

| Driver cable pin | Pins |
|---|---|



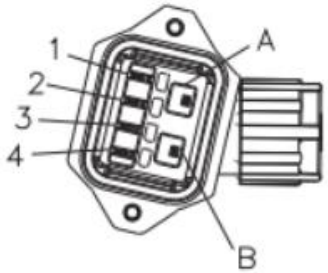

| Motor | Color | Driver |
|---|---|---|
| 1 | Blue | U |
| 2 | Black | V |
| 3 | Red | W |
| 4 | Yellow-green | PE |

**Direct connector E-CASPB*M*-N with holding brake**



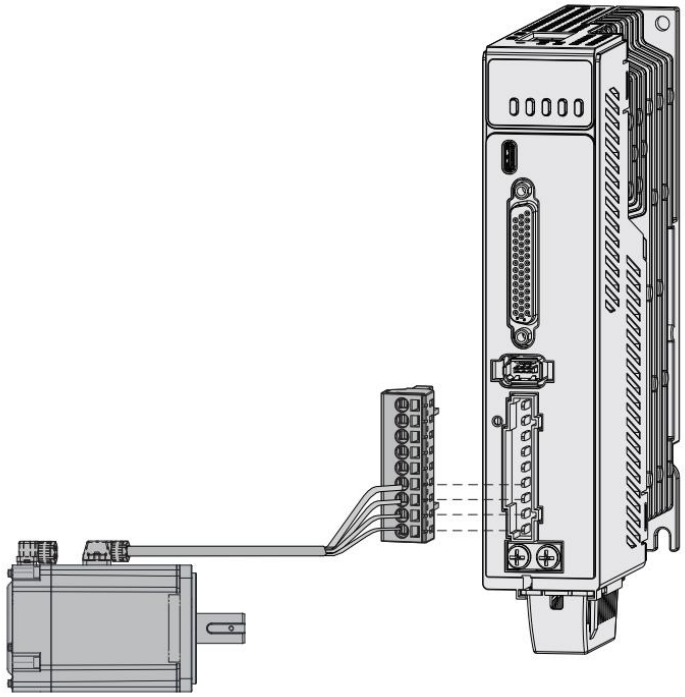

Motor side Driver side

| Driver cable pin | Pins |
|---|---|



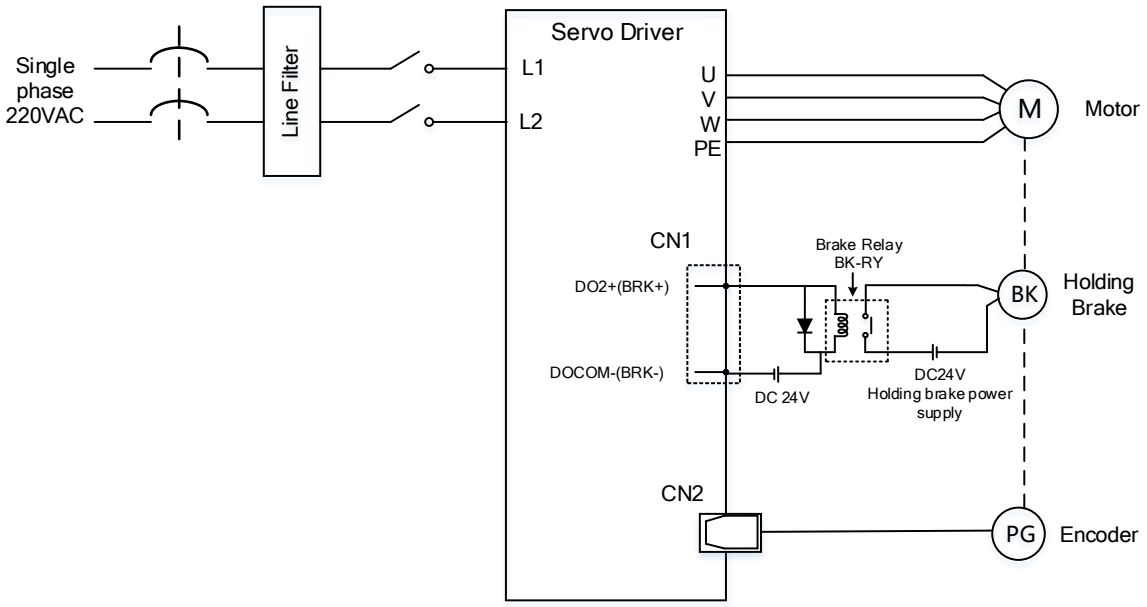

| Motor | Color | Driver |
|---|---|---|
| 1 | Blue | U |
| 2 | Black | V |
| 3 | Red | W |
| 4 | Yellow-green | PE |
| A | Black | 0V |
| B | Red | 24V |

Example of connect motor's power cable to servo driver



## 4.6 Holding Brake Connection

Holding brake is activated when servo driver 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.

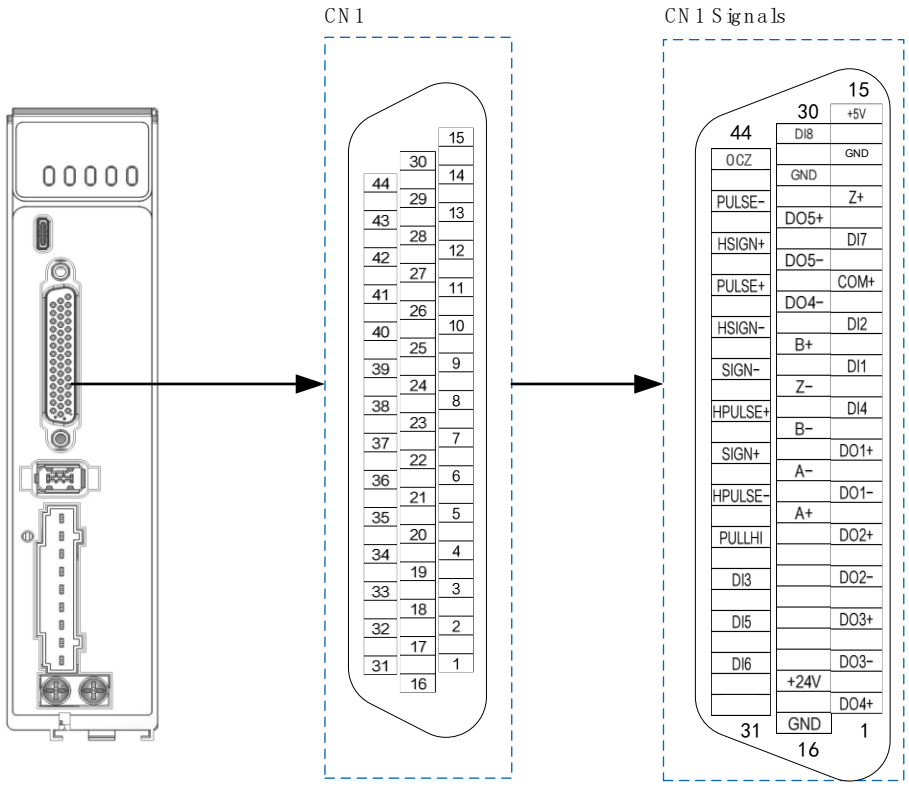



Holding brake wiring diagram

- Mechanical noise might exist when motor with holding brake is in operation but it doesn't affect the functionality of the motor.
- When the holding brake circuit is closed (holding brake deactivated), there might be magnetic flux leakage. Please be aware not to use magnetic sensor around motor with holding brake.
- 24V operating voltage for the holding brake has to be ensured to maintain the functionality of the holding brake. Please consider the voltage dropped over lengthy motor cables due to increase in cable resistance.
- It is recommended to have an isolated switching power supply for the holding brake to prevent malfunctioning of the holding brake in case of voltage drop.
- If the motor is using a magnetic encoder, holding brake wires need to be differentiated between positive and negative terminal to prevent interference to the magnetic encoder due to wrong polarity. It might cause alarm, loss in encoder accuracy or abnormal vibration, etc.
- Motor with optical encoder has no such problem, so holding brake circuit can be connected in anyway.

## 4.7 CN1 I/O Control Signal

E-DFAS□□P Series Servo Driver uses DB 44-Pin connector.




Note: It is recommended to use 24-26AWG cables for CN1

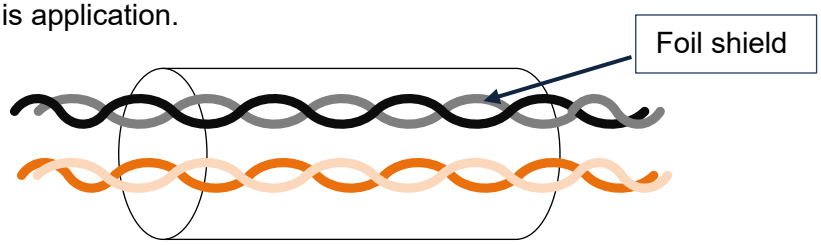
### 4.7.1 CN1 Full Pin Assignment Table

| Function | Pin | Signal | Label | Description |
|---|---|---|---|---|
| **Position command** | 41 | PULSE+ | Low speed pulse command input | Low speed pulse command input mode：<br>● Differential (5V)<br>● Single ended (24V)<br>Low speed pulse and direction command input mode ：<br>PULSE+ & PULSE-：5V Differential (500KHz)<br>SIGN+ & SIGN-：5V Differential (500KHz)<br>PULLHI & PULSE-：24V Single ended (200KHz)<br>PULLHI & SIGN- ：24V Single ended (200KHz) |
| | 43 | PULSE- | Low speed pulse command input | |
| | 37 | SIGN+ | Low speed direction command input | |
| | 39 | SIGN- | Low speed direction command input | |
| | 35 | PULLHI | Open collector 24V common input | |
| | 38 | HPULSE+ | High speed pulse command input | 4MHz High speed pulse command input，5V differential input (Pins 38 and 41 are internally shorted, and pins 36 and 43 are internally shorted; high and low speed pulse inputs can be selected through P00.05 pulse input without rerouting) |
| | 36 | HPULSE- | High speed pulse command input | |
| | 42 | HSIGN+ | High speed direction command input | |

| | | | | |
|---|---|---|---|---|
| | 40 | HSIGN- | High speed direction command input | 4MHz High speed direction command input， 5V differential input(Pins 42 and 37 are internally shorted, and pins 40 and 39 are internally shorted; high and low speed direction input can be selected through P00.05 pulse input without changing lines) |
| **Common** | 17 | +24V | Internal 24V power supply | 24V internal power supply, range 20V~28V. Max. output current 200mA |
| | 14 | GND | | |
| **Digital inputs and outputs** | 11 | COM+ | Common DI | Common DI |
| | 9 | DI1 | POT | Positive limit |
| | 10 | DI2 | NOT | Negative limit |
| | 34 | DI3 | INH | Command pulse inhibition |
| | 8 | DI4 | A-CLR | Alarm clearing |
| | 33 | DI5 | SRV-ON | Servo enabled |
| | 32 | DI6 | *Null* | - |
| | 12 | DI7 | *Null* | - |
| | 30 | DI8 | HOME-Switch | Homing switch (sensor) |
| | 7 | DO1+ | SRDY+ | Servo ready signal output |
| | 6 | DO1- | SRDY- | |
| | 5 | DO2+ | INP1+ | Positioning done signal output |
| | 4 | DO2- | INP1- | |
| | 3 | DO3+ | BRK-OFF+ | Holding brake output |
| | 2 | DO3- | BRK-OFF- | |
| | 1 | DO4+ | ALARM+ | Alarm output |
| | 26 | DO4- | ALARM- | |
| | 28 | DO5+ | HOME-OK+ | Homing done signal output |
| | 27 | DO5- | HOME-OK- | |
| **Frequency divider output** | 21 | A+ | Encoder A phase frequency divider output | Differential output，A/B phase quadrature frequency divided pulse output signal |
| | 22 | A- | | |
| | 25 | B+ | Encoder B phase frequency divider output | |
| | 23 | B- | | |
| | 13 | Z+ | Encoder Z phase frequency divider output | Differential output, motor Z phase signal output |
| | 24 | Z- | | |
| | 44 | OCZ | Z-phase open collector output | Channel Z output (Open collector) |
| | 29 | GND | Z-phase open collector output signal ground | Channel Z output ground (Open collector) |
| **Common** | 15 | +5V | Internal 5V power supply | 5V internal power supply. Max. output current 200mA |
| | 16 | GND | | |
| | Fram | | FG | Frame grounding |

### 4.7.2 CN1 Control Signal Cable Selection

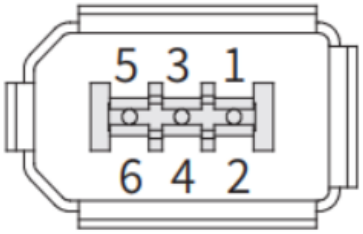
To ensure I/O signal is not affected by electromagnetic interference, a **shielded cable** is recommended for this application.




Cables for digital signals should be shielded twisted pair cable. Cables for CN1 connectors should be 24-28AWG in diameter.

Please keep at least 30cm from main power supply/control circuit power cable (L1C/L2C/L1/L2/L3，U/V/W) to P0Event electromagnetic interference of I/O signals.

## 4.8 CN2 Encoder Connection Port

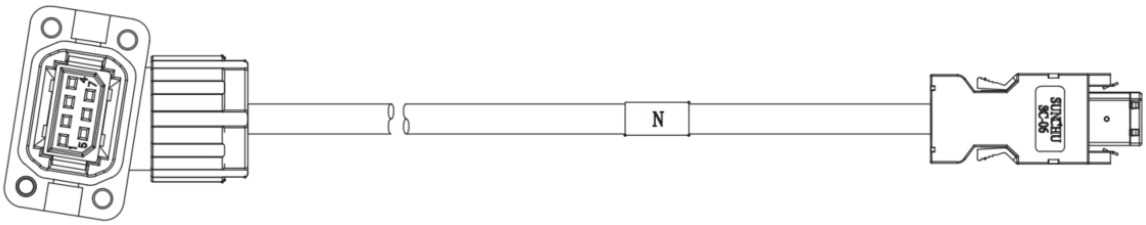



| Connector | Pin | Signal | Description |
|---|---|---|---|
| CN2 | 1 | VCC5V | Power supply 5V |
| | 2 | GND | Power supply ground |
| | 3 | BAT+ | Battery positive terminal |
| | 4 | BAT- | Battery negative terminal |
| | 5 | SD+ | SSI Data+ |
| | 6 | SD- | SSI Data- |
| | Frame | PE | Shield grounding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

- 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.

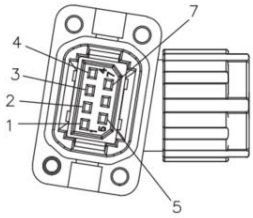
Motor encoder cable selection

**Direct connector E-CAS1E*M*-N Incremental encoder**



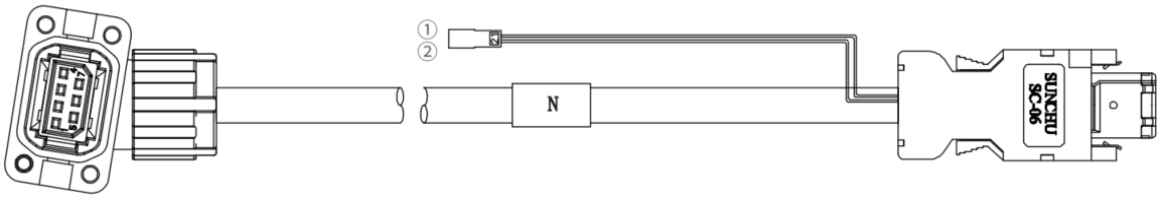

Motor side Driver side

| Motor cable pin | Pin |
|---|---|



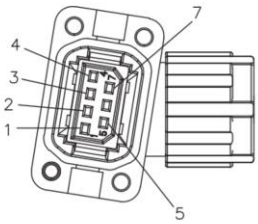

| Motor | Color code | Driver |
|---|---|---|
| 1 | Frame | Shielded |
| 2 | White | 1 (+5V) |
| 3 | Black | 2 (0V) |
| 4 | Blue | 5 (SD+) |
| 5 | Purple | 6 (SD-) |

**Direct connector E-CAS2E*M*-N Absolute encoder**



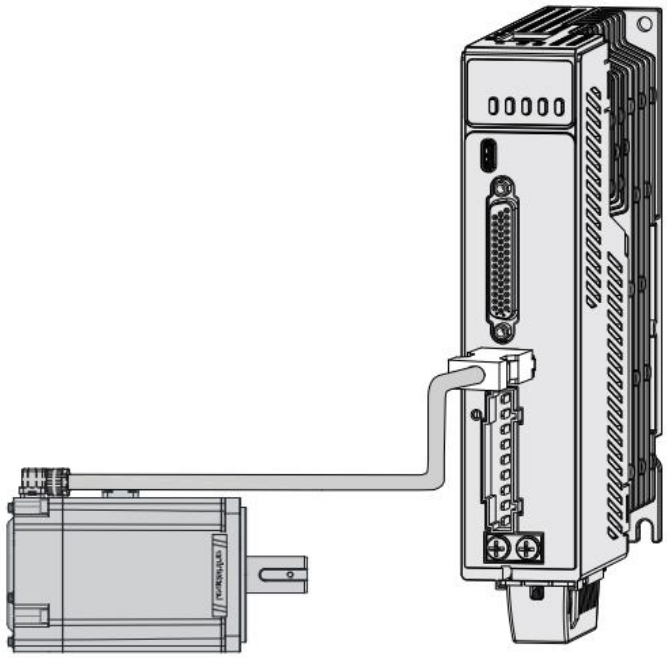

Motor side Driver side

| Motor cable pin | Pin |
|---|---|



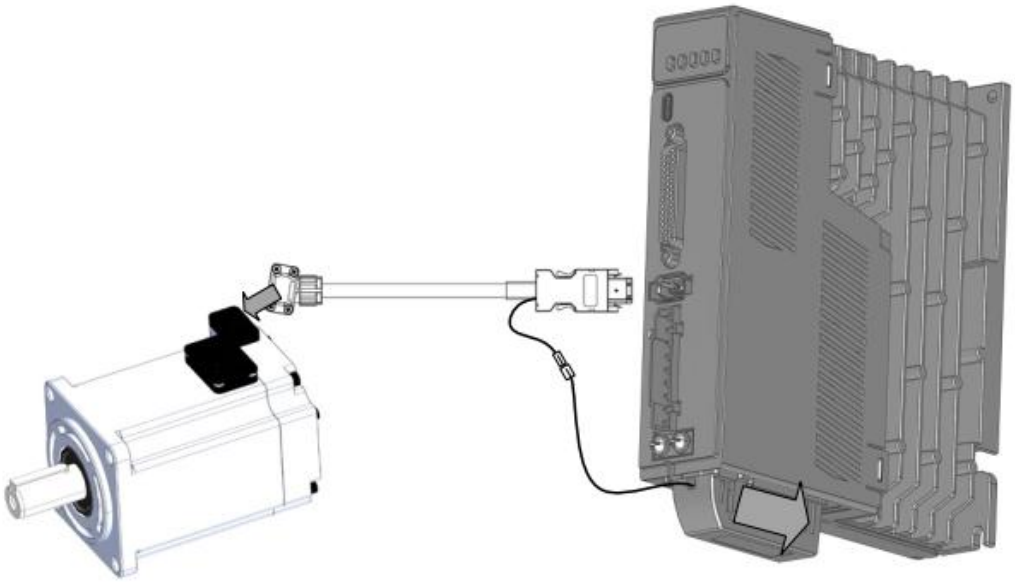

| Motor | Color code | Driver |
|---|---|---|
| 1 | Frame | Shielded |
| 2 | White | 1 (+5V) |
| 3 | Black | 2 (0V) |
| 4 | Blue | 5 (SD+) |
| 5 | Purple | 6 (SD-) |
| 6 | Red | ① (BAT+) |
| 7 | Black | ② (BAT-) |

Example of connect motor's encoder cable to servo driver



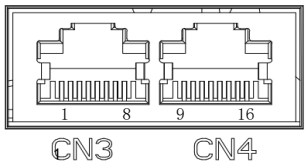
## Battery box for absolute encoder

E-DFAS□□P series servo drivers come with battery kit installed on the driver or on the encoder cable.



## 4.9 CN3/CN4 – RS485 Communication Port

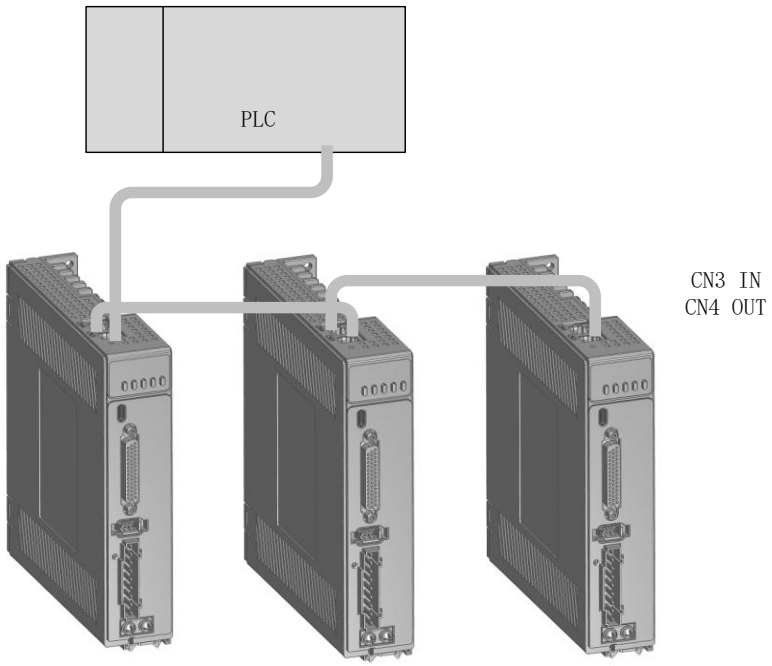
The E-DFAS□□P series drivers support RS485 communication.
When using multiple drivers simultaneously, RS485 interfaces are provided to connect them with the host controller and enable multi-axis communication.




| Port | Pin | Signal | Description |
|---|---|---|---|
| CN3<br>CN4 | 1, 9 | RS485+ | RS485 Differential signal+ |
| | 2, 10 | RS485- | RS485 Differential signal- |
| | 3, 11 | / | / |
| | 4, 12 | RS485+ | RS485 Differential signal+ |
| | 5, 13 | RS485- | RS485 Differential signal- |
| | 6, 14 | / | / |
| | 7, 15 | GND | Ground |
| | 8, 16 | GND | Ground |
| | Frame | PE | Shield grounding |

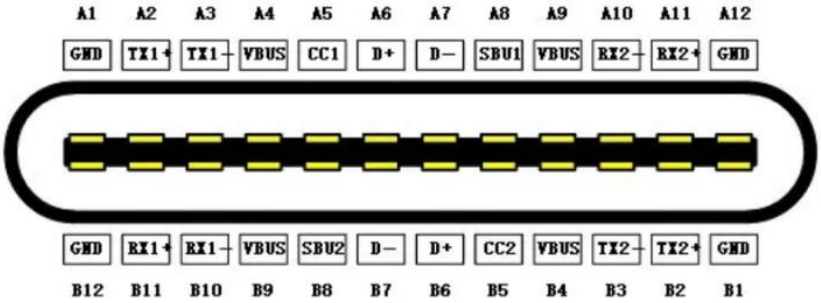
Note: Pins 1/2 and Pins 4/5 share the same RS485 signal line.

Example of connecting multiple drivers



## 4.10 USB Type-C Tuning Port

E-DFAS□□P series servo driver 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 driver connecting to main power supply.




| Port | 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 |

Note:

- When the main power is off, the driver can be connected to a PC via a debug cable to modify parameters using the MISUMI EDrive software.
- If connection issues occur due to strong interference, use a debug cable with a magnetic ring to improve stability.

## 4.11 I/O Signals

### 4.11.1 Pulse Input Circuit

When PLC or Motion Controller command pulse output circuits can be divided into 2 categories, namely differential output or open collector. Hence, on the side of servo driver, there are 2 types of command pulse input method as well: Differential drive input and open collector input.

Pulse input frequency:

1. High speed pulse input (4MHz)
2. Low speed pulse input (200kHz/500kHz)

Pulse input frequency can be set in P00.05.

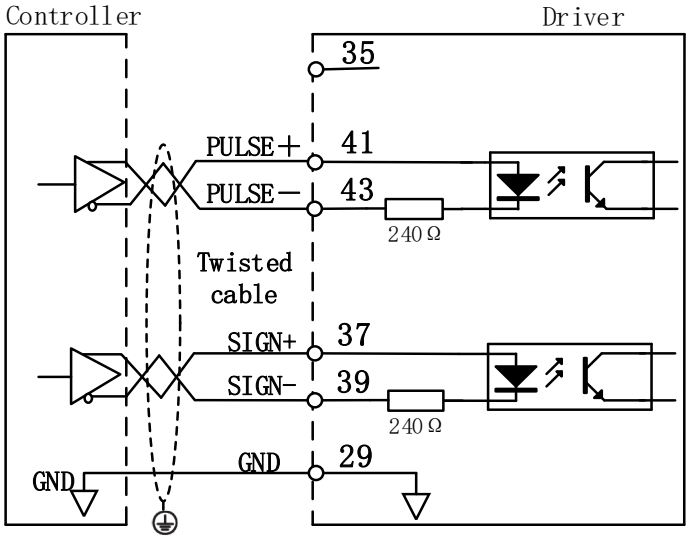
| Pulse | | Max. Frequency | Min pulse width(μs) |
|---|---|---|---|
| Low speed | Differential | 500k | 1 |
| | Open collector（Single ended） | 200k | 2.5 |
| High speed differential | | 4M | 0.125 |

Note:

- High-/low speed pulse cannot be used at the same time.
- If output pulse width is smaller than min pulse width, error might occur at pulse receiving end.

## 5V differential drive input (Low Speed)

5V differential drive input (max. tolerable command input pulse frequency = 500kHz), input voltage of 3-6V with 50% duty ratio.
This input method will not be easily affected by noise with better delivery accuracy. Pin 47 and 43 of CN1 are for pulse signal input; pin 37 and 39 are for direction signal input.

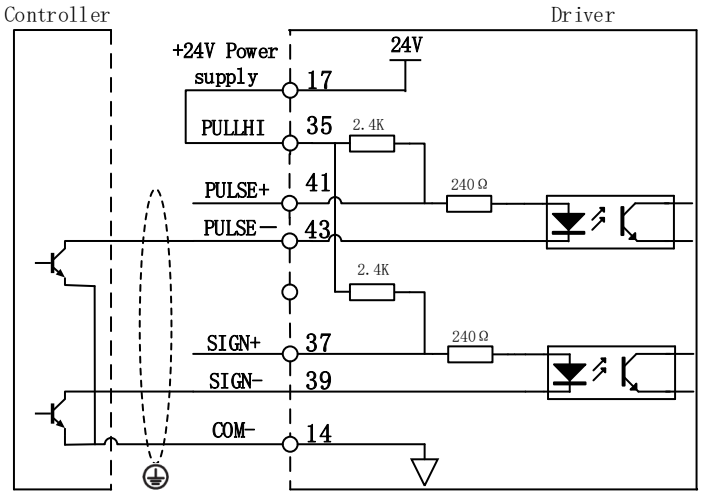



## Single ended open collector drive input (Low Speed)

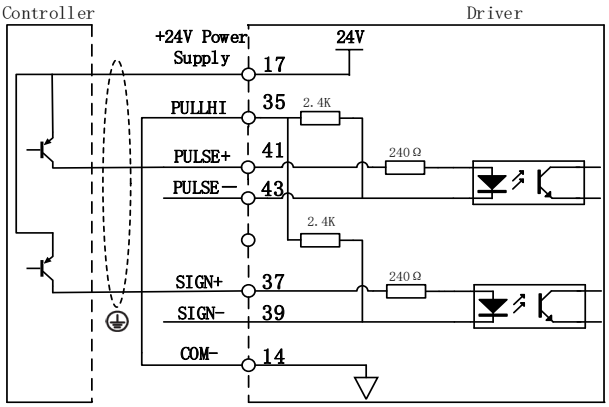
Max. tolerable command pulse input frequency under open collector = 200kHz. Input voltage of 12-24V with 50% duty ratio.

1. **Using driver internal 24V power supply**

When pulse input comes from NPN type device:



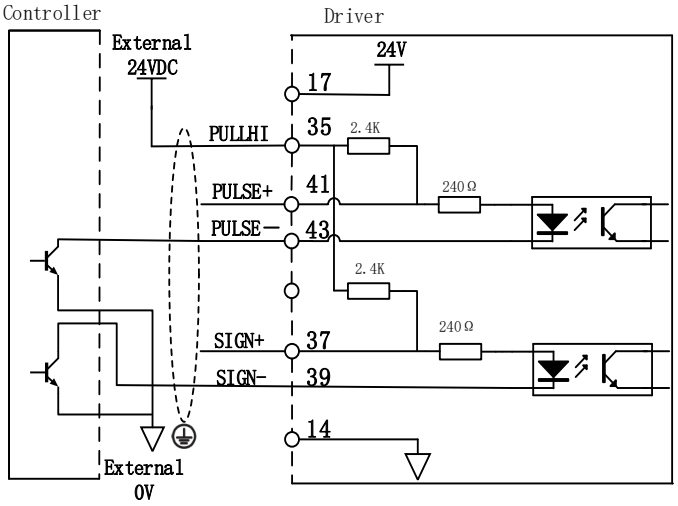
When pulse input comes from PNP type device:



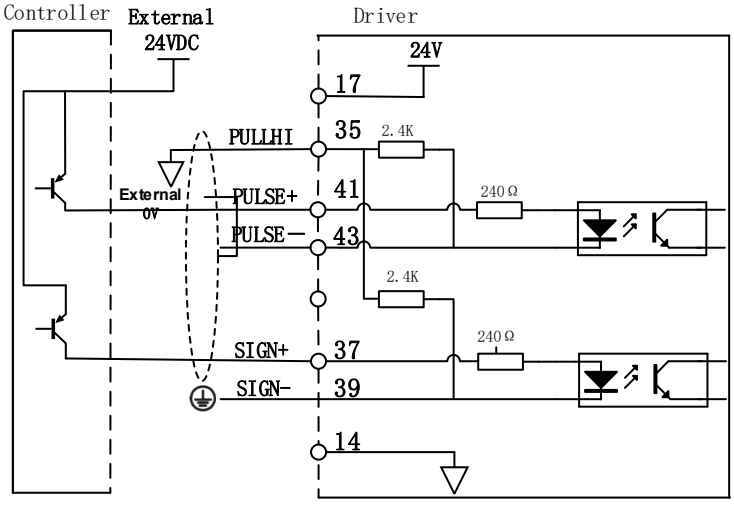

2. **Using external power supply**

**Method 1: Using driver internal resistor (Recommended)**

When pulse input comes from NPN type device:

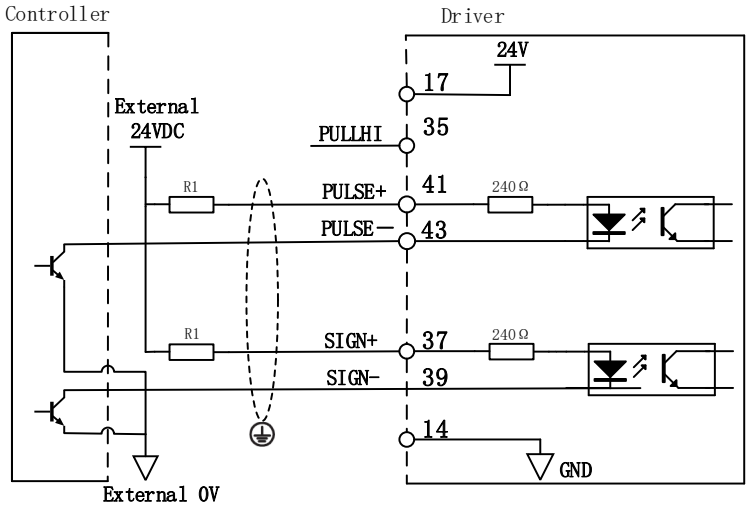



When pulse input comes from PNP type device:

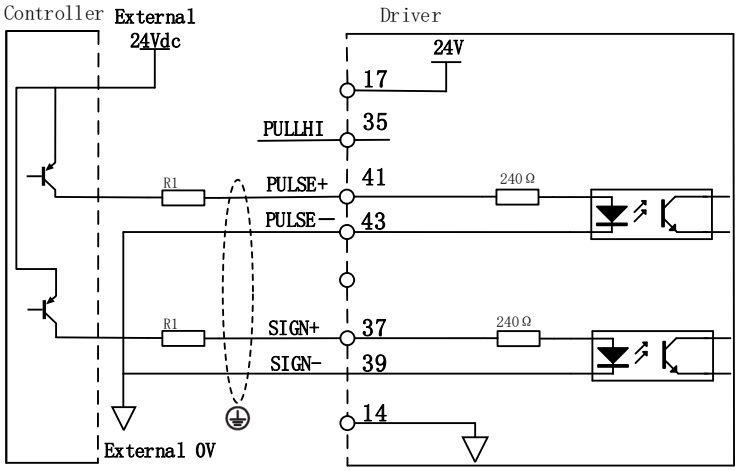


**Method 2: Using external resistor**

When pulse input comes from NPN type device:




When pulse input comes from PNP type device:




Using 24V external power supply, driver internal includes current limitation equivalent to VDC value. By installing a resistor, driver's noise tolerance will be improved.

Resistance of current limiting resistor = $\frac{\text{VDC}-1.5\text{V(Voltage drop)}}{\text{R1(Current limiting)}+220\,\Omega}=10\text{mA}$.

If VDC = 24V, resistance of current limiting resistor approximates 2kΩ. (Rough estimation)

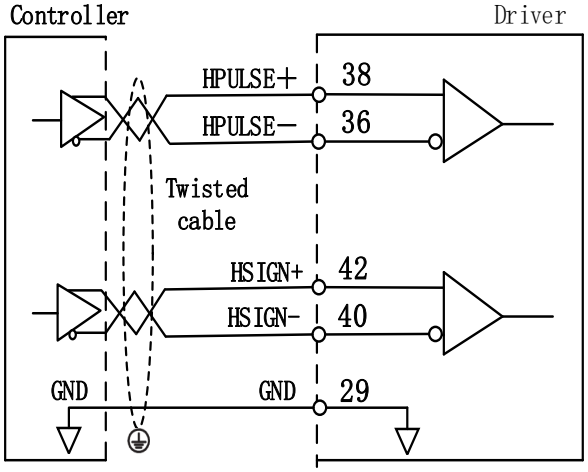
| Vcc Voltage | R1 Resistance | R1 Power rating |
|---|---|---|
| 24V | 2.4kΩ | 1/2 W |
| 12V | 1.5kΩ | 1/2 W |

Note:

- 5V differential drive method is recommended for accurate delivery of pulse data.
- E-DFAS□□P series servo driver supports 5V differential drive and 24V single ended open collector drive, different connection pins for both methods.
- External power supply needs to be provided externally when using single ended open collector drive method. Please note that reversed polarity might cause damage to the servo driver.

5V differential drive input (High Speed)

5V differential drive input (Max. tolerable command pulse input frequency: 500kHz). Due to high-speed pulse input, it is highly recommended to use shielded cable and be isolated from power cable.




Please make sure that differential input is 5V or it might cause instability of input pulse.

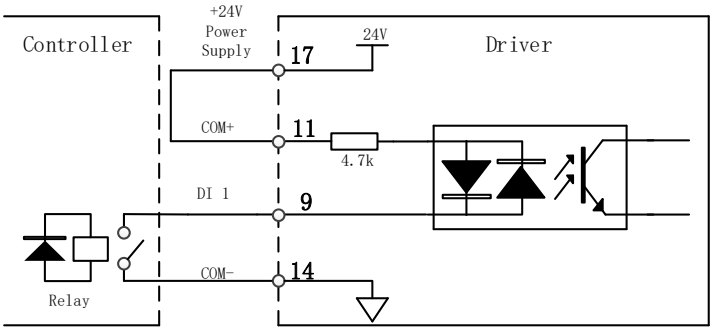
- Pulse lost during command pulse input
- Inversed pulse direction during direction command
- Please connect 5V signal to GND on driver to lower noise interference.

## 4.11.2 Digital Input Circuit

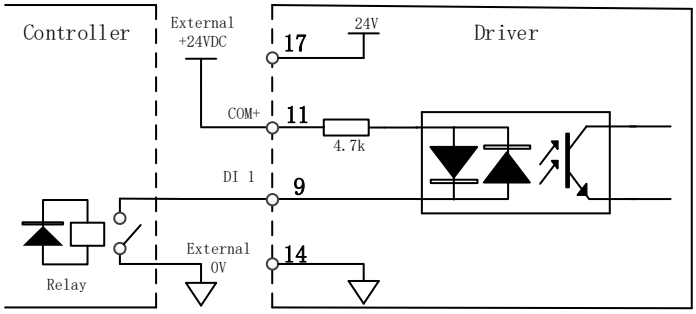
Using DI1 as an example (DI2-DI8 use the same input circuit). The internal circuit of common input is a bidirectional optocoupler which supports common anode and common cathode configurations. There are 2 types of outputs from master device: Relay output and Open Collector output as shown below.

Relay output:

1. Using internal 24V power supply

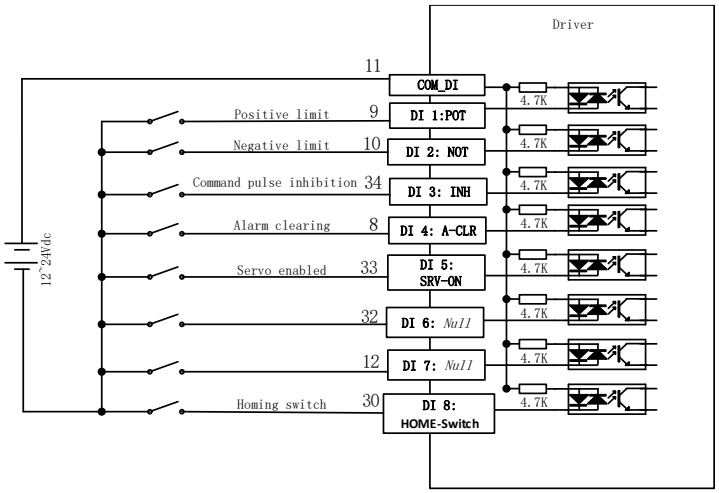


2. Using external power supply

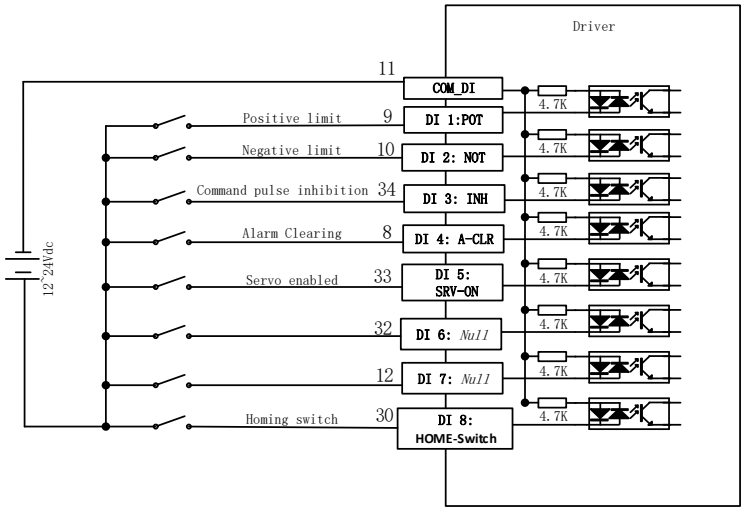



**Please connect to a flyback diode when using relay input to P0Event damage to DO terminal.*

E-DFAS□□P Series AC Servo Driver supports both common anode and cathode connection:
Common Anode:

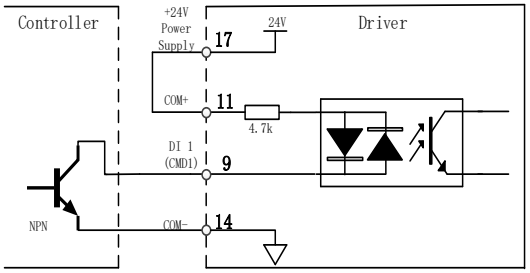



Common Cathode:

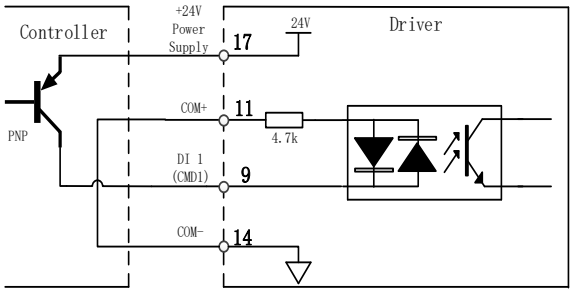


## Open collector output

Common Anode (Internal power supply)

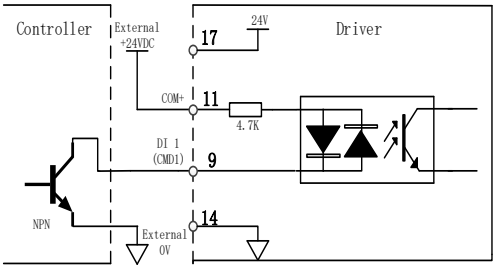



Common Cathode (Internal power supply)

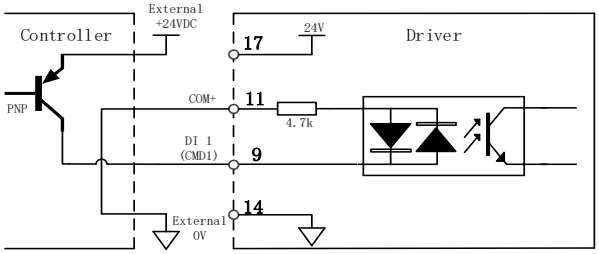



** Please P0Epare switching power supply with output of 12-24VDC, current≥ 100mA;*

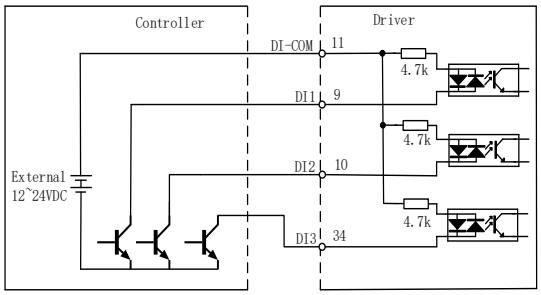
Common Anode (External power supply)



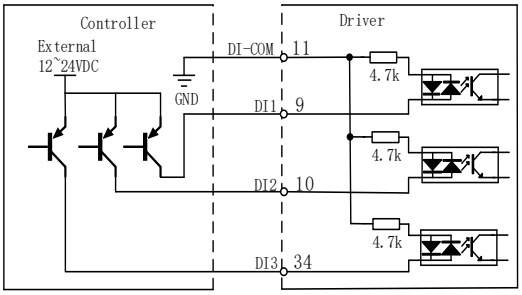

Common Cathode (External power supply)




NPN:



PNP:




**Please do not mix NPN and PNP connections in applications*

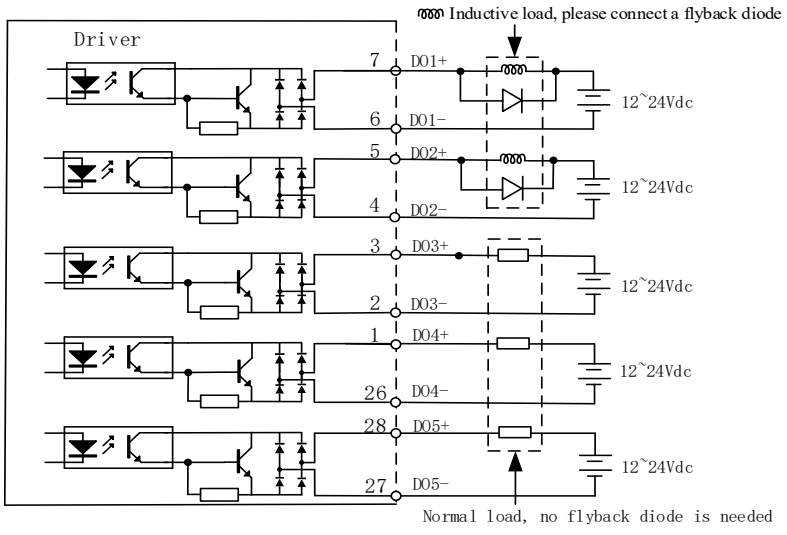
DI1-DI8 Default Signal Assignment

| Signal | | Default | Pin | Description |
|---|---|---|---|---|
| Digital Input | DI1 | POT | 9 | Positive limit |
| | DI2 | NOT | 10 | Negative limit |
| | DI3 | INH | 34 | Command pulse inhibition |
| | DI4 | A-CLR | 8 | Alarm clearing |
| | DI5 | SRV-ON | 33 | Servo enabled |
| | DI6 | - | 32 | - |
| | DI7 | - | 12 | - |
| | DI8 | ORG | 30 | Homing switch *(Only in PR mode)* |
| +24V | | | 17 | Internal 24V power supply, Voltage range+20~28V, Max current output 200mA |
| COM- | | | 14 | |
| COM+ | | | 11 | Common DI |

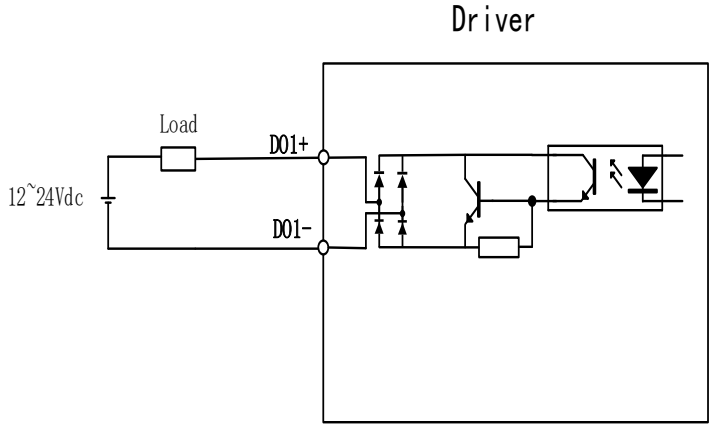
## 4.11.3 Digital Output Circuit

There are 5 digital outputs. DO1-DO5 are all double ended outputs. Can be connected to independent control signal power supply and reference ground is different from single ended output signals.

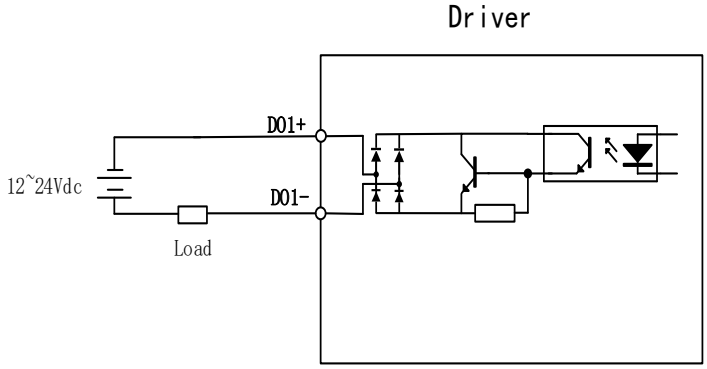
Double ended outputs DO1-DO5 (Supports both NPN & PNP)



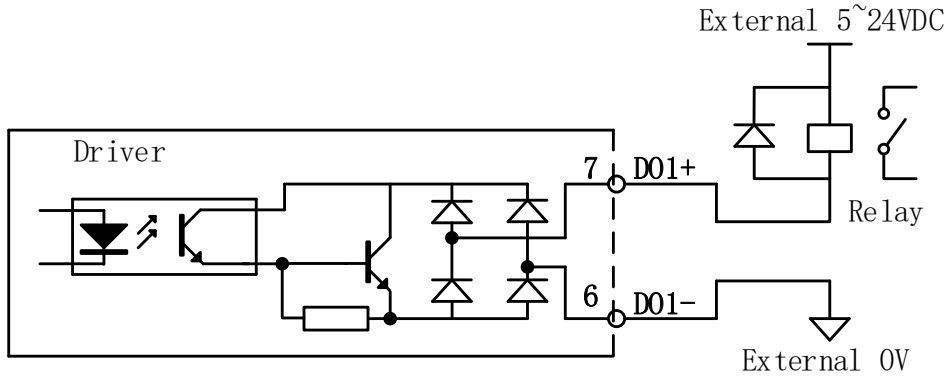
NPN:




PNP:

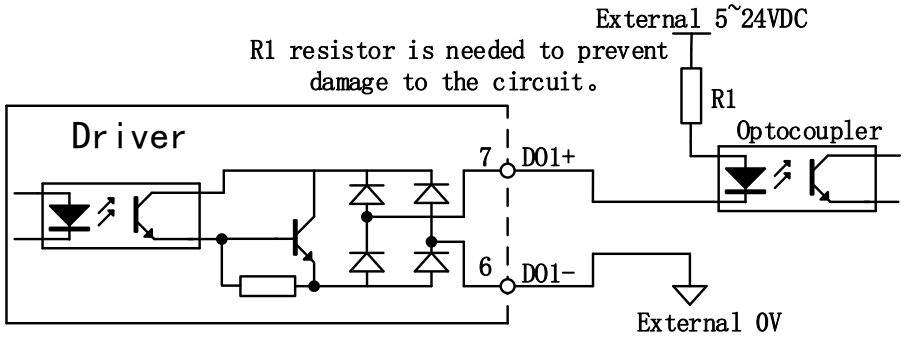



Relay:




**Please connect to a flyback diode when using relay input to P0Event damage to DO terminal.*

Optocoupler:




**For servo driver internal optocoupler output circuit: Max. Voltage: 30VDC, Max. Current:50mA*

- External power supply needs to be provided. Reversed connection of power supply might cause damage to the driver.
- When output = open collector, max current 50mA, external power supply max voltage 25V. Hence, DO loads need to satisfy these conditions. If excessive or output connected directly to power supply, it might cause damage to the driver.
- If the load is an inductive load such as a relay, please install freewheeling diodes on both ends of the load in parallel. If the diode is connected in reverse, it might cause damage to the driver.

DO1-DO5 Default Signal Assignment

| Signal | | Default | Pin | Description |
|---|---|---|---|---|
| Digital Output | DO1+ | SRDY+ | 7 | Servo Ready |
| | DO1- | SRDY- | 6 | |
| | DO2+ | INP+ | 5 | Positioning completed |
| | DO2- | INP- | 4 | |
| | DO3+ | BRK- OFF+ | 3 | External brake released |
| | DO3- | BRK-OFF- | 2 | |
| | DO4+ | ALARM+ | 1 | Alarm |
| | DO4- | ALARM- | 26 | |
| | DO5+ | WARN1+ | 28 | Warning |
| | DO5- | WARN1- | 27 | |

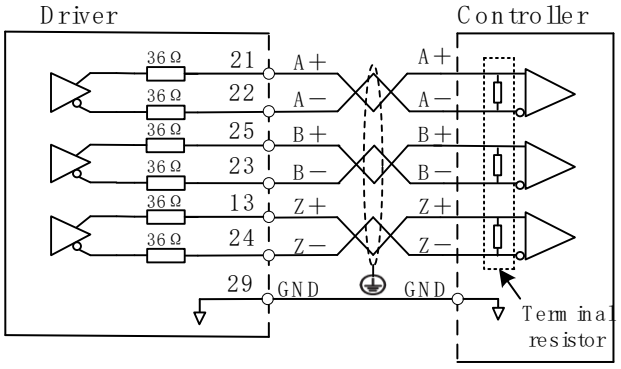
### 4.11.4 Encoder Frequency Divider Output Circuit

E-DFAS□□P series supports 2 kinds of frequency divider output: Differential and open collector.

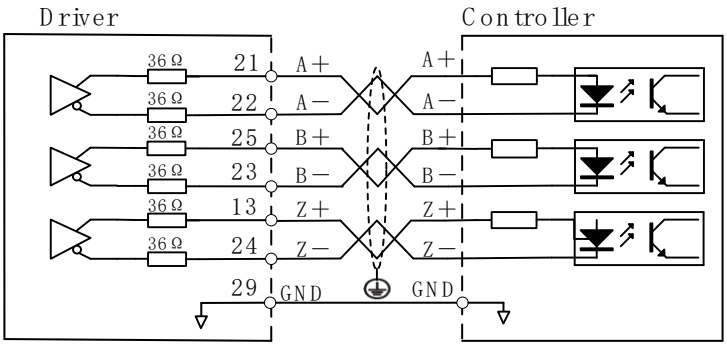
| Pin | Signal | Description | |
|---|---|---|---|
| 21 | A+ | Motor encoder A phase frequency divider output | Differential, High＞=2.5VDC，Low<=0.5VDC，Max current output±20mA。 |
| 22 | A− | | |
| 25 | B+ | Motor encoder B phase frequency divider output | |
| 23 | B− | | |
| 13 | Z+ | Motor encoder Z phase frequency divider output | |
| 24 | Z− | | |
| 44 | OCZ | Motor encoder Z phase OC signal output | |
| 29 | GND | Reference ground | |
| 15 | +5V | Internal 5V power supply, Max current output 200mA | |
| 16 | GND | | |
| Frame | PE | - | |

Encoder frequency divider output (Differential)

Encoder signal after frequency division will go through differential driver to deliver differential output. Feedback signal will be provided if the master device is in position control mode. Please install a differential optocoupler receiving circuit to receive the signals. A terminal resistor must be installed between differential input circuits. Resistance of the resistor as per actual use.



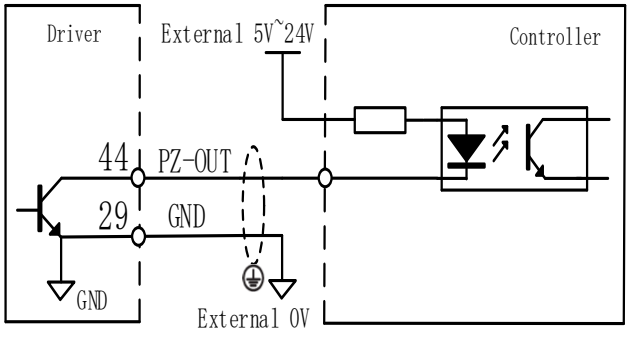

Using an optocoupler receiving circuit:




If a differential receiving circuit instead an optocoupler is used on the controller side, please connect pin 29 (GND) to GND of differential receiving circuit.

## Encoder frequency divider output (Open Collector)

Encoder signal after frequency division will be delivered through an open collector output.




*Please connect driver frequency divider signal GND to GND of external power supply.*
*Use shielded twisted pair cable to lower noise interference.*

## 4.12 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

① Grounding resistance > 100Ω

② When there are multiple drivers connected in parallel, PE terminal of the main power supply and ground terminal of servo drivers 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:

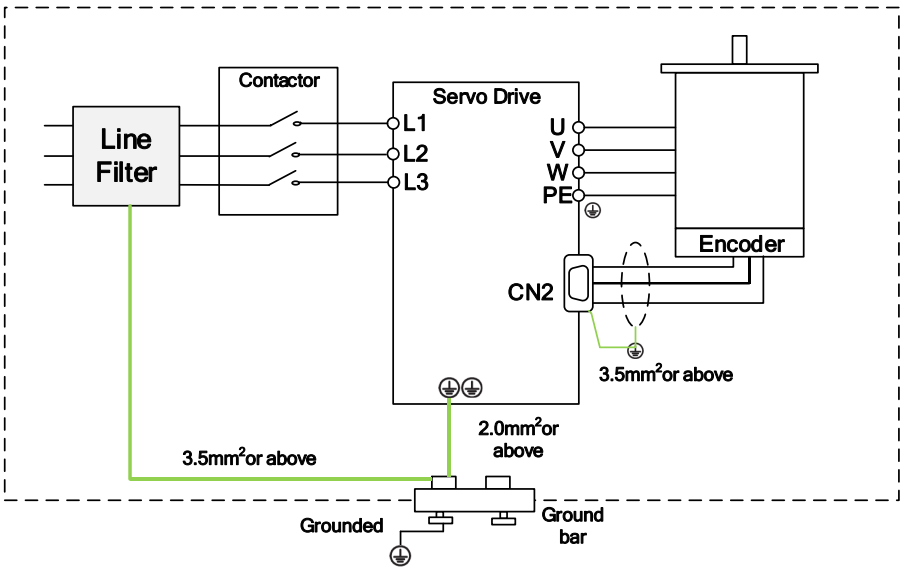
①Install master device and line filter close to the servo driver

②Install surge suppressor for relay and contactor

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

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

### 4.12.1 Grounding Connection and Other Anti-Interference Wiring Connections

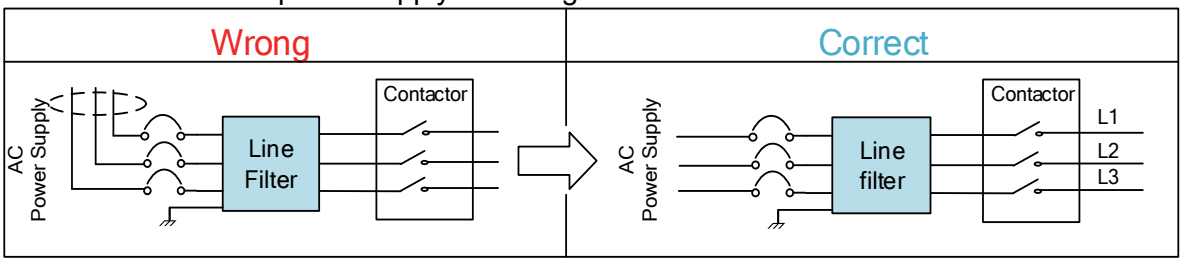



- Servo motor frame should be grounded. Please connect the PE terminal of servo motor and servo driver and ground them together to reduce interference.
- Ground both ends of the foil shield of encoder cable.

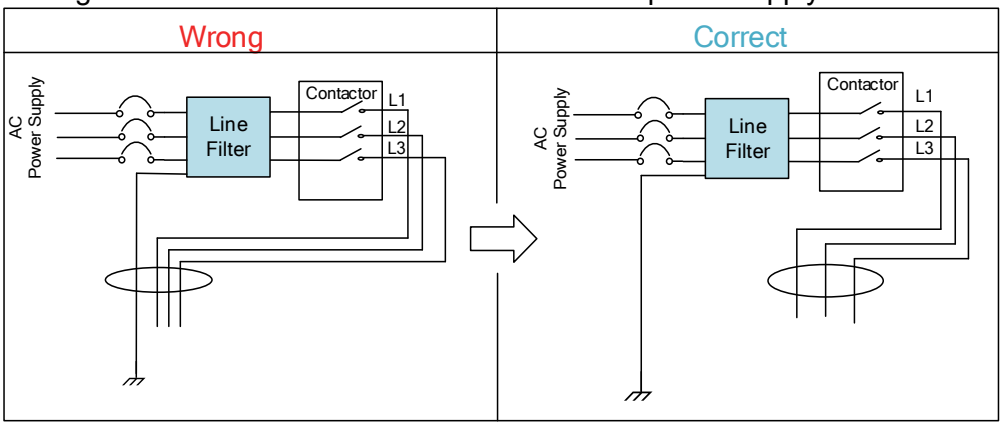
### 4.12.2 Using Line Filter

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

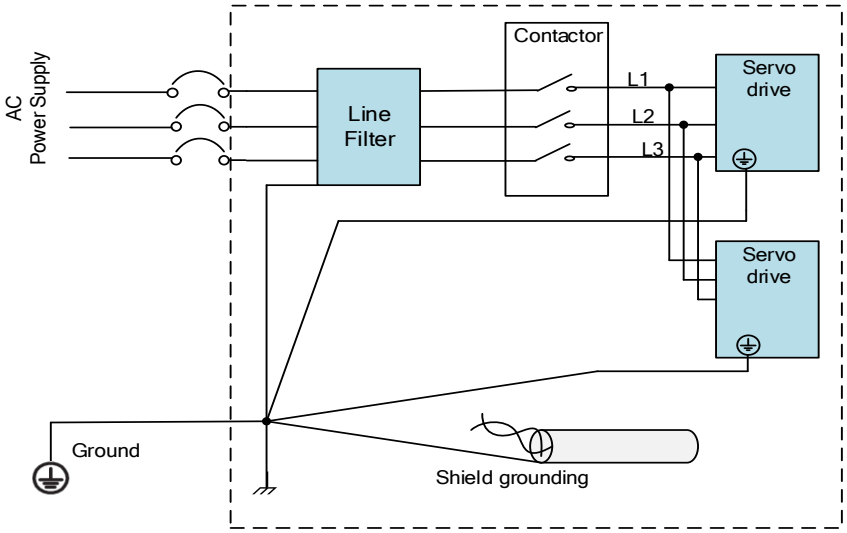
Do not band the main power supply cable together.




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



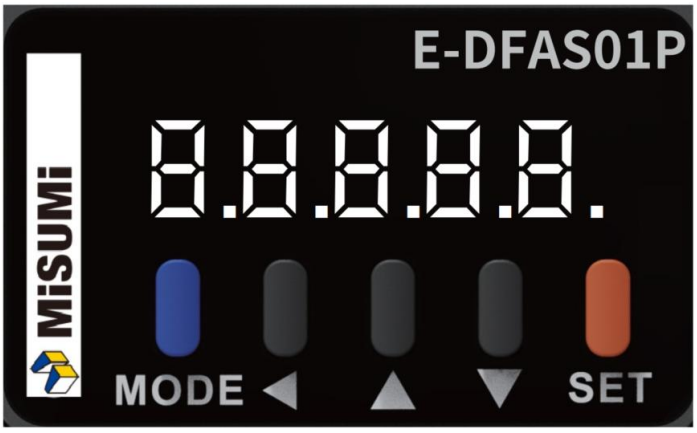

Ground wires inside an electrical cabinet



# Chapter 5 Servo Driver Operation

## 5.1 Front Panel

Servo Driver front panel consists of 5 push buttons and a 8-segments display. Can be used for displaying status, alarms, functions, parameters setting and auxiliary functions.



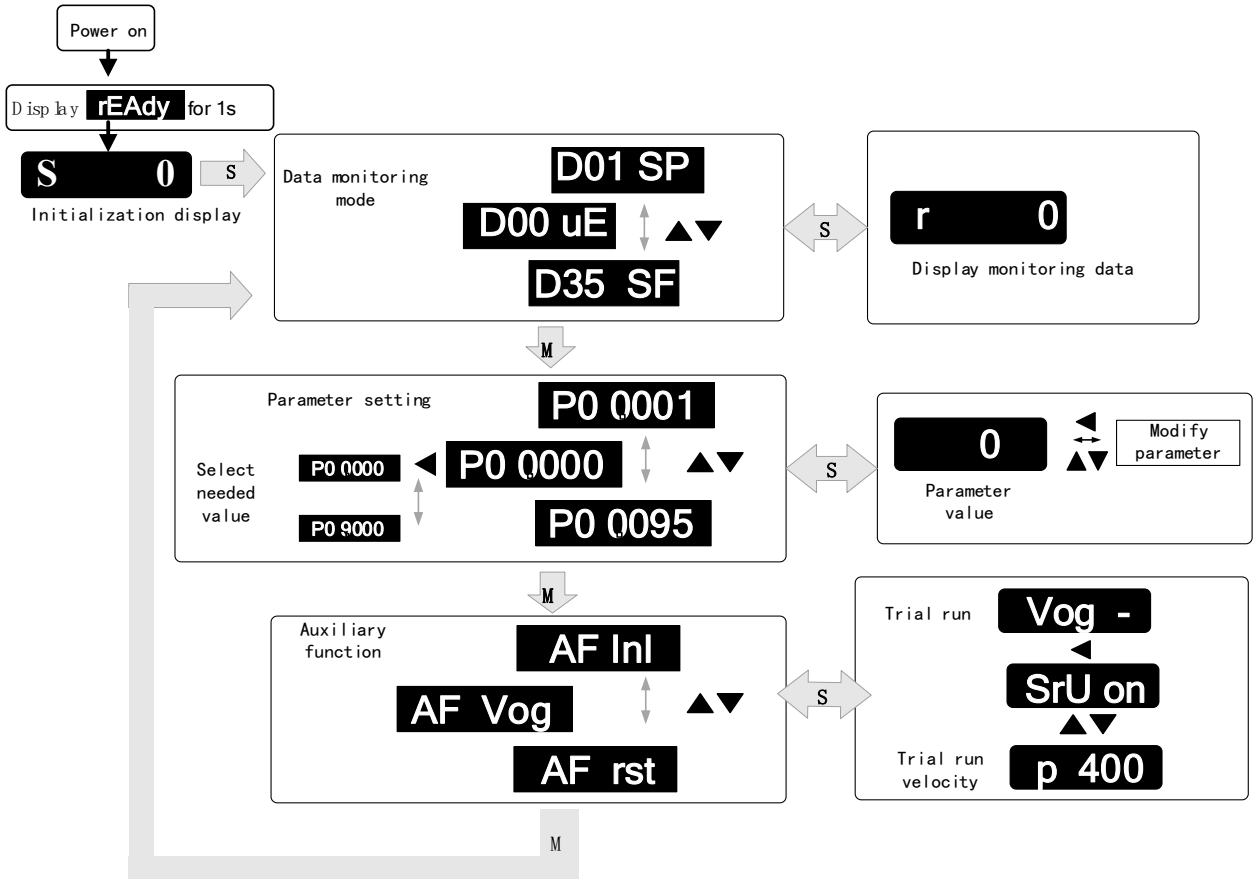

Front panel

Buttons and functions

| Label | Symbol | Function |
|---|---|---|
| Display | / | Consists of 5 push buttons and a 8-segments display |
| Mode | **M** | To switch between 3 modes:<br>1. Data monitoring mode: To monitor changes of motion data values<br>2. Parameters setting mode: To set parameters<br>3. Auxiliary functions mode: To operate common functions, such as trial run, alarm clearing |
| Enter | **S** | To enter or confirm |
| Up | ▲ | To switch between sub-menus / Increase |
| Down | ▼ | To switch between sub-menus / Decrease |
| Left | ◄ | To switch between values |

## 5.2 Panel Display and Operation

### 5.2.1 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) P0Ess **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. P0Ess **M** to switch to other modes.

(3) P0Ess ▲or▼to select the type of parameters in data monitoring mode. P0Ess **S** to confirm.

(4) P0Ess◀ to select current segment in parameters settings mode. P0Ess▲or▼to increase/decrease the value of segment. P0Ess **S** to confirm the modified value(s) and save the parameters.

### 5.2.2 Front Panel Locking

To P0Event any misuse of the front panel, it can be locked. Limitations when locked are as shown below.

| Mode | Limitation |
|---|---|
| Data monitoring | Not limited |
| Parameters setting | Parameters can only be read, not modified. |
| Auxiliary functions | Not limited |

To lock and unlock the front panel

| | Front Panel | EDrive |
|---|---|---|
| Lock | ①Set P05.35 = 1.<br>②Restart driver.<br>③Front panel is now locked. | |
| Unlock | ① Please refer to auxiliary function **AF UnL**<br>② Front panel is now unlocked. | ① Set P05.35 = 0.<br>② Front panel is now unlocked. |

### 5.2.3 Data Monitoring Mode

E-DFAS□□P series servo driver offers the function to monitor different types of data in data monitoring mode. After entering this mode, P0Ess **S** to monitor any data that starts with **d**. P0Ess **S** again to get back to data monitoring mode and **M** to switch to any other modes.

**Data list in data monitoring mode**

| No. | Label | Descriptions | Display | Unit | Data Format (x = numerical value) |
|---|---|---|---|---|---|
| 0 | d00uE | Position command deviation | **d00uE** | pulse | "xxxx" |
| 1 | d01SP | Motor velocity | **d01SP** | r/min | "**r xxxx**" – Motor actual velocity<br>"**F xxxx**" – External encoder feedback velocity |
| 2 | d02CS | Position control command velocity | **d02CS** | r/min | "xxxx" |
| 3 | d03Cu | Velocity control command velocity | **d03Cu** | r/min | "xxxx" |
| 4 | d04tr | Actual feedback torque | **d04tr** | % | "xxxx" |
| 5 | d05nP | Feedback pulse sum | **d05nP** | pulse | "xxxx" |
| 6 | d06cP | Command pulse sum | **d06CP** | pulse | "xxxx" |
| 7 | d07 | Maximum torque during motion | **d07** | / | "**d xxxx**" – Max torque %<br>"**V xxxx**"- Average load ratio |
| 8 | d08FP | Internal command position sum | **d08FP** | pulse | "xxxx" |
| 9 | d09cn | Control mode | **d09Cn** | / | Position: "**Ct PoS**"<br>Velocity: "**Ct SPd**" |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | Torque: "**Ct trq**" |
| 10 | d10Io | I/O signal status | **d10 Io** | / | - |
| 11 | d11Ai | Analog input | **d11Ai** | V | - |
| 12 | d12Er | Alarm cause and record | **d12Er** | / | "**Er xxx**" Alarm code |
| 13 | d13rn | Warning | **d13rn** | / | "**H xxx**" Warning code |
| 14 | d14r9 | Regeneration load factor | **d14r9** | % | "xxx" |
| 15 | d15oL | Overload factor | **d15oL** | % | "**L xxx**" – Motor overload %<br>"**d xxx**" – Driver overload % |
| 16 | d16Jr | Inertia ratio | **d16Jr** | % | "xxx" |
| 17 | d17ch | Motor not running cause | **d17Ch** | / | "**CP xxx**" Error code |
| 18 | d18ic | No. of changes in I/O signals | **d18ic** | / | "xxx" |
| 19 | d19 | Internal use | **d19** | / | " xxxx" |
| 20 | d20Ab | CSP position command sum | **d20Ab** | puls e | " xxxx" |
| 21 | d21AE | Single turn encoder data | **d21AE** | puls e | "**A xxxx**" – motor encoder single turn data<br>"**F xxxx**" – external encoder single turn data |
| 22 | d22rE | Multiturn encoder data | **d22rE** | r | " xxxx" |
| 23 | d23 id | 485 received frame | **d23id** | / | "id xxx"<br>"Fr xxx" |
| 24 | d24PE | Position deviation | **d24PE** | Unit | "**A xxxx**" – Position deviation<br>"**F xxxx**" – Full closed loop deviation (Command unit)<br>"**H xxxx**" - Full closed loop deviation (Encoder unit) |
| 25 | d25PF | Motor electrical angle | **d25PF** | puls e | " xxxx" |
| 26 | d26hy | Motor mechanical angle | **d26hy** | puls e | " xxxx" |
| 27 | d27 Pn | Voltage across PN | **d27Pn** | V | " xxxx" |
| 28 | d28 no | Software version | **d28no** | / | "d xxx Servo software"<br>"F xx Communication software"<br>"p xxx Servo power rating"<br>"C xx CPLD software" |
| 29 | d29AS | Internal usage | **d29AS** | / | "**A xxxx**" "**F xxxx**" – external encoder serial no. |
| 30 | d30NS | No. of times of encoder communication error | **d30sE** | / | "**A xxxx**" – Motor encoder communication error count<br>"**F xxxx**" – External encoder communication error count |
| 31 | d31 tE | Accumulated uptime | **d31tE** | / | " xxxx" |
| 32 | d32Au | Automatic motor identification | **d32Au** | / | "r xxx Motor no."<br>"E xxx Servo no." |
| 33 | d33At | Driver temperature | **d33At** | ℃ | "**d xxx**" – driver temperature |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | "C xxx" – MCU temperature |
| 34 | d34 | Servo status | d34 | / | "xxx" |
| 35 | d35 SF | Internal usage | d35SF | / | "xxxxxx" |

## Description of data monitoring function

When using the front panel to monitor data, data is divided in low/high bit and positive/negative.




High bit: 1st and 2nd values on the right has two decimal points
Low bit: 1st and 2nd values on the right has no decimal point.




Positive: 1st and 2nd values on the left has no decimal point.
Negative: 1st and 2nd values on the left has two decimal points

## 1. d00uE Position command deviation

Shows high bit and low bit of position deviation




Positive: 1st and 2nd values on the left has no decimal point.
Negative: 1st and 2nd values on the left has two decimal points

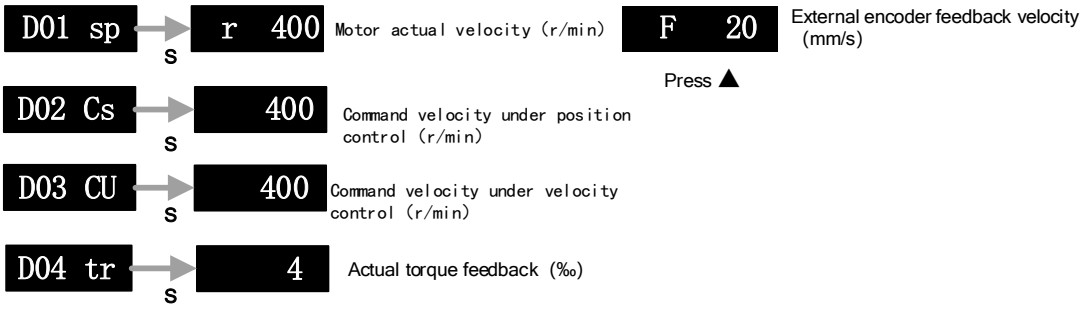
Press ◄ to switch between low and high bit
Example : Position command deviation=260885



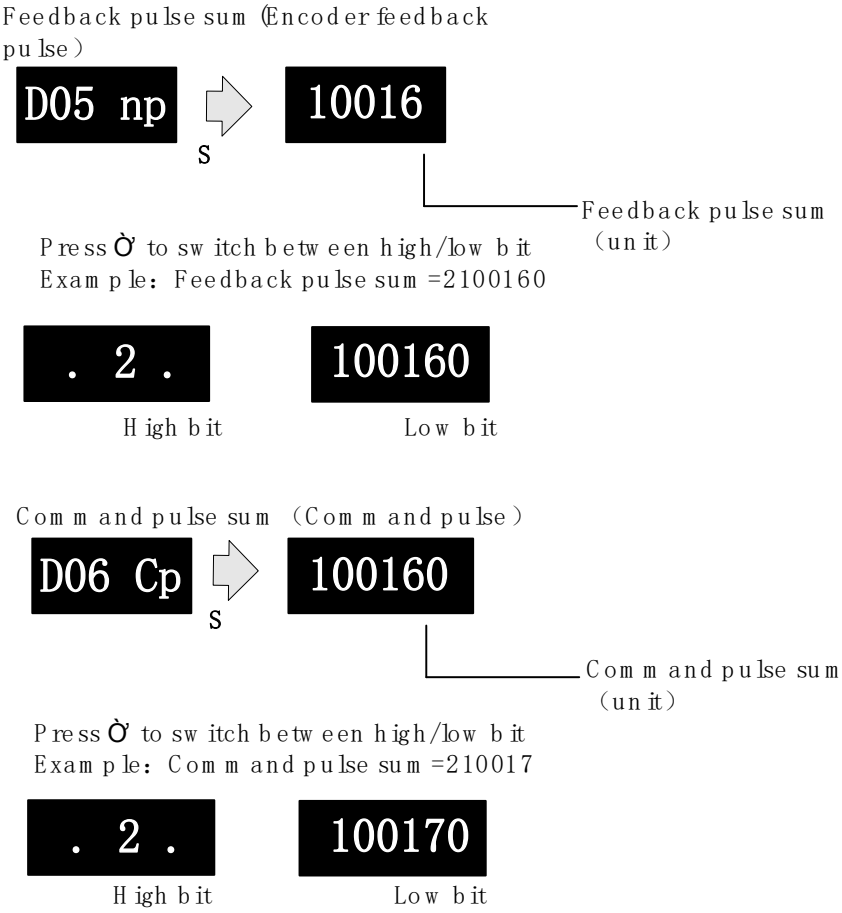

High bit: 1st and 2nd values on the right has two decimal points
Low bit: 1st and 2nd values on the right has no decimal point.

## 2. d01SP Motor velocity, d02CS Position control command velocity, d03CU Velocity control command velocity, d04 tr Actual torque feedback

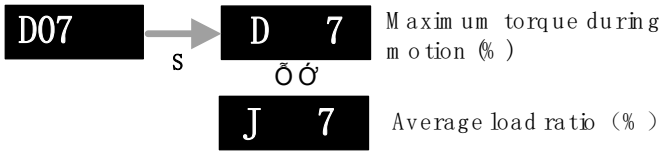
**d04 tr** reflects actual current.



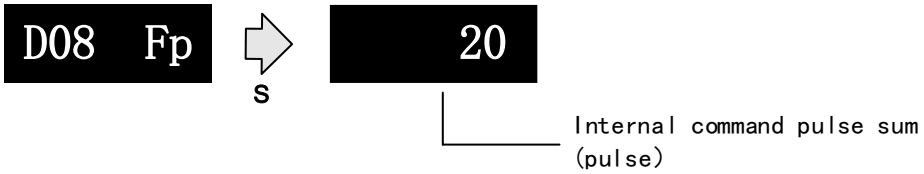

## 3. d05nP Feedback pulse sum d06CP Command pulse sum



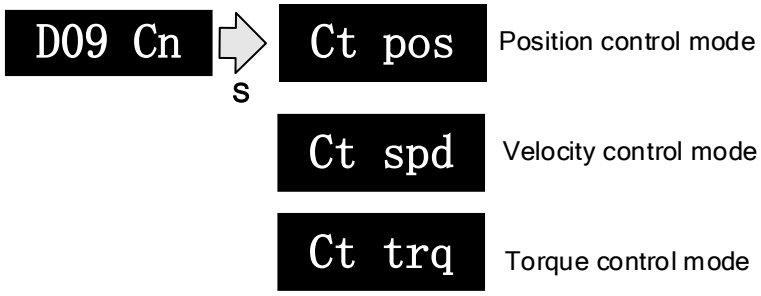
## 4. d07 Maximum torque during motion




## 5. d08FP Internal command pulse sum




## 6. d09Cn Control mode

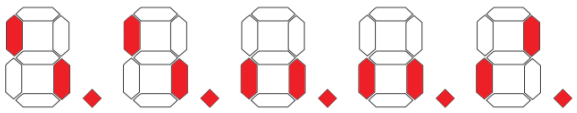



## 7. d10Io I/O signal status

When the top half of the digital tube is lit, the signal is valid; when the bottom half of the digital tube is lighted, the signal is not valid. Decimal points reP0Esent I/O status, input when lighted, output when not lighted.

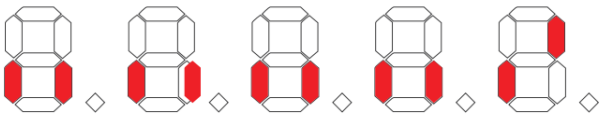
■ **Input:** From low to high bit (Right to left) DI1, DI2, .... DI10. Decimal point is lighted to reP0Esent input signals.

In the example below, DI1, DI8 and DI10 input signal is valid; DI2-DI7, DI9 input signal is invalid.

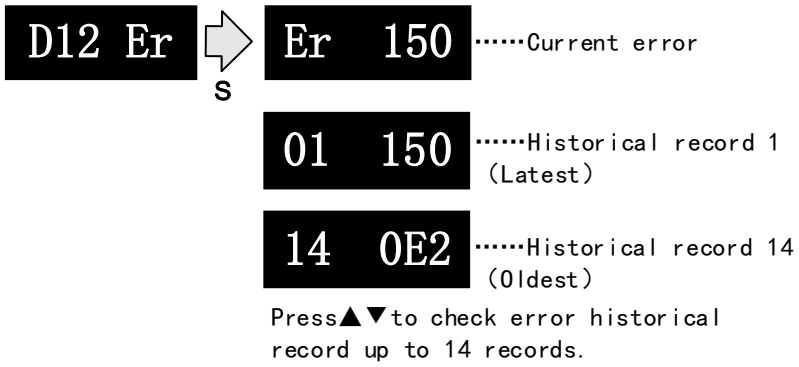


■ **Output:** From low to high bit (Right to left) DO1, DO2, … DO10. Decimal point is not lighted to reP0Esent output signals.

In the example below, DO1 output signal is valid; DO2-DO10 output signal is invalid.

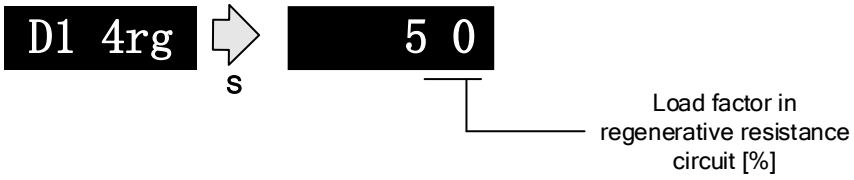


## 8. d12Er Alarm cause and historical record



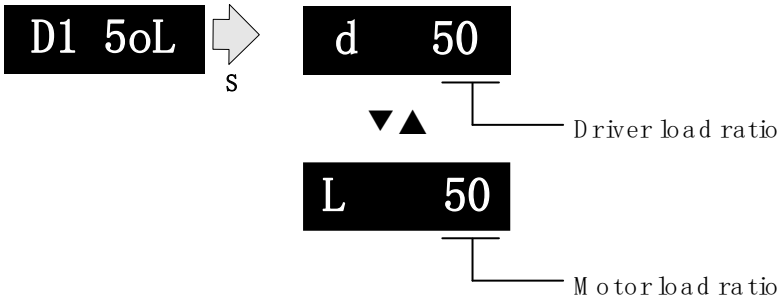

## 9. d14rg Regenerative load factor d15oL Overload factor

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




Overload factor（Er101 might occur, if d increases indefinitely

Er100 might occur, if L increases indefinitely）

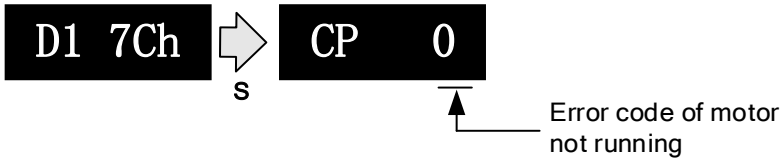



## 10. d16Jr Inertia ratio




Use auxiliary function **AF_GL** or EDrive to measure the inertia ratio. The result will be shown on **D1 6Vr**, hold M to write the value in P00.04.

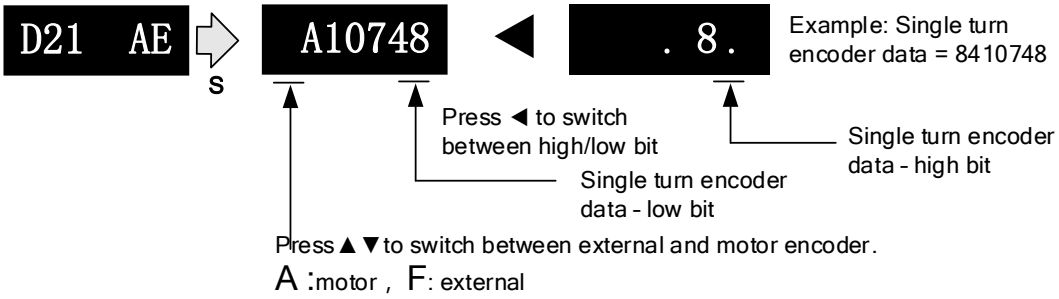
## 11. d17Ch Motor not running cause



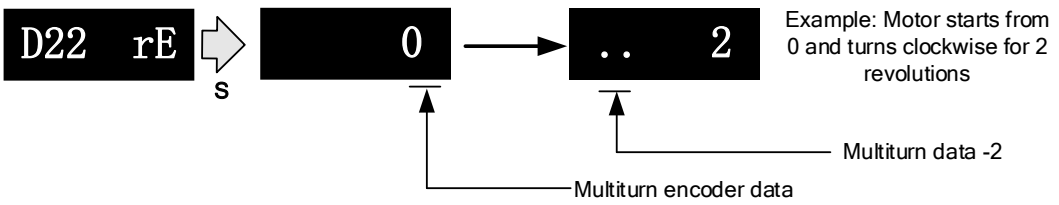

**"d17Ch" Motor No Running Cause - Codes & Descriptions**

| Display Code | Description | Content |
|---|---|---|
| CP 0 | Normal | |
| CP 1 | DC bus undervoltage | Check if DC bus voltage is too low on D27 |
| CP 2 | No SRV-ON signal | Servo-ON input (SRV-ON) is not connected to COM- |
| CP 3 | POT/NOT input valid | P05.04 = 0, POT is in open circuit, velocity command is in positive direction<br>NOT is in open circuit, velocity command is in negative direction |
| CP 4 | Driver alarm | / |
| CP 5 | Relay not clicked | Check input voltage |
| CP 6 | Pulse input prohibited (INH) | P05.18=0 |
| CP 7 | Position command too low | No command or too low |
| CP 8 | CL valid | P05.17=0, deviation counter connected to COM- |
| CP 9 | Zero speed clamp valid | P03.15 = 1, Zero speed clamp input is open |

## 12. d21AE Single turn encoder data d22rE Multiturn encoder data

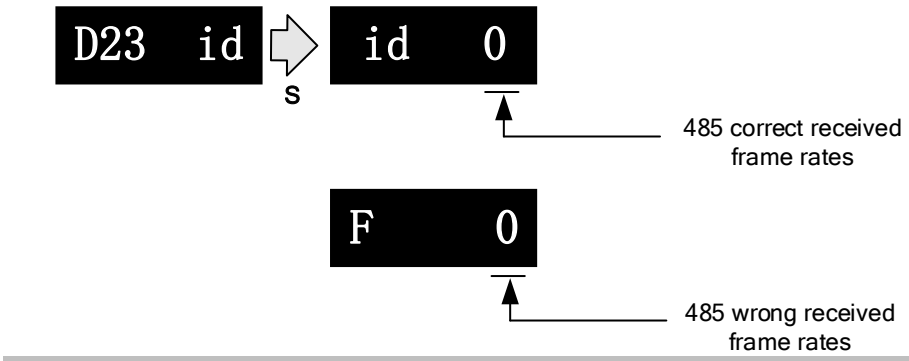



For 23-bit encoder, single turn encoder data = 0~8388607. Each value corresponds to certain position in a single revolution of the rotor, clockwise motion as negative, counter clockwise motion as positive. When counter clockwise single turn data > 8388607, multiturn data +1, clockwise single turn data < 0, multiturn data -1.

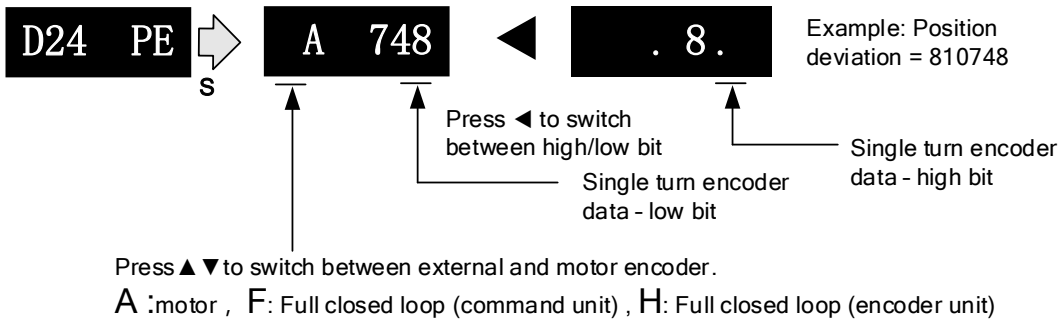



Multiturn encoder data range: -32768~+32767, As no. of revolution goes over range, 32767 will jump to -32768, -32767(counter clockwise); -32768 will jump to 32767, 32766 (clockwise)

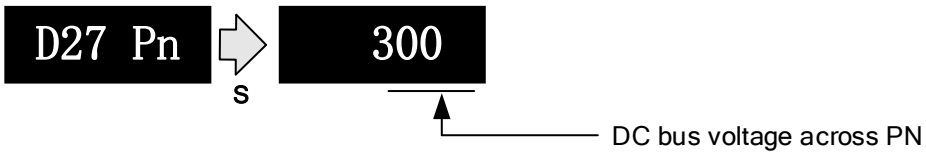
## 13.d23id 485 received frame



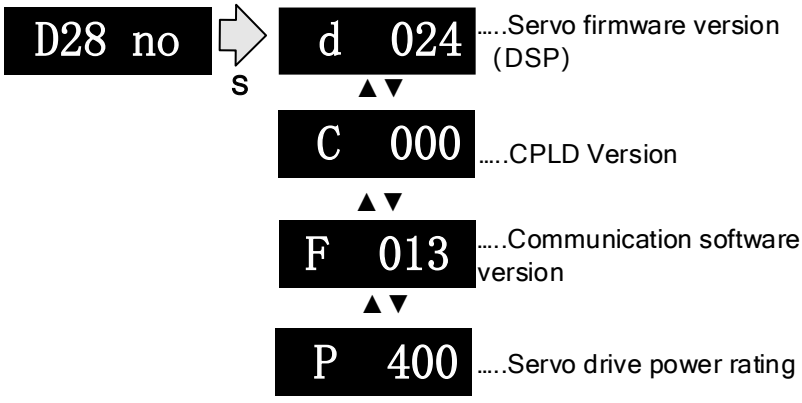

## 14. d24PE Position deviation



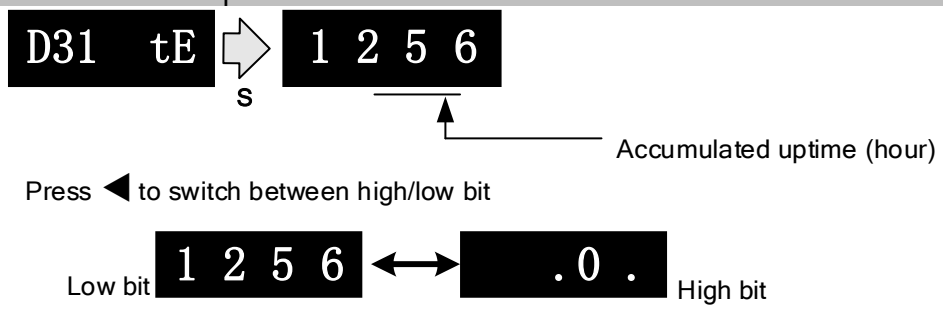

## 15. d27Pn DC bus voltage




## 16. d28no Software version



## 17. d31tE Accumulated operation time



## Display setting at power on

■ Default setting for initialization display settings at power on is **d34**, if any other display is required, please set on P05.28.

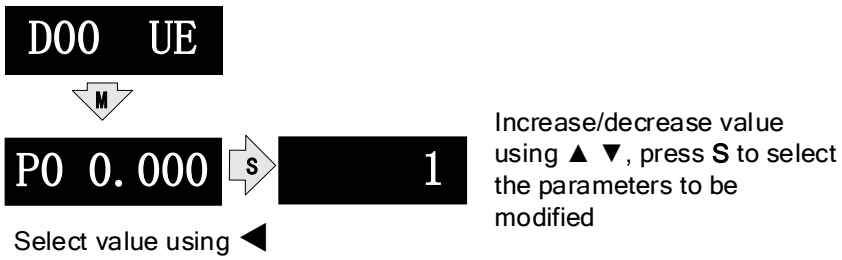
Please refer to P05.28 for any display content required on the front panel during initialization

| P05.28 | Label | LED initial status | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~35 | Unit | — | Default | 1 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0539 | | |
| | Valid | Immediate | | | | | | |

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

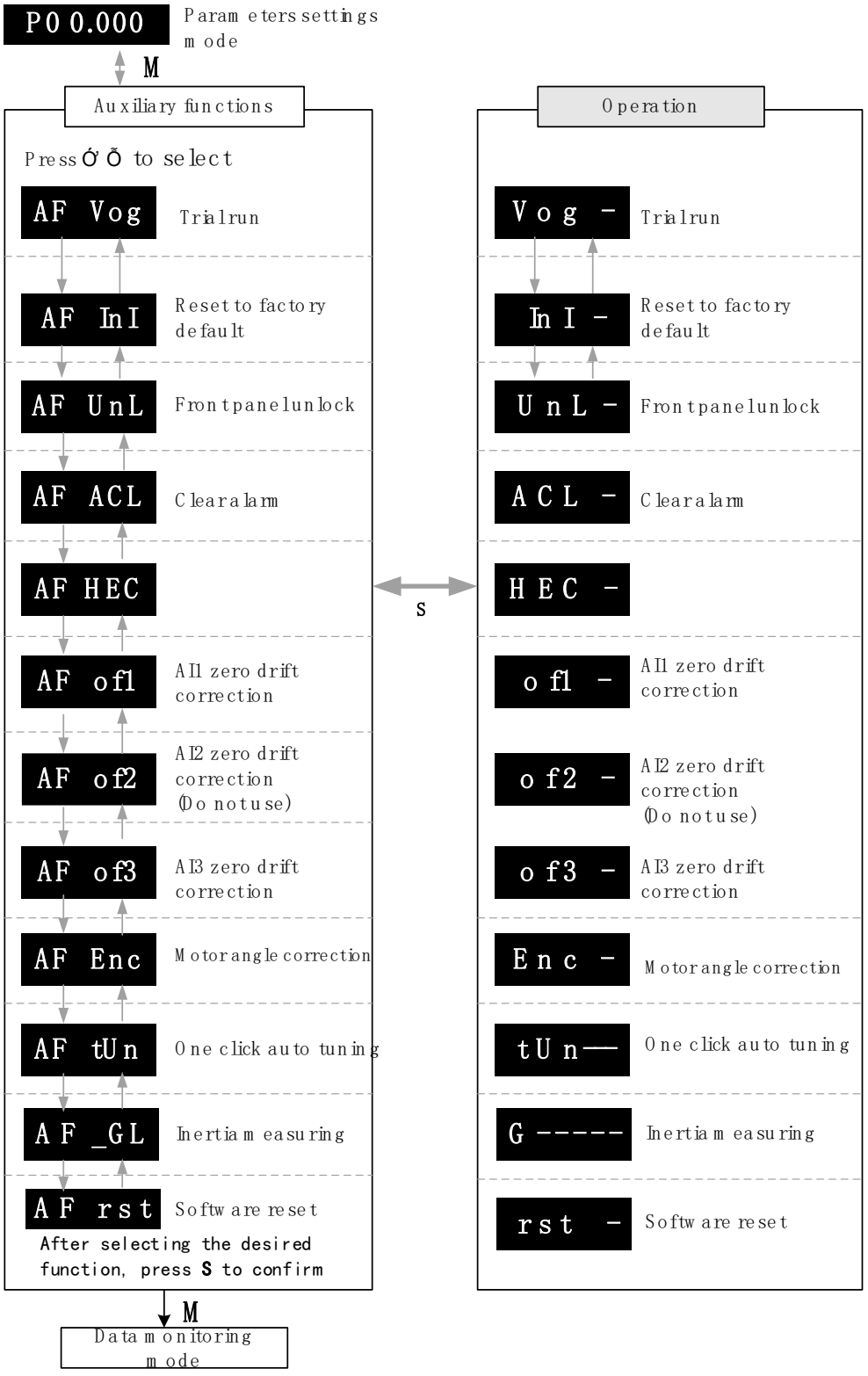
| Value | Status | Value | Status | Value | Status |
|---|---|---|---|---|---|
| 0 | Position deviation | 14 | Regenerative load rate | 28 | Software version |
| 1 | Motor speed | 15 | Overload rate | 29 | Internal usage |
| 2 | Position command deviation | 16 | Inertia load ratio | 30 | Encoder communication failure counts |
| 3 | Velocity control command | 17 | Cause(s) of non-rotation | 31 | Accumulated uptime |
| 4 | Actual feedback torque | 18 | No. of I/O changes | 32 | Internal usage |
| 5 | Feedback pulse sum | 19 | Internal usage | 33 | Driver temperature |
| 6 | Command pulse sum | 20 | Absolute encoder data | 34 | Servo status |
| 7 | Max. torque | 21 | Encoder single turn data | 35 | Internal usage |
| 8 | Position command frequency | 22 | Encoder multiturn data | | |
| 9 | Control mode | 23 | 485 receive frame | | |
| 10 | I/O status | 24 | Encoder position deviation | | |
| 11 | | 25 | Internal usage | | |
| 12 | Alarm cause & history record | 26 | Internal usage | | |
| 13 | Warning ID | 27 | PN Voltage | | |

### 5.2.4 Parameters Setting Mode



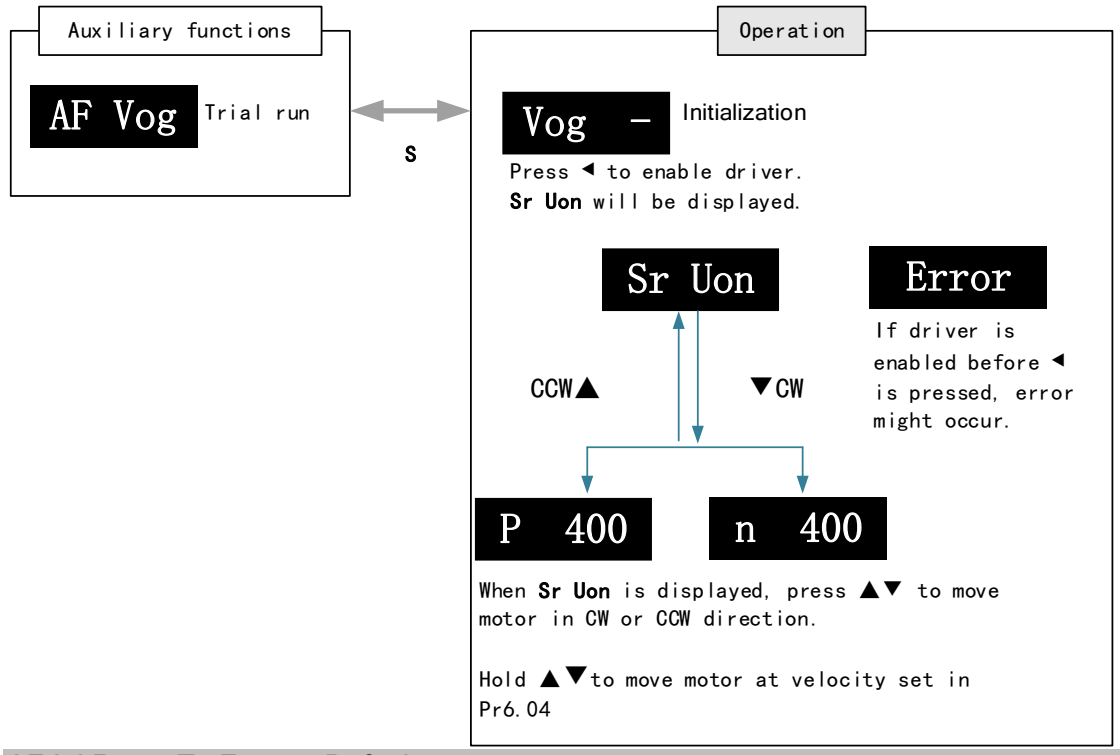

After modifying the selected parameter to desired values, P0Ess **S** to confirm and save the changes. If the parameter is modified but user does not want to save the changes, P0Ess **M** to exit without saving. Some parameter modifications will only take effect after the driver is restarted.

## 5.2.5 Auxiliary Function



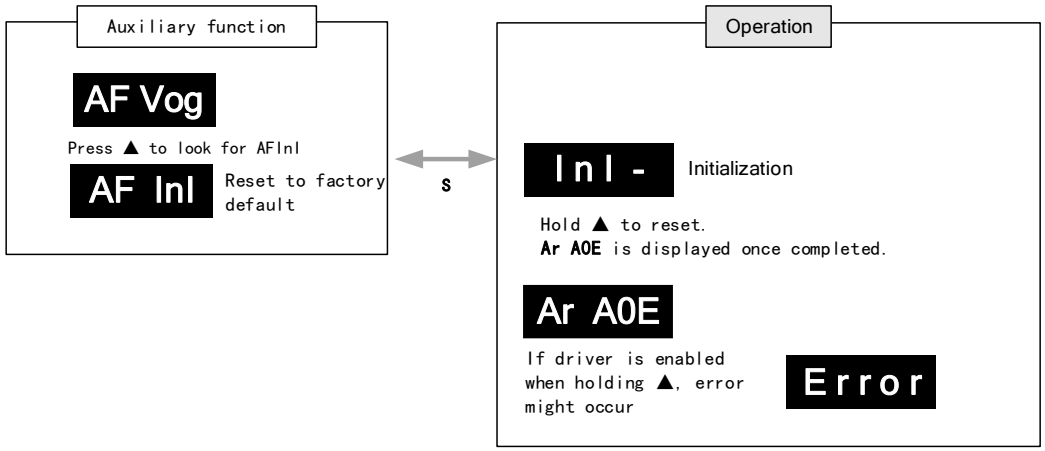
## AF Vog Trial Run

- Please Disable Servo Driver Before Performing Any Trial Run.
- Please Don't Modify Gain Related Parameters During Trial Run To P0Event Any Occurrence Of Mechanical Vibrations.
- Only Use Trial Run When P00.01 Set To 0, 1, 6.
- Please Check P06.04 (JOG Velocity) And P06.25 (JOG Acceleration) Before Running.
- P0Ess **S** To Exit Trial Run.

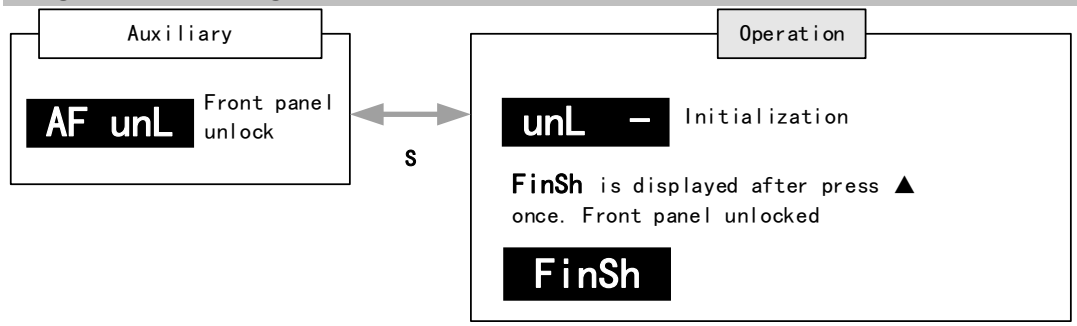



## AF Inl Reset To Factory Default

To Reset Parameters Settings To Factory Default. Can Be Used To Reset Parameters Using Auxiliary Function On Front Panel Or Using Object Dictionary.

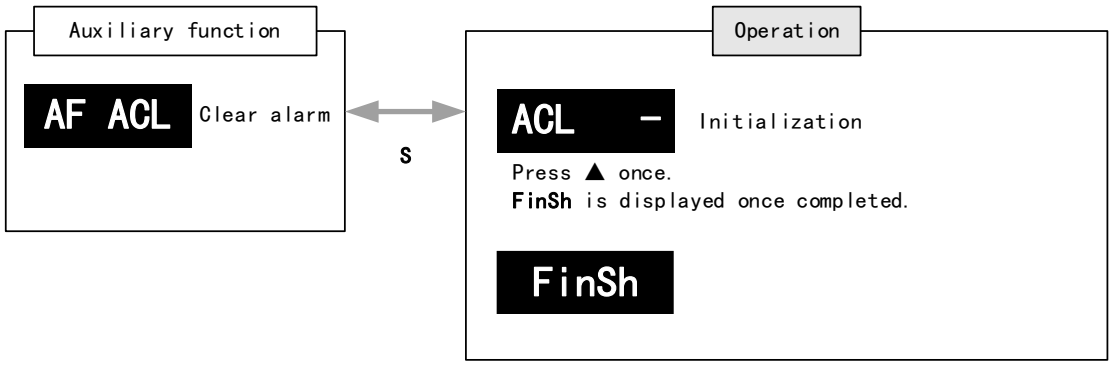


## AF Unl Front Panel Unlock



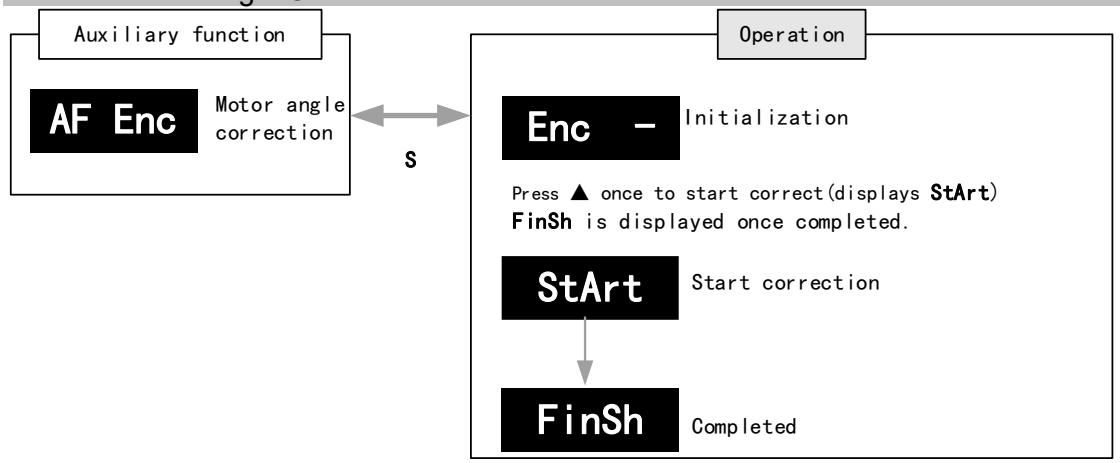

## AF ACL Clear Alarm

Alarm Can Be Cleared Using This Auxiliary Function But Before That, The Error Needs To Be Solved And Driver Needs To Be Restarted.




*For Alarms That Can Be Cleared Using This Function, Please Refer To Table In Chapter 8.*

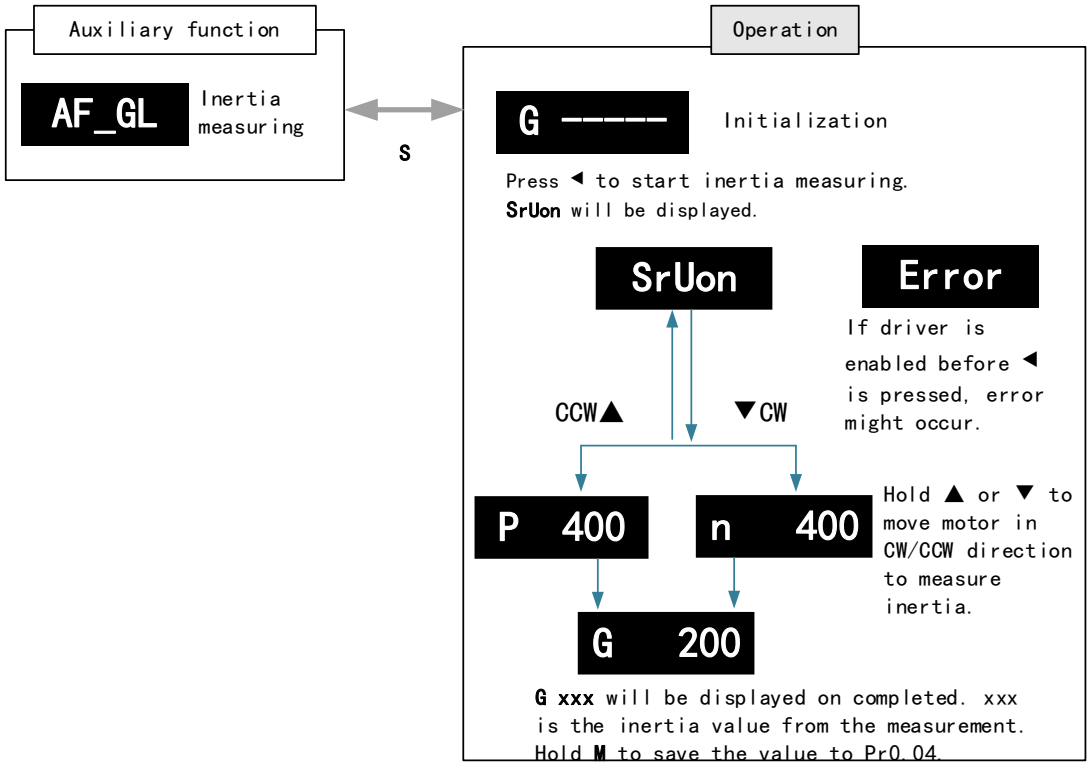
## AF Enc Motor Angle Correction




## AF_GL Inertia Measuring

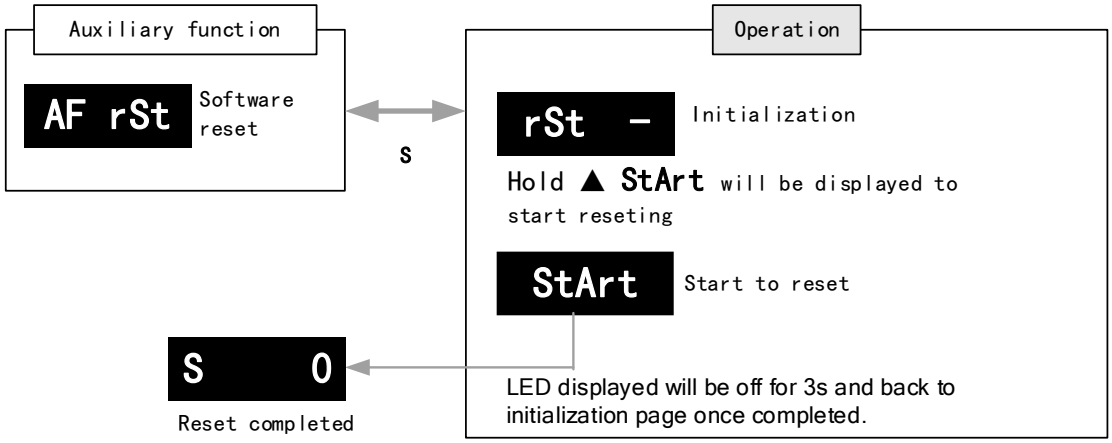
Please Make Sure: 1. Velocity < 300RPM, Average Velocity Duration < 50ms
2. Acceleration/Deceleration Time < 500ms

P0Ess **S** To Exit And Disable The Driver Once Completed.



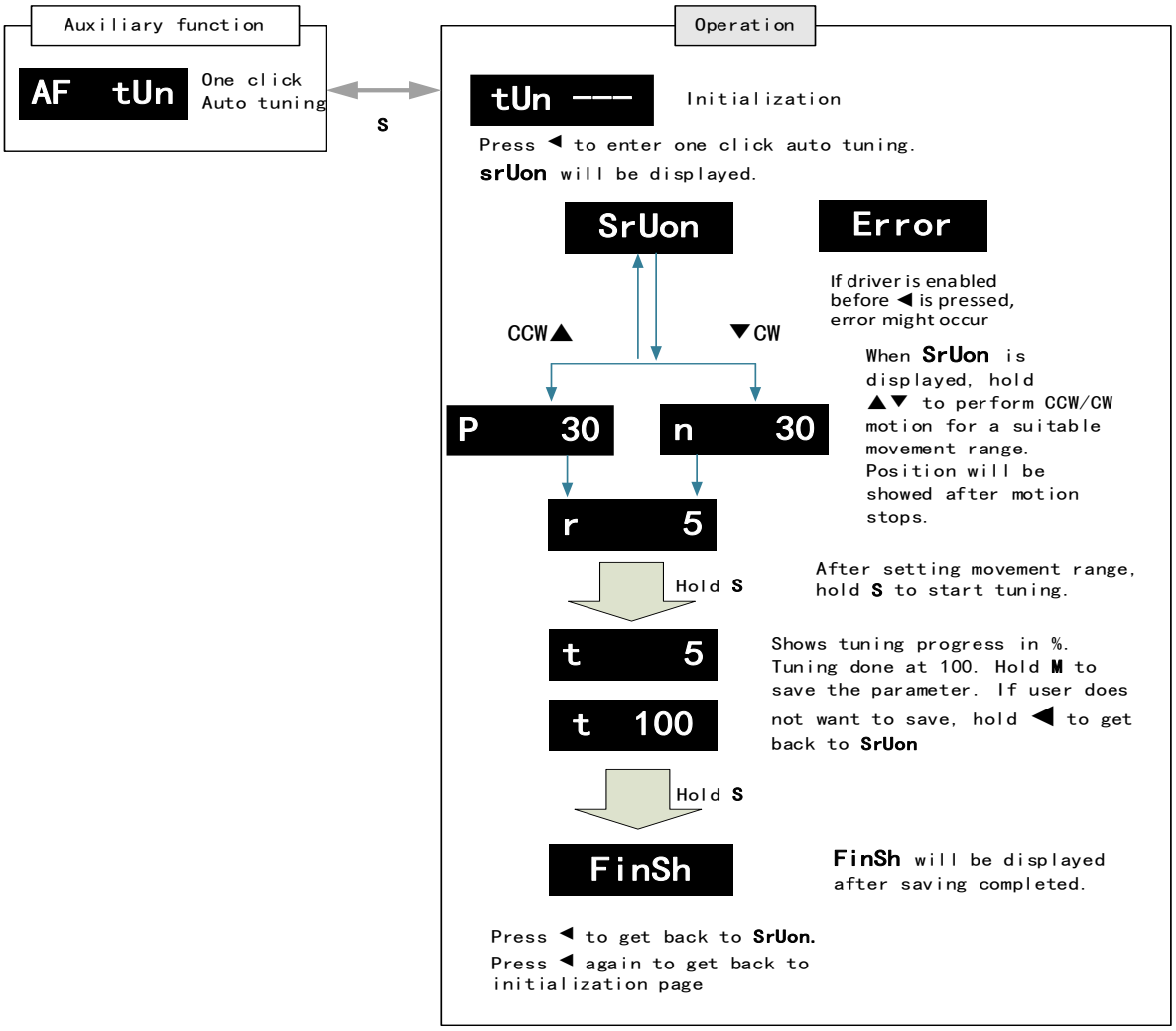

## AF Rst Software Reset

Software Reset Is Used Mainly On Parameters Modification That Takes Effect Only After Driver Restart.




## 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.




## 5.2.6 Abnormal Alarm

When a driver error occurs, the front panel will automatically switch to abnormal alarm display mode, showing the corresponding error code.

■ If the panel does not display anything, first check whether the main power supply voltage is faulty. If the power supply is within the correct range, the issue may be with the servo driver itself. Please consult MISUMI support staff.

■ For clearable alarms, you can use the alarm reset function in the auxiliary menu to clear the alarm. For non-clearable alarms, you must resolve the root cause and then power cycle the system to clear the alarm.

■ The servo stop method depends on the type of fault. Faults are categorized into Type 1 and Type 2, and the corresponding stop method is configured via parameter P05.10.

## 5.3 Get Started with Driver Operation

### 5.3.1 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. |

### 5.3.2 Power On

Connect 220V 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.

### 5.3.3 Trial Run

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

Related Parameters

| No. | Parameters | Label | Set value | Unit |
|---|---|---|---|---|
| 1 | P00.01 | Control mode settings | 9 | / |
| 2 | P06.04 | JOG trial run command velocity | User defined | r/min |
| 3 | P06.25 | 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

### 5.3.4 Debugging Software

Our company provides free download and usage of the debugging software MISUMI EDrive via our website. When used with a debugging cable, one end connects to a PC and the other to the Type-C port of the servo driver, enabling communication between the PC and the servo driver.

Main Functions of MISUMI EDrive

■ System Monitoring: Monitor the servo driver's operating status, alarms, and capture/save real-time operation data.
Key modules include:

- Oscilloscope function
- Alarm display
- Status monitoring (corresponds to front panel motion data monitoring)
- Oscilloscope: Supports single/multi-frame high-precision sampling, overlapping waveforms, analog and digital channels, and dual cursors for waveform analysis.

■ Auto Tuning: Automatically adjusts gain parameters based on simple operating condition settings.
■ Parameter Management: Read and download all parameters from P00 to P09, load previously saved parameter files, modify and write parameters to the driver, save to EEPROM, and restore factory settings.
■ IO Configuration: Configure or monitor IO signals via the IO settings interface, with support for forced IO input/output.
■ Trial Run (JOG): Perform simple forward/reverse motor movements. Supports position and speed test runs.
■ Inertia Identification: Identify load inertia through a series of actions and write the actual inertia ratio to P00.04 via parameter management.
■ Mechanical Characteristic Analysis: Analyse the system’s resonance frequency and apply notch filters for improvement.
■ Gain Adjustment: Adjust servo rigidity level and tuning method. In manual mode, individual parameters can be modified. In standard/real-time mode, predefined rigidity tables are used, and individual parameters cannot be changed.
■ Position Comparison: Configure up to 42 position comparison points.
■ Black Box: Read and analyse servo black box data using the debugging software.

Notes:

- Supports USB-powered connection to the driver, allowing parameter modification via MISUMI EDrive without external power.
- Recommended to use a Windows 10 PC.
- Serial port driver vendors no longer support Windows 7, which may cause disconnection after power cycling the driver.
- If using Windows 7, you may need to replug the debugging cable to reconnect.

### 5.3.5 Front Panel Trial Run

**JOG Test Run (Jogging Control) Operation Procedure**

Set all parameters related to jogging control.

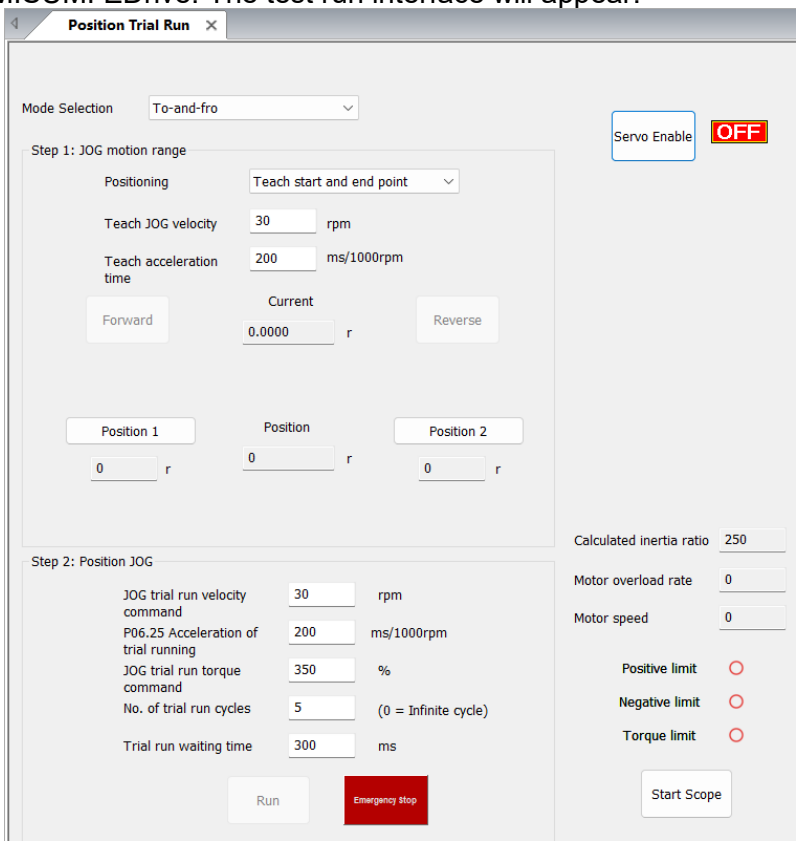
1) After successfully writing the parameters, power off and restart the driver.
2) Ensure the driver is in a disabled state to enter JOG control mode.
3) Enter the “AF Jog” submenu under Auxiliary Functions Mode.
4) Press the SET key once — the display should show “Jog -”.
5) Press ◄ key once — if there are no issues, the display should show “SrUon”. If “Error” appears, press the ▲ key again — it should then show “SrUon”. If it still shows “Error”, switch to the “d17Ch” submenu under Data Monitoring Mode to check why the motor is not rotating. Troubleshoot the issue and retry.
6) In Position JOG Mode, once “SrUon” is displayed, hold the ▲ key to increase motor speed up to the maximum set in P06.04, and the motor will run forward continuously. Release the ▲ key to decelerate and stop — the display should return to “SrUon”. Hold the ▼ arrow key to run the motor in reverse at increasing speed up to P06.04. Release the ▼ key to decelerate and stop — the display should return to “SrUon”. If the motor does not rotate, check the “d17Ch” submenu in Data Monitoring Mode to identify the issue and retry after resolving it.
7) During the JOG test run, press the SET key to exit JOG control mode.

### 5.3.6 Trial Run Using Debugging Software

Use the MISUMI EDrive debugging software to perform test runs on the servo driver and motor.

**Debugging Software Trial Run Procedure**

1) Wiring Check:
   - Confirm correct wiring for power input and motor output.
   - Use a Type-C cable to connect the servo driver to the PC for communication.
2) Confirm Power Supply Voltage, ensure it is within the rated range.
3) After establishing communication between the PC and the driver, open the test run function in MISUMI EDrive. The test run interface will appear.




4) Set to Reciprocating Motion Mode, choose positioning start/end point operation mode. After clicking Enable, the red OFF will turn green ON. Set the teaching motion attributes — avoid high speeds to prevent collisions. Use the forward/reverse motion buttons to teach and set the desired start and end points.
5) STEP-2: Configure JOG motion attributes. Execute the set motion within the taught range. Set the number of repetitions for reciprocating motion based on the planned path.

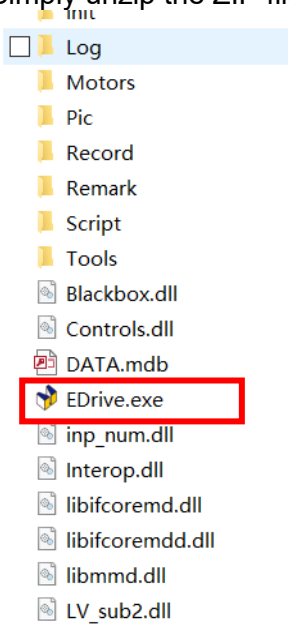
During operation, use the monitoring panel on the right to view: Estimated inertia, Motor speed, Motor load rate and Limit status indicators.

# Chapter 6 EDrive Quick Commissioning Guide

## 6.1 Software Installation

EDrive software can be downloaded from Misumi website for free.
https://sg.misumi-ec.com/linked/material/mech/MSM1/CAD/3D/10311229039/E-DHAS.zip

Simply unzip the ZIP file and double-click the EXE file in the folder to open it.




## 6.2 Connect to Drive

A serial USB type A to type C cable is required for commissioning the drive through EDrive.

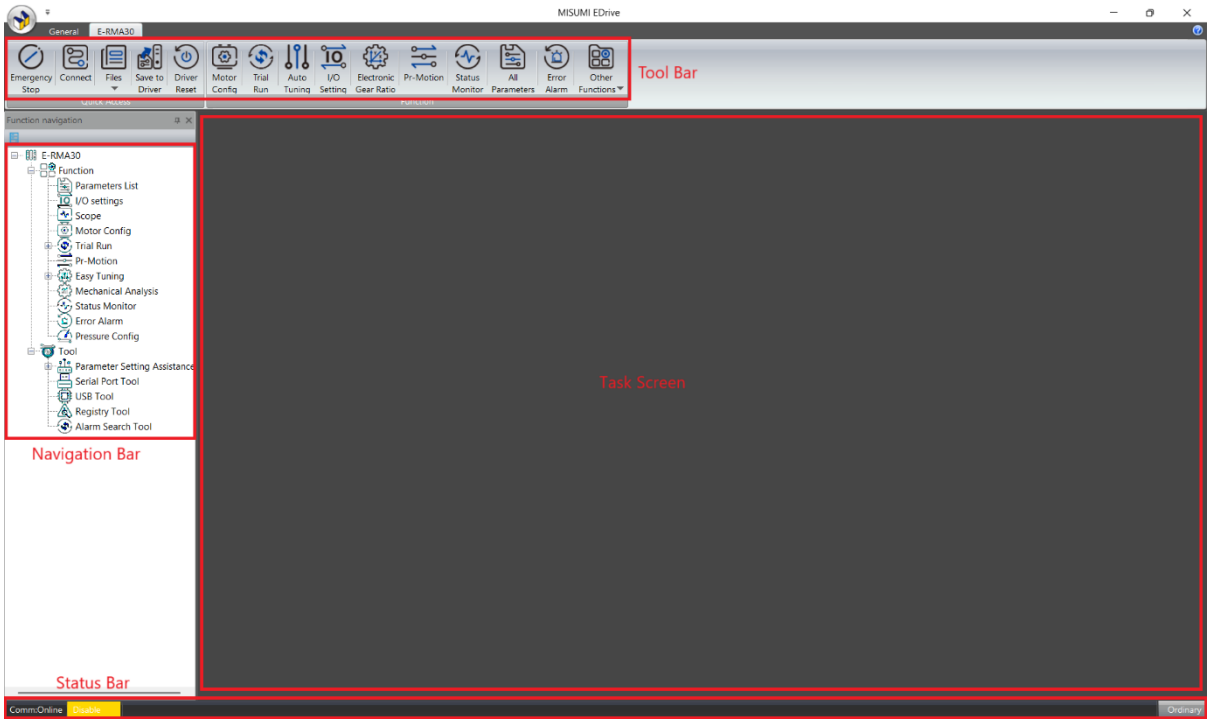


When the drive software is started with the USB plugged in, it is automatically identified, and when you press the connect button, it is connected.

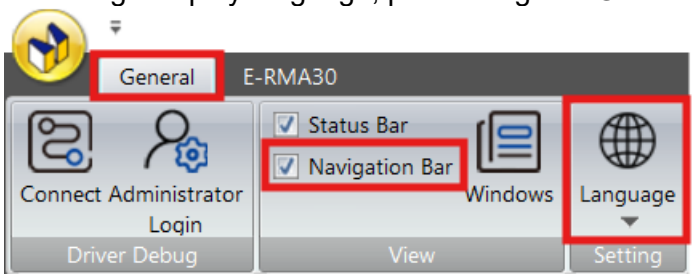



## EDrive Screen Components

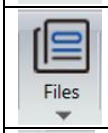
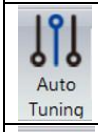
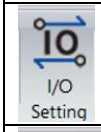
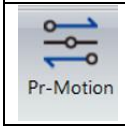
**Tool Bar:** Select various common functions and execute operations or enter related function interfaces.
**Navigation Bar:** Fully displays the functions and tools of the servo drive.
**Status Bar:** Displays the current connection status, emergency stop status, enable status, and alarm status of the servo.
**Task Screen:** Displays the interface of the selected function.
**General Bar:** Allows for administrator login, display mode switching, and debugging software reset.

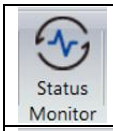


The Navigation Bar is hidden by default. To open it, please go to ‘General’ and check ‘Navigation Bar’.
To change display language, please to go to ‘General’ -> ‘Language’.




Can open the operation windows of various functions through the function names displayed on the Tool Bar and the Navigation Bar in the main window.

| Icon | Name | Description |
|---|---|---|
|  | **Emergency Stop** | Emergency stop during motion. |
|  | **Connect** | Connect or disconnect the drive from PC.<br>Check Drive’s information. |
|  | **Files** | Open parameter file or download to drive. |
|  | **Save to Driver** | Save parameters to drive. |
|  | **Driver Reset** | Soft restart drive. |
|  | **Motor Config** | Select built in Misumi LMAC motor configuration parameters or create user's motor parameters.<br>Modify motor parameters. |
|  | **Trial Run** | To do jog motion or point to point debug motion. |
|  | **Auto Tuning** | Set and execute auto tuning process. |
|  | **I/O Setting** | Configure physical I/O and virtual I/O.<br>Monitor I/O functions and status. |
|  | **Electronic Gear Ratio** | Set Electronic Gear Ratio. |
|  | **Pr Motion (Pulse drive only)** | Set Pr motion parameters.<br>Set Pr motion paths.<br>Manual trigger Pr motion paths. |

| | | |
|---|---|---|
|  | **Status Monitor** | Select monitoring values.<br>Set monitoring rate. |
|  | **All Parameters** | Check and modify all the parameters.<br>Read/Save parameters from/to drive/PC.<br>Compare parameters values. |
|  | **Error Alarm** | Check, read or search Alarm.<br>Check cause(s) of motor not moving. |
|  | **Other Functions** | Open configuration page for Gantry Function and Position Comparison |
|  | **EtherCAT (EtherCAT drive only)** | Open Object Dictionary, 402 Observer, Diagnostics and Object Dictionary Tool.<br>Download ESI file. |

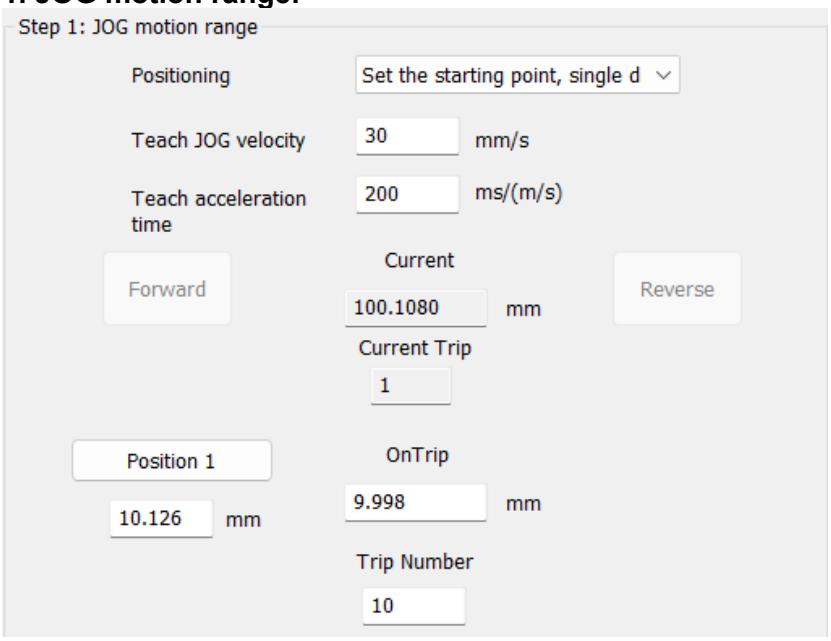
## 6.3 First Motor Movement

Trial Run is divided into Position Trial Run and Velocity Trial Run.
Position Trial Run: Perform reciprocating or unidirectional motion at the set operating speed within the defined positioning range.
Velocity Trial Run: Perform continuous unidirectional motion or jog at the set speed.

### Position Trial Run

There are 4 kinds of JOG motion mode:
To-and-fro: The motor moves back and forth within the start and end positions.
One way motion (Positive direction): The motor uses the absolute value of the start and end position difference as the distance for each unidirectional movement, maintaining forward motion.
One way motion (Negative direction): The motor uses the absolute value of the start and end position difference as the distance for each unidirectional movement, maintaining reverse motion.
Multiple round trip motion: The motor uses the absolute value of the start and end position difference as the distance for each unidirectional movement. Moves back and forth based on set trip numbers.

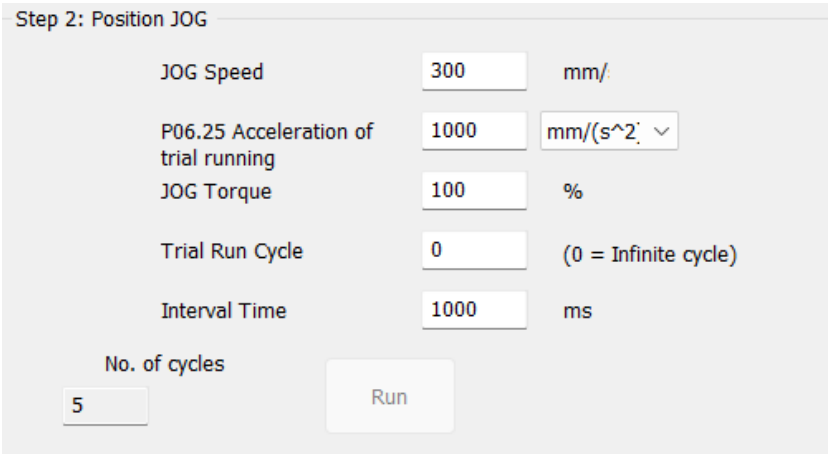
**1. JOG motion range:**




You can use the trial run function to configure the operating path, speed, and acceleration to make the motor move.
Currently, there are three ways to teach the operating range for E-RMA/RME position trial run:
Teach start and end point: After enabling the servo, use the forward and reverse buttons to adjust the position. Click the Set Current Position as Start/End button to complete the start and end position settings.
Input start and end points: Select this mode to directly input the positions in the start and end input boxes. The motor will move to the start point and then perform reciprocating motion.
Input distance: Select this mode to input the operating distance in the position difference. The motor will perform reciprocating motion at the current position.

Note: The teaching speed should not be too fast to avoid collision!

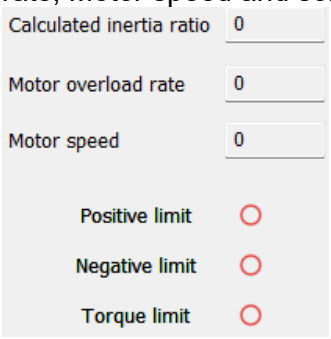
**2. Position JOG:**




After setting the operating range, the motor will operate differently based on the Position JOG mode.
Before operation, you can set the JOG Speed and Acceleration/Deceleration of trial running.
JOG Torque: You can limit the maximum torque during operation.
Trial Run Cycle Set the number of runs.
Interval Time: Set the interval time for Position JOG.

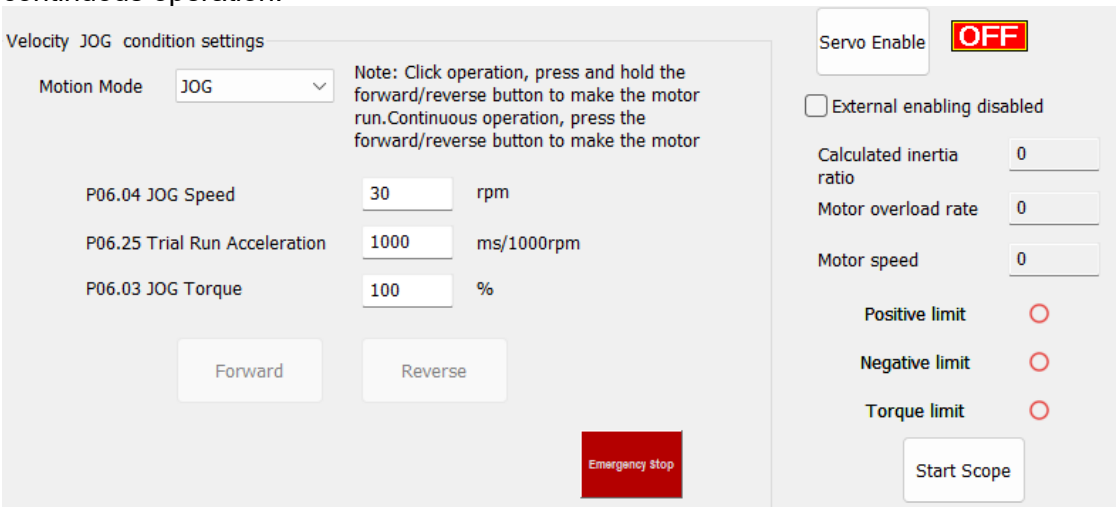
**3. Trial Run Status Monitoring:**

The status on the right side allows you to view the Calculated inertia ratio, Motor overload rate, Motor speed and some limit states.




## Velocity Trial Run

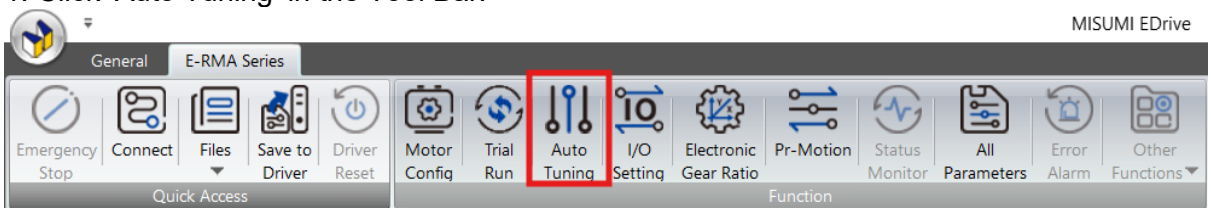
Velocity Trial Run primarily operates at the set speed and is divided into jog operation and continuous operation.



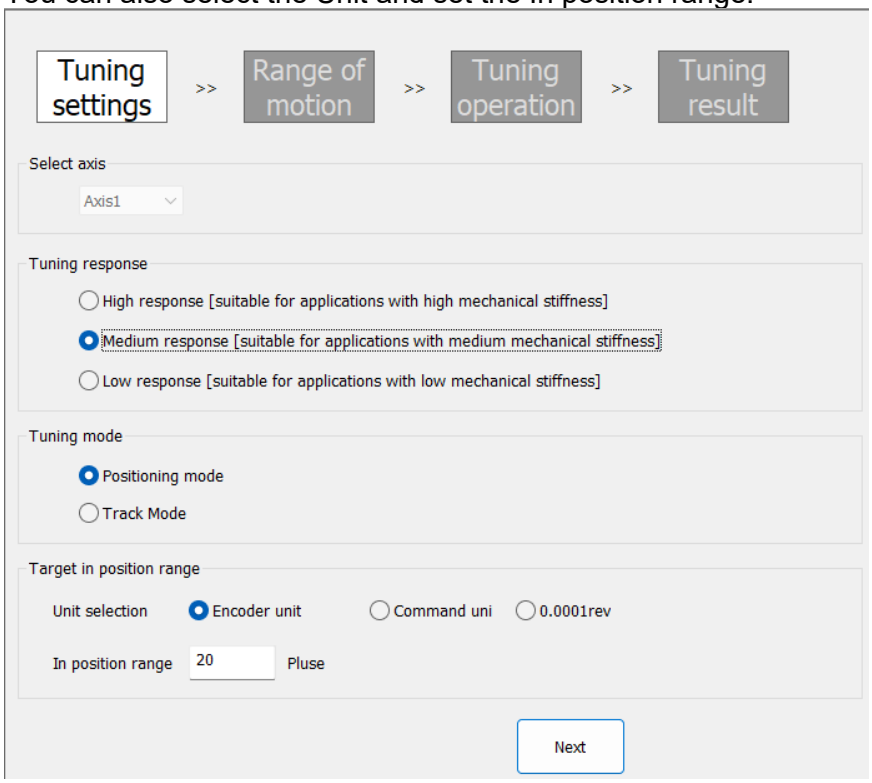
JOG:
The motor runs only while holding the forward/reverse button. When the button is released, the motor stops.
Continuous:
For continuous operation, pressing the forward/reverse button once will make the motor run continuously.

## 6.4 Auto Tuning

1. Click ‘Auto Tuning’ in the Tool Bar.



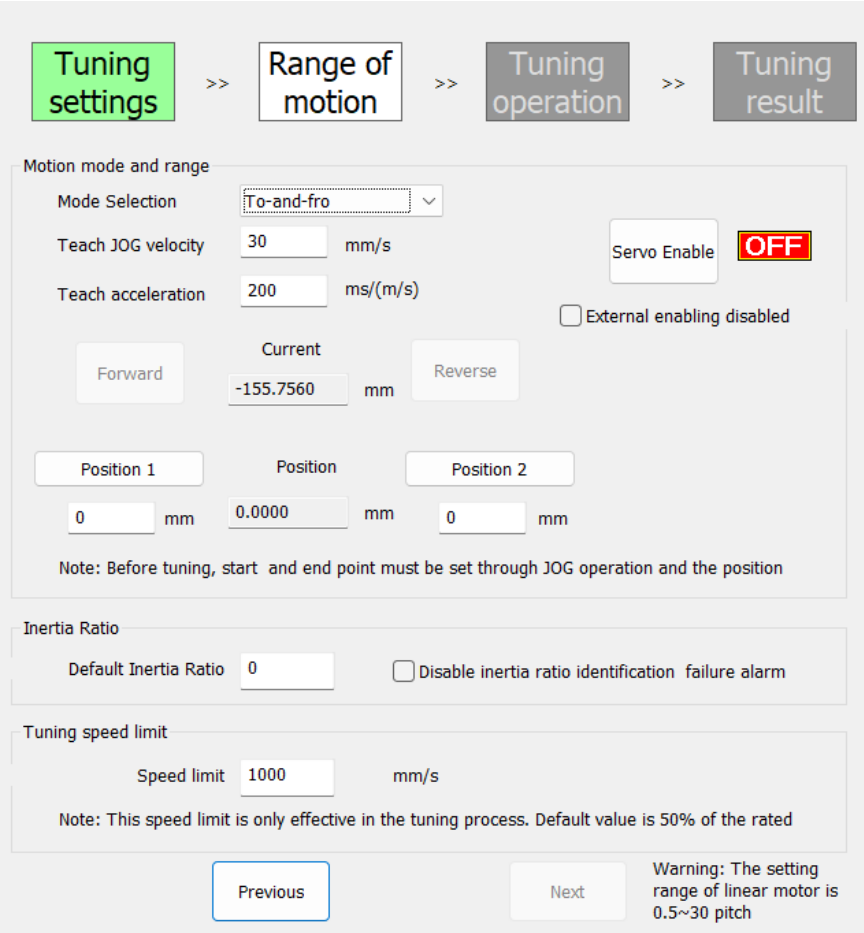

2. Enter the “Auto Tuning” interface. The first screen is for tuning adjustments. The main purpose is to set the execution standards for the auto-tuning process.
‘Tuning response’ is divided into three situations, selected based on the actual mechanical conditions.
‘Tuning mode’ is divided into Positioning mode and Track mode.
You can also select the Unit and set the In position range.




3. Click ‘Next’ to enter the operating range setting interface, where you can set the operating range for one-click auto-tuning.
There are three operating modes, chosen based on the allowable movement direction of the actual machinery:

- To and fro: The motor moves back and forth within the start and end positions.

- One way motion (Positive): The motor uses the absolute value of the start and end position difference as the distance for each unidirectional movement, maintaining forward motion.
- One way motion (Negative): The motor uses the absolute value of the start and end position difference as the distance for each unidirectional movement, maintaining reverse motion.



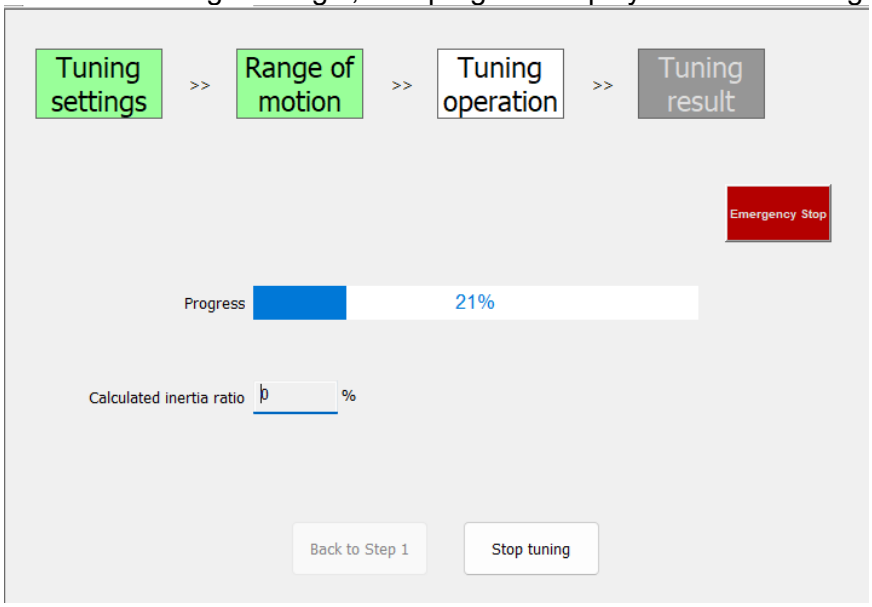

After enabling the servo, use the Forward and Reverse buttons to adjust the position. Click the 'Position 1(2)' button to complete the setting.

**Note**: The closer the start and end positions are to the actual application travel difference, the better the tuned parameters will adapt, although the adjustment time may increase.

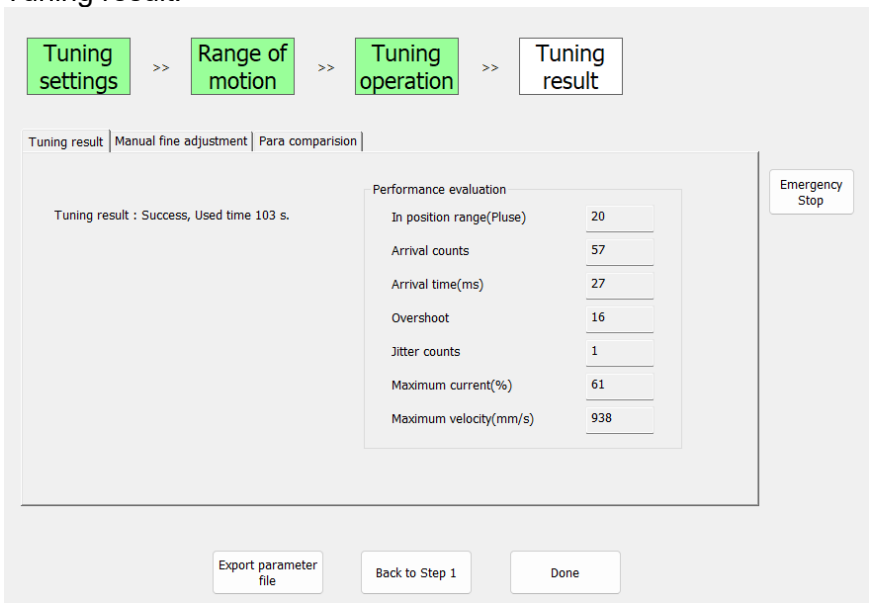
After setting the operating range, you need to set the 'Inertia Ratio'. You can choose whether to mask inertia recognition failures to avoid unsuccessful tuning due to inertia recognition failures. The inertia ratio can be manually entered or preset to a suitable value to avoid equipment shaking in belt applications due to low inertia.

Tuning Speed Limit: Please use the highest speed that will be used in application.

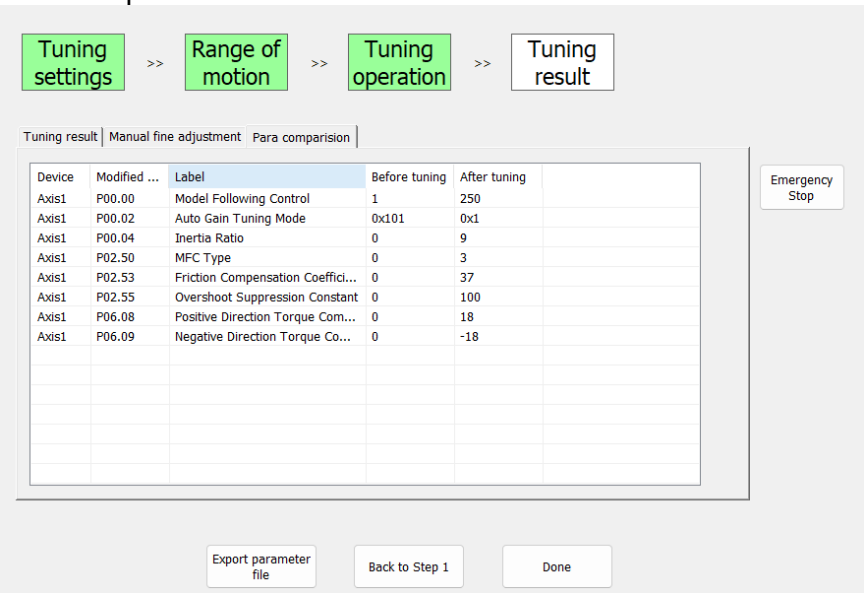
4. Click ‘Next’ and confirm the safety of the movement to enter the tuning operation interface. Tuning will begin, with progress displayed and an emergency stop button provided.



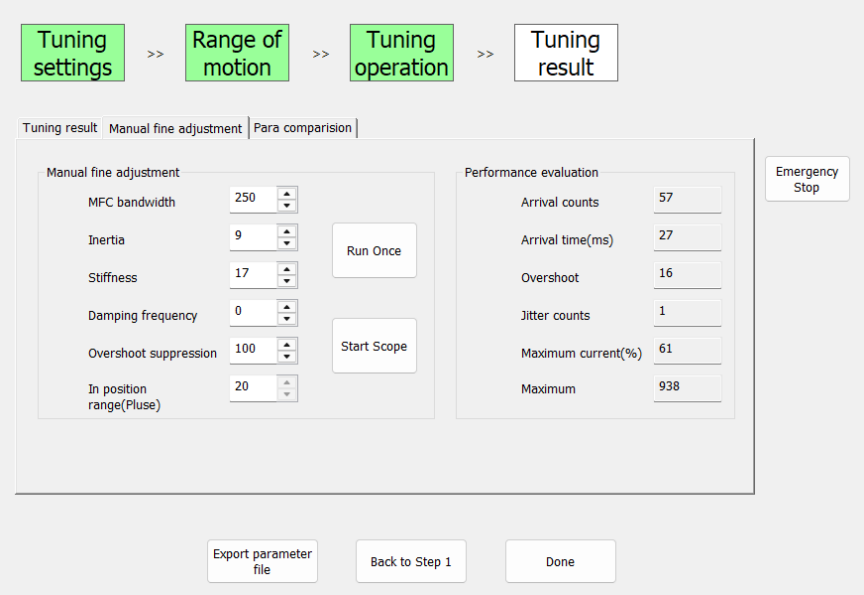

5. After tuning is completed, it will jump to the tuning results interface, showing the Tuning result, Manual fine adjustment and Para comparison.
Tuning result:



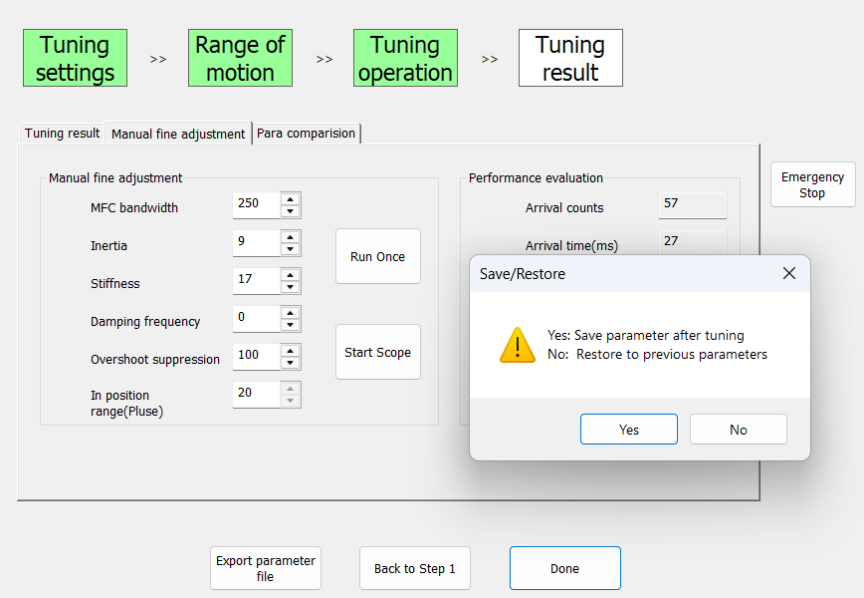
Para comparison:




Manual fine adjustment:
If you need to fine-tune the tuning effect, you can enter the manual fine-tuning to modify the gain.




After fine-tuning the parameters, run it again to check the performance evaluation or use the Scope to see if it meets the actual needs.
If you are satisfied with the tuning results, click ‘Done’, and a prompt will ask if you want to save the parameters. Click ‘Yes’ to save the tuned parameters, or ‘No’ to restore the parameters before tuning.

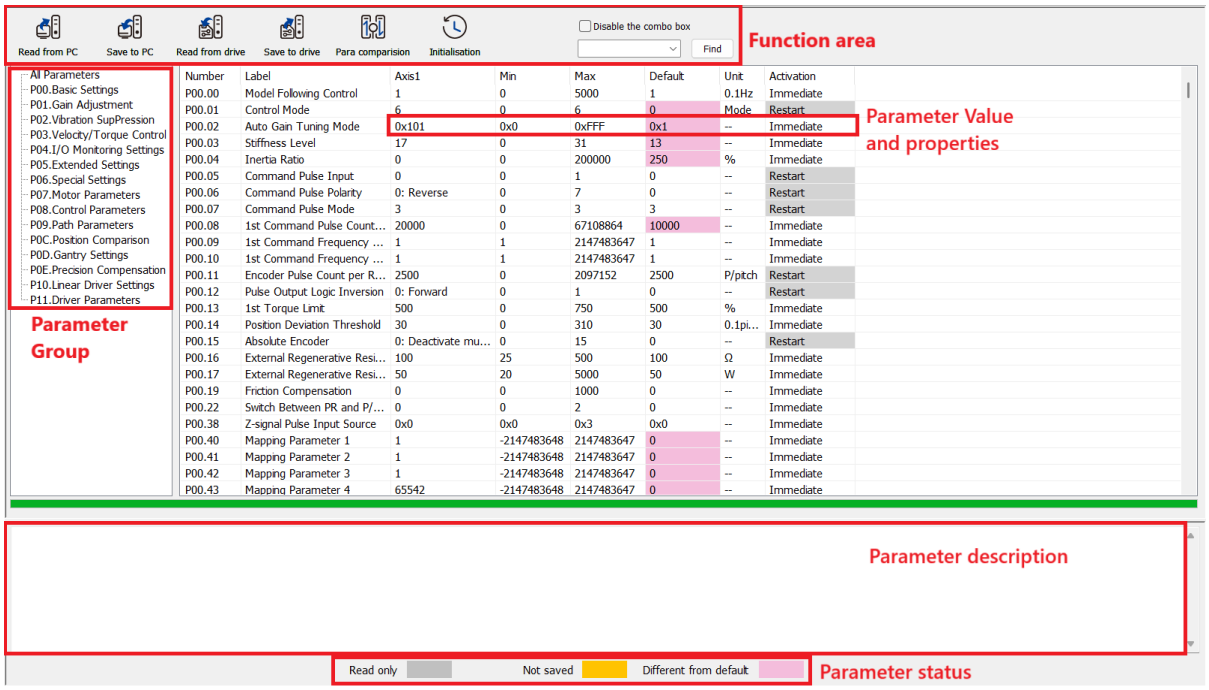



**Note**: After clicking 'Done', regardless of whether you click 'Yes' or 'No', you will exit the one-click auto-tuning interface.

## 6.5 Read & Save Parameters

Parameter Management includes 'All Parameters', 'Parameter Download', 'Parameter file open' and 'Offline Parameter file modification'.

### 6.5.1 All Parameters




**Function area:**




**Read from PC:** Open a saved parameter file.
**Save to PC:** Save the current parameter recipe as a file to the computer.

**Read from drive:** Read and refresh the current drive parameters.
**Save to drive:** Save the current parameters to the drive EEPROM.
**Para comparison:** Compare current values with factory default values, current values with parameter files, parameter files with default values, and parameter files with each other.
**Initialization:** Restore the current axis parameters to the default factory settings. After restoring factory settings, the drive needs to be restarted.

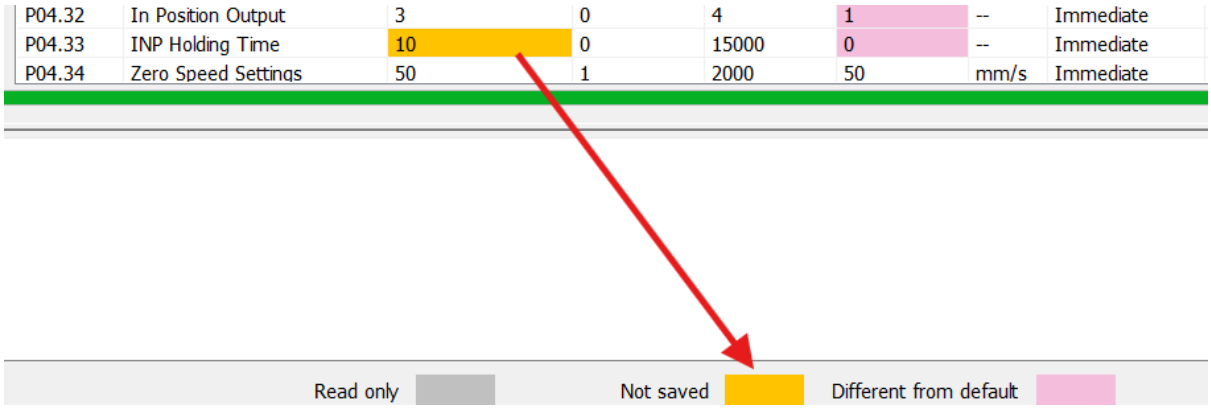
**Parameter Group:** Displays the current servo's parameter group. You can select a parameter group to display all parameters of that group.
**Parameter value and properties:** The parameter status will show the current set value, the parameter's range, default value, unit, effective mode, etc. Additionally, after modifying the axis set value, it will display the parameter save status. The default value will show whether the current set value matches the default value.
**Parameter description:** Clicking on a parameter with the mouse will display the description of the current parameter.

### 6.5.2 Parameter Modification and Download

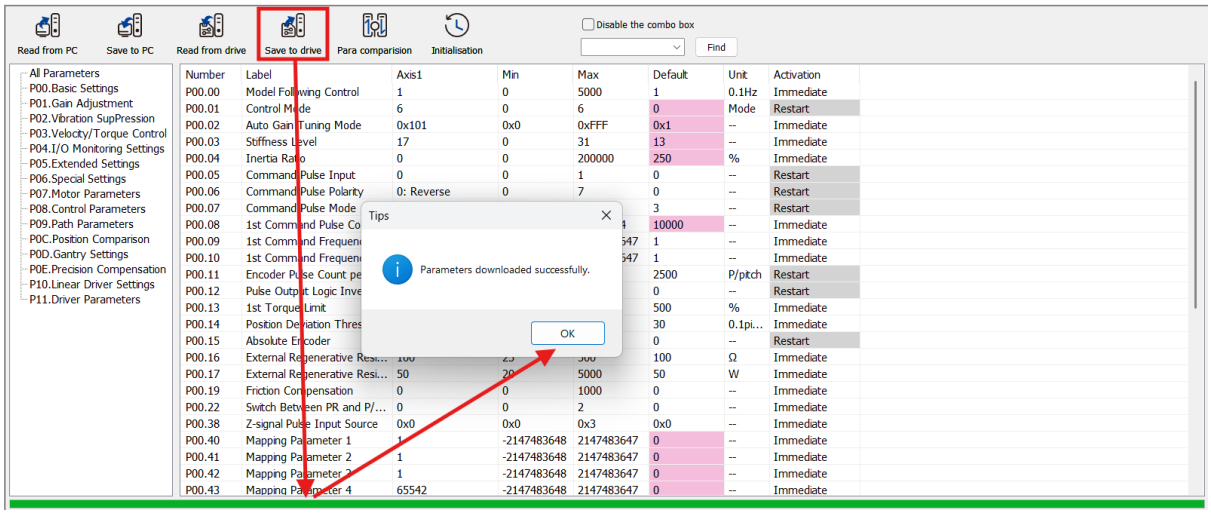
1. Parameter modification:
Select the parameter you want to modifying and click the current value to modify it.

| Number | Label | Axis1 | Min | Max | Default | Unit | Activation |
|---|---|---|---|---|---|---|---|
| P00.00 | Model Following Control | 1 | 0 | 5000 | 1 | 0.1Hz | Immediate |
| P00.01 | Control Mode | 6 | 0 | 6 | 0 | Mode | Restart |
| P00.02 | Auto Gain Tuning Mode | 0x101 | 0x0 | 0xFFF | 0x1 | -- | Immediate |
| P00.03 | Stiffness Level | 17 | 0 | 31 | 13 | -- | Immediate |

2. After setting, exiting the edit or pressing Enter will directly send the parameter to the drive, but it will not be saved to the EEPROM. After powering on again, the parameter will revert to the value saved in the EEPROM.
When the parameter value is sent but not saved, an orange background will notify the user that the current set value is not saved.

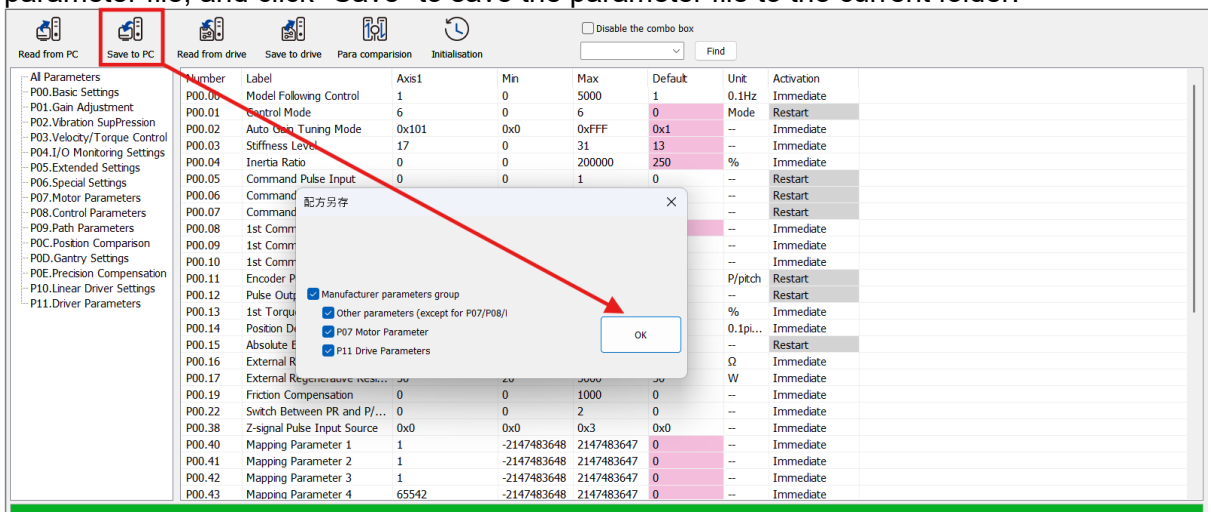



3. Save to drive:
After modifying, if you need to save the parameter to the drive EEPROM to prevent loss due to power failure, or if the effective mode is a power-off effective parameter, you must save the parameter. Click "Parameter Save" to save the parameter to the EEPROM. A green progress bar will show the save progress, and a prompt will indicate that the parameter has been successfully sent.




## 6.5.3 Parameter Save to PC

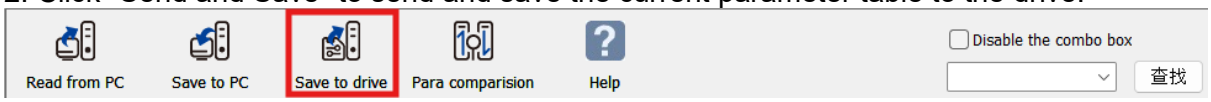
Save to PC allows you to save the servo drive's parameters to a file, enabling you to confirm drive parameters without connecting to the servo drive or import parameters into another servo drive.
Clicking " Save to PC " in the function area allows you to save the servo drive's parameter recipe as a file. After clicking "Save to PC," select all the check box in the pop out window then click ‘OK’. A save dialog box will pop up. Choose an appropriate path, name the parameter file, and click "Save" to save the parameter file to the current folder.




## 6.5.4 Read Parameter File From PC

Open the parameter file saved on the PC (with the .msm file extension). After opening, you can view the parameter settings in the parameter file and send the parameter recipe file to the currently connected drive.
1. Click "Read from PC" in the Function area to open the parameter file.

2. Click "Send and Save" to send and save the current parameter table to the drive.

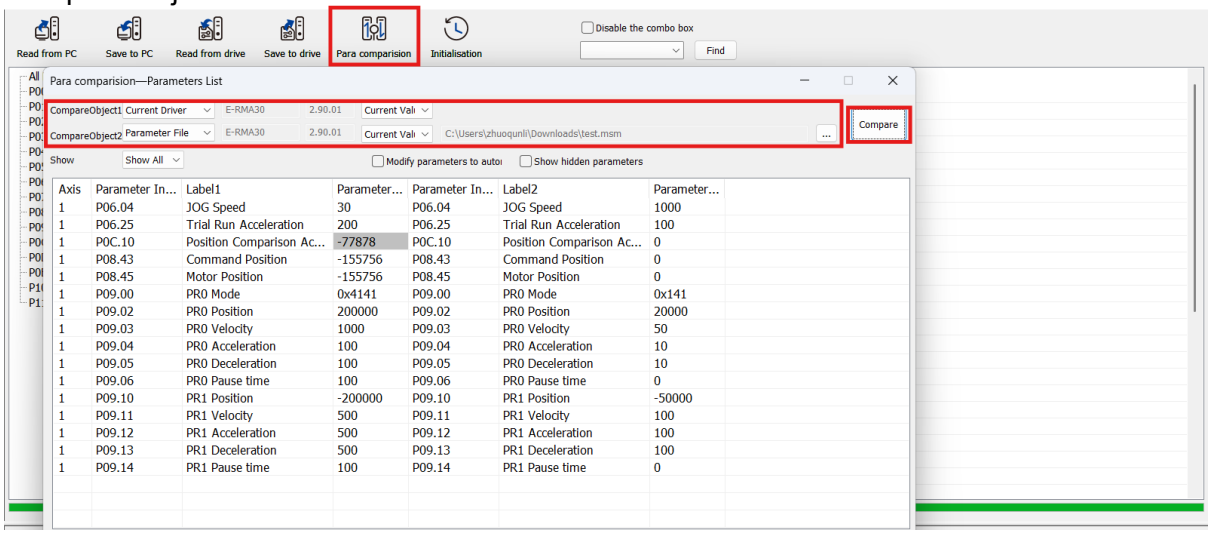



3. To prevent confusion and operational errors or risks, there are corresponding restrictions on sending and saving parameters:

1. If the drive series of the parameter file does not match the drive series to be sent: Sending is not allowed.
2. If the drive series matches but the software version does not: Differences are indicated, but sending is allowed.

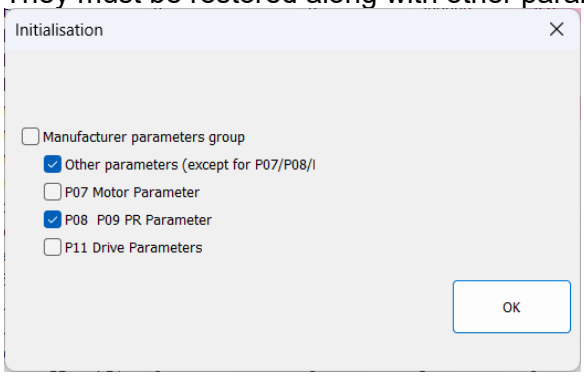
### 6.5.5 Compare Parameters

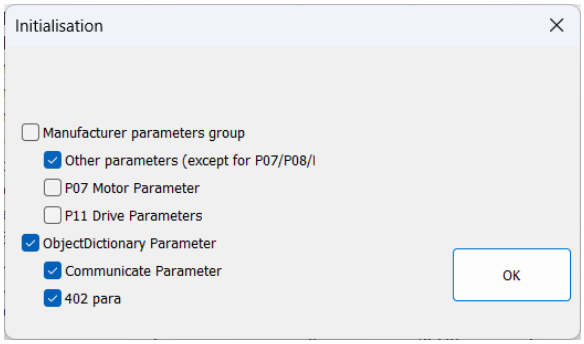
Click the “Para comparison”, and a comparison box will pop up. You can select parameters to compare. It provides comparisons between the current parameter table, default values, and parameter files.
After clicking “Compare”, it will display the parameters where Compare Object 1 and Compare Object 2 are inconsistent.




### 6.5.6 Initialization

Click the “Initialization”, and a restore factory settings popup will appear. You can select the parameter groups you want to restore to factory settings:
Manufacture parameters group:
Other parameters (except for P07/P08(P011))
P07 Motor Parameter
P08 P09 RE Parameter (For Pulse drive only)
P11 Drive Parameters
Objection Dictionary Parameter: (For EtherCAT drive only)
Communicate Parameter
402 para
**Note**: Manufacturer group parameters do not support resetting only P07 or P11 parameters. They must be restored along with other parameters.





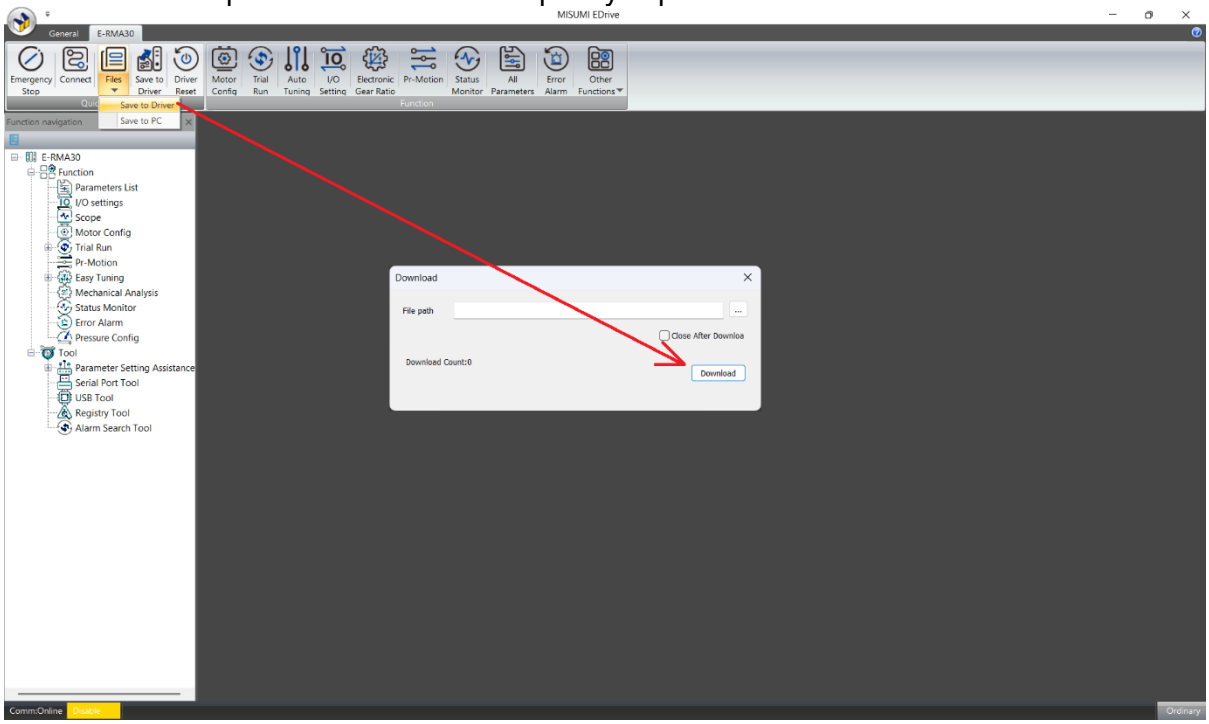

After the progress bar is completed, the factory reset is successful. If unsuccessful, a failure prompt will appear.

**Note:**

1. Factory reset is not allowed in the enabled state.
2. After restoring factory settings, please perform a soft reset/power-off restart of the drive.

### 6.5.7 Save to Drive

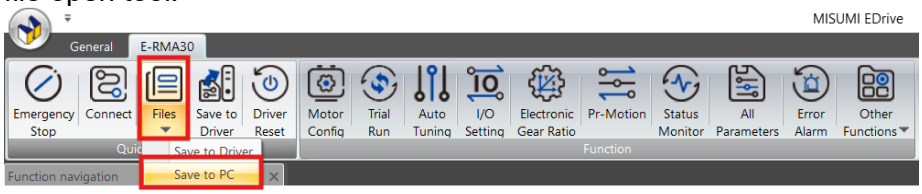
There is no need to open the parameter summary table for sending and counting. This is for scenarios where parameters need to be quickly imported into other drives.




### 6.5.8 Open Parameter File, Object Dictionary File and Scope File

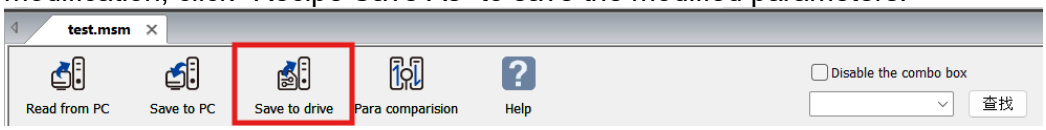
In offline mode, you need to switch to offline mode and select the corresponding series to open the relevant parameter file.

If you must open parameters in offline mode without selecting offline mode, you can use the file open tool.



### 6.5.9 Offline Parameter File Modification

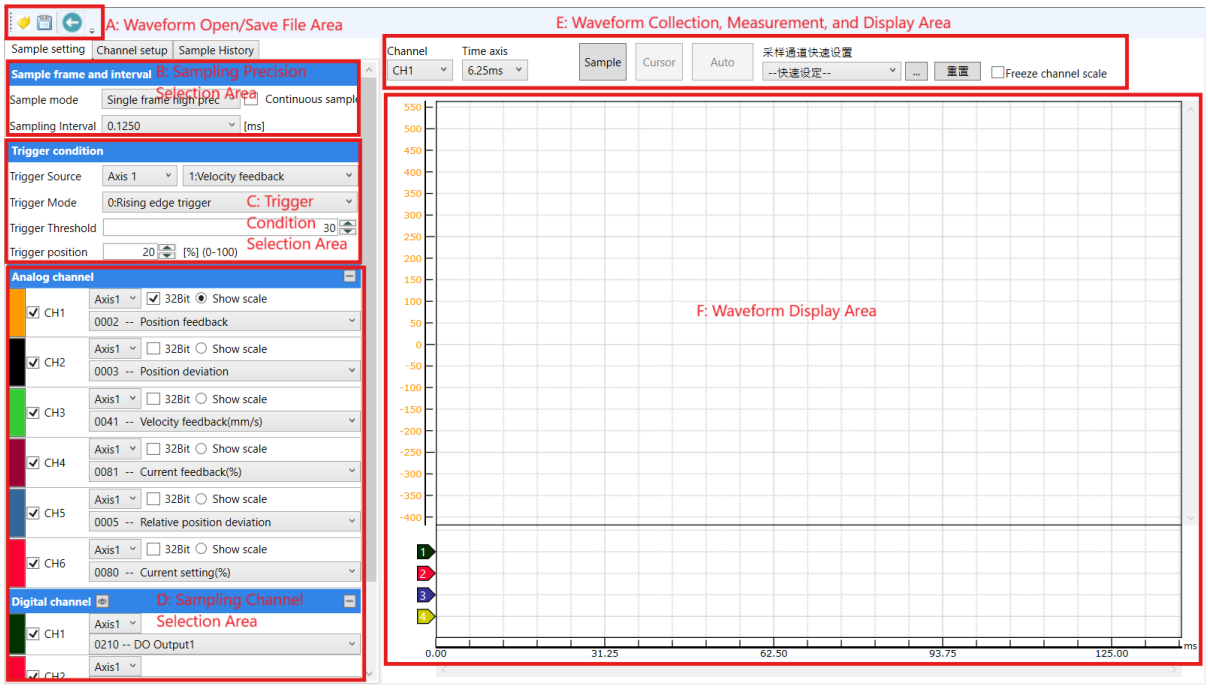
After opening the offline parameter file, you can modify the parameter settings. After modification, click "Recipe Save As" to save the modified parameters.



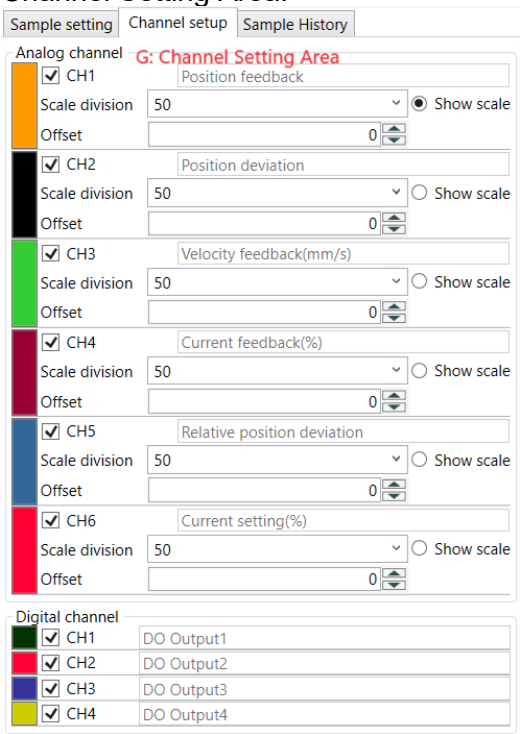

## 6.6 Scope Measurement

Display the operating status as waveform images on the scope to monitor the action status during servo adjustment.
Double click “Scop’ under Navigation Bar to open it. The scope's functional areas are as follows:

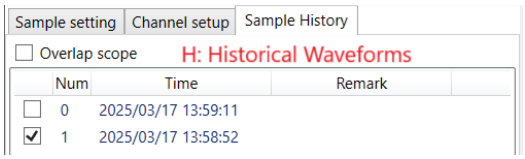
| **Area** | **Function description** |
|---|---|
| A: Waveform Open/Save File Area | Supports opening waveform files and saving waveforms as files. |
| B: Sampling Precision Selection Area | Mode: Options include single-frame high precision and multi-frame high/low precision.<br>Sampling Interval: With 1024 sampling points, the larger the sampling interval, the longer the total sampling time.<br>Continuous Sampling: When continuous sampling is selected, waveform sampling will occur as long as the trigger conditions are met after clicking Collect. |
| C: Trigger Condition Selection Area | Allows setting trigger conditions, with options for axis signals and channel signals. |
| D: Sampling Channel Selection Area | Can set six groups of analog channels and four groups of digital signal channels. |
| E: Waveform Collection, Measurement, and Display Area | Includes scale display, time axis, collect button, cursor function, and adaptive features. |
| F: Waveform Display Area | Displays the collected waveforms. |
| G: Channel Setting Area | Allows changing the scale value and offset of each channel waveform. |
| H: Historical Waveforms | View the waveforms from the last 16 collections, and perform waveform overlay and comparison of multiple waveforms. |




Channel Setting Area:



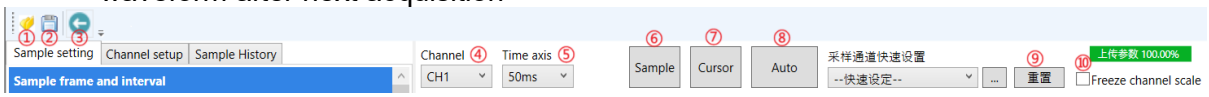

H: Historical Waveforms




Buttons Introduction:

① Open offline files
② Save graph data
③ Hide configuration bar
④ Select simulation channel Y-axis
⑤ Set X-axis interval

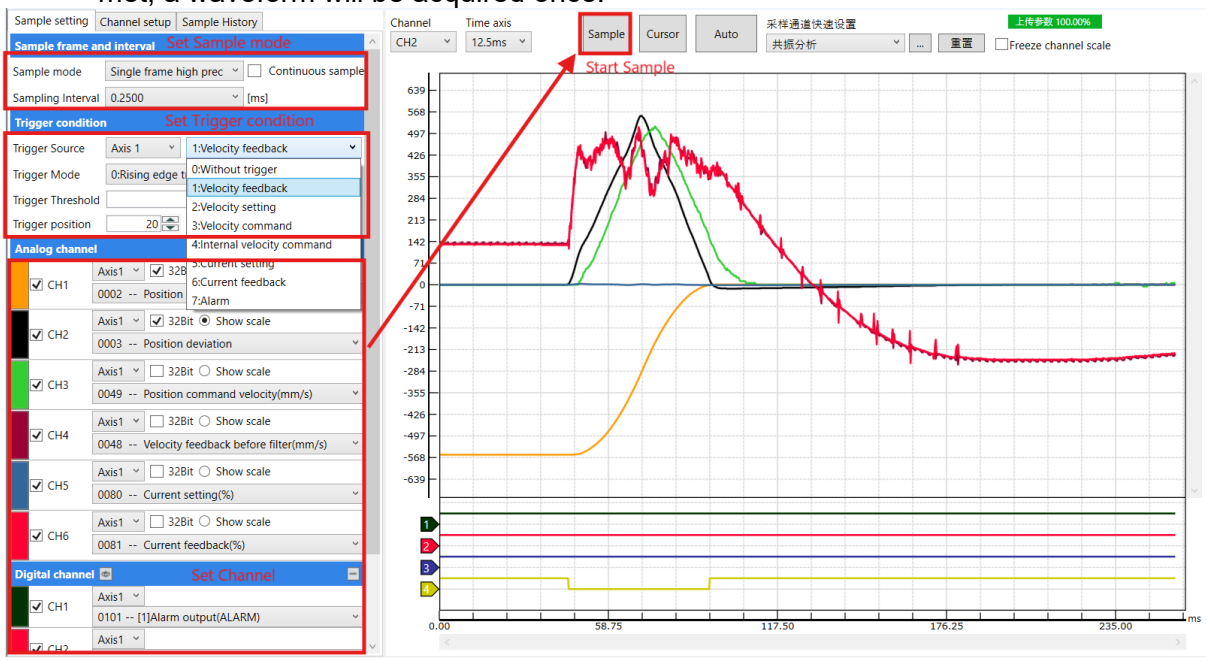
⑥ Start acquisition
⑦ Open cursor
⑧ Automatically calculate suitable simulation channel scale value and offset to fit waveform to screen size
⑨ Reset sampling settings
⑩ Maintain channel display ratio. Do not perform auto-adaptation when drawing waveform after next acquisition




## 6.6.1 Single Capture

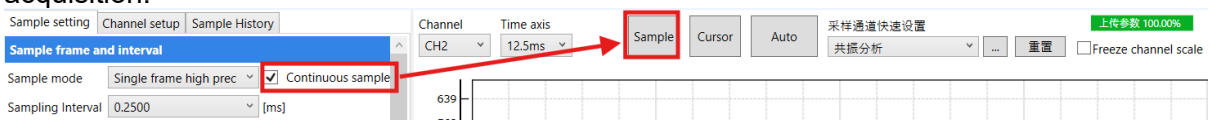
Single frame high precision:

(1) Set the sampling mode to Single frame high precision and adjust the sampling interval according to actual needs. The larger the sampling interval, the longer the total sampling time, and the worse the precision.
(2) Set the trigger conditions. The trigger source can be selected as either an axis or a channel. The trigger mode can be set to rising edge or falling edge. Position setting: For example, when the position is set to 50%, the trigger point is at 50% of the entire waveform.
(3) Channel settings: Set the desired sampling channels according to your needs.
(4) After completing the settings, click "Acquire." As long as the trigger conditions are met, a waveform will be acquired once.




## 6.6.2 Continuous Capture

After selecting ‘Continuous sampling’, click ‘Sample’. As long as the trigger conditions are met, waveforms can be acquired without needing to click ‘Sample’ before each waveform acquisition.



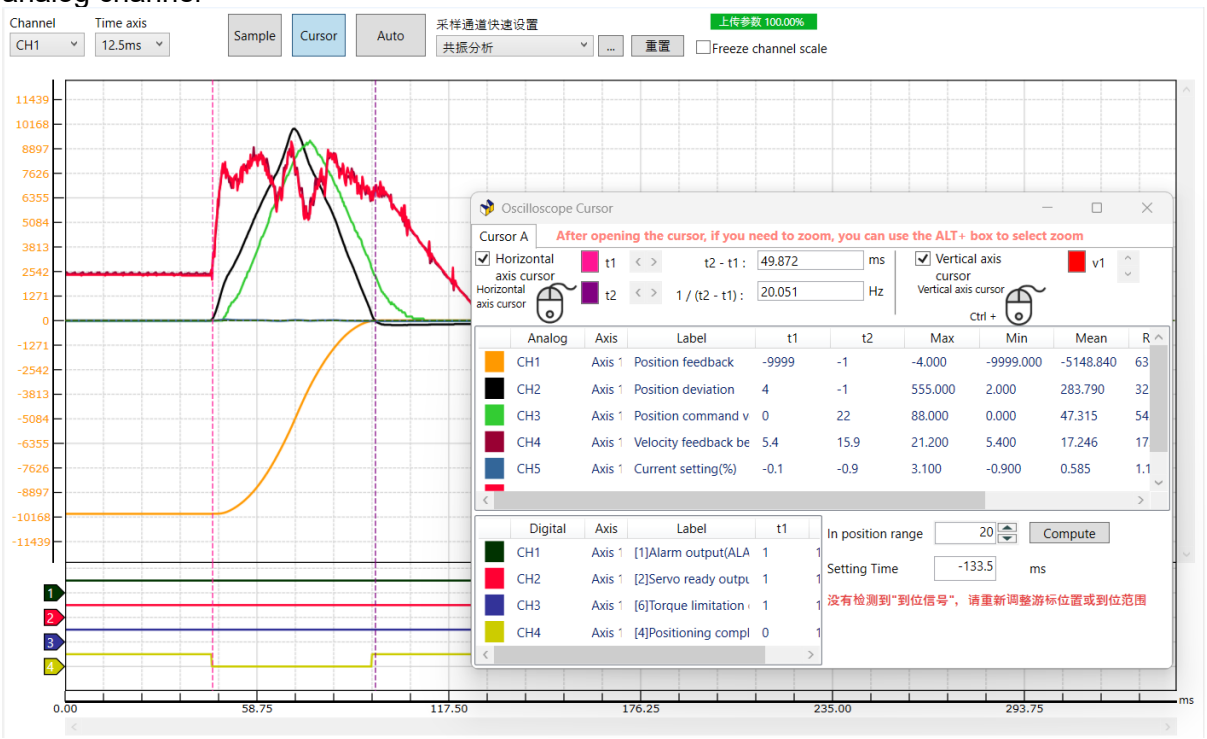

## 6.6.3 Zoom In/Out

This supports quick zooming of Scope waveforms.

Simply select the waveform area to be enlarged, and it will be magnified to fit the entire waveform interface.
Forward selection enlarges the waveform, reverse selection reduces it, and double-clicking the waveform returns it to the initial state.

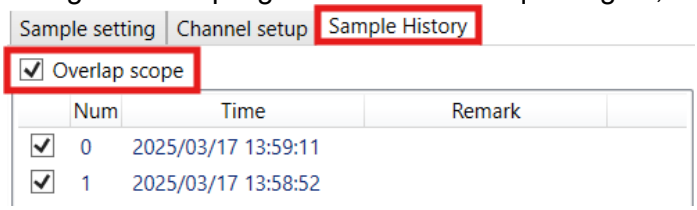
### 6.6.4 Cursor Function

After data acquisition is complete, click the cursor button to open the cursor window. The cursor includes the following functions:
Supports two X-axis cursors: t1, t2, placed using the left and right keys
Supports two Y-axis cursors: v1, v2, placed using Ctrl + left and right keys
Displays the amplitude corresponding to t1, t2, v1, v2 for each channel
Calculates the maximum, minimum, average, and effective values between t1 and t2 for the analog channel




### 6.6.5 Overlap Scop

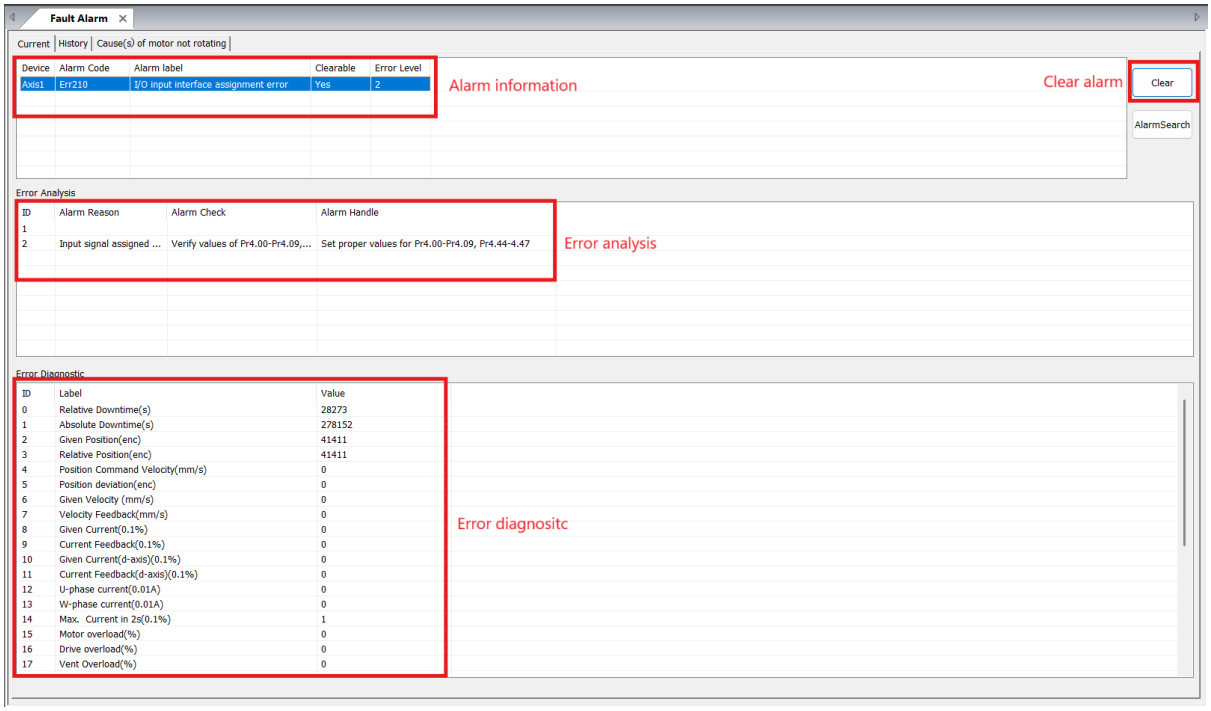
Switch to the ‘Sample History’, which records the last 16 waveforms acquired. At this point, you can select ‘Overlap scop’ to compare multiple sets of waveforms.
**Note**: ‘Sample History’ only saves waveforms with the same sampling conditions. If you change the sampling conditions and acquire again, the historical waveforms will be cleared!



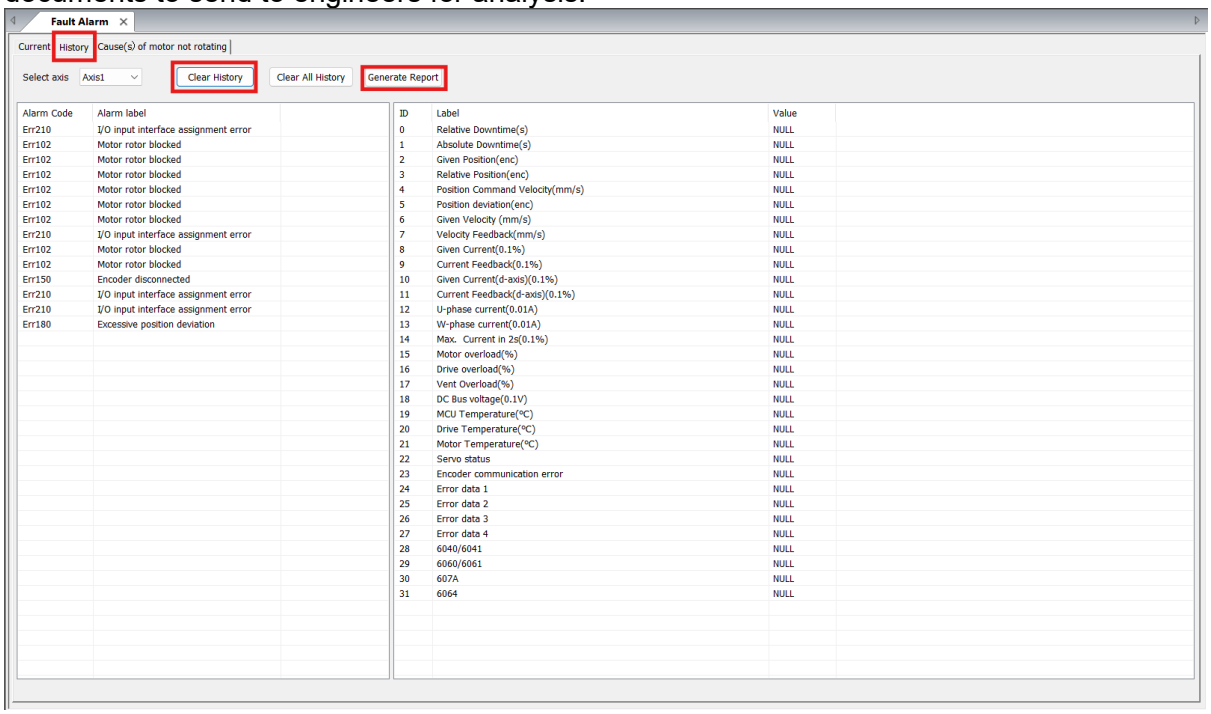

## 6.7 Fault Diagnosis

Fault analysis currently includes two methods: Error Alarms and Black Box.

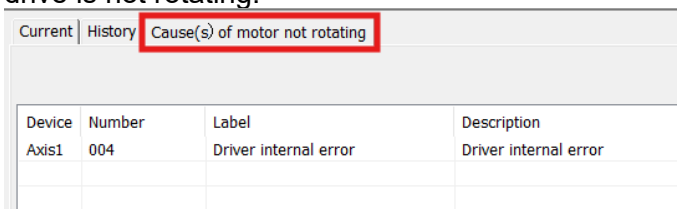
When a fault alarm occurs, an alarm message will appear in the status bar below. You can double-click the alarm message in the Status bar to enter the fault alarm function or click the ‘Error Alarm’ button in the Tool Bar to enter.
Clicking on the current alarm allows you to view the current alarm information, fault type, fault analysis, and some information at the time of the fault, making it convenient for diagnosing and analysing the alarm.
If the current fault is clearable, after eliminating the cause of the fault, click "Clear" to remove the alarm status.



Clicking "History" allows you to view previous alarm information, saving up to the last 14 alarm messages. If there are more than 14 alarms, the alarm information will be overwritten in order of occurrence.
Clear Historical Alarms: You can clear the alarm history of the drive. Generate Report: You can generate a file of historical alarms, making it convenient for customers to create fault documents to send to engineers for analysis.




Clicking "Cause(s) of motor not rotating" allows you to view the current reasons why the drive is not rotating.



# Chapter 7 Control Mode

Control modes for E-DHAS□□PF series AC servo drivers can be divided into 3 categories: Position control mode, Velocity control mode and Torque control mode. RS models also come with a hybrid control mode which is a combination of any 2 modes which are above.

3. Position control mode determines position through pulse count. External input pulse frequency determines rotational speed, mainly through motion controller, control card (5V pulse), PLC (24V pulse). Due to the ability of position control mode to control velocity and position tightly, it is usually used in positioning devices. It is the most widely used control mode for servo drivers.
4. Velocity control mode controls rotational speed through digital I/O or communication command settings. Mainly use in application where speed stability is required.
5. Torque control mode is used in applications where forced applied on production material is restricted, mainly winding or scrolling devices. For example, coil winding machines or optical fiber cable production. Torque settings change according to the coil winding diameter as to maintain stable force output throughout the process.

To set control mode

| P00.01 | Label | Control Mode Settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0003 | | |
| | Valid | After restart | | | | | | |

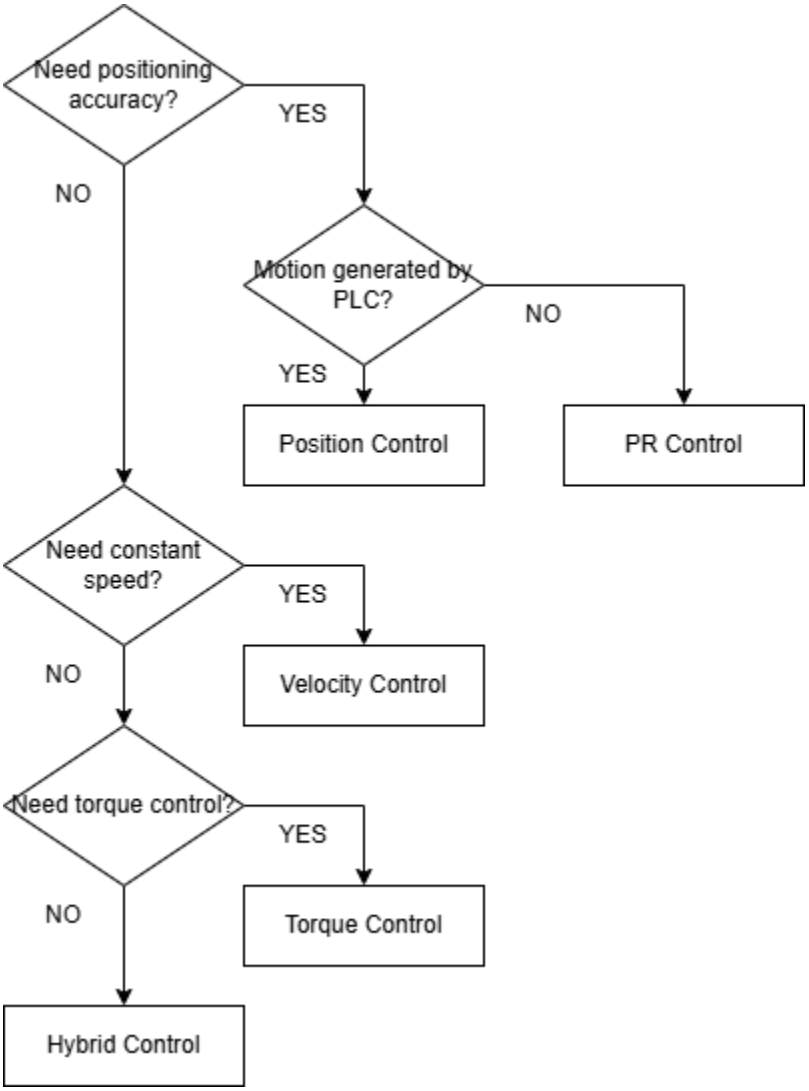
| Value | Description | |
|---|---|---|
| | 1st mode | 2nd mode |
| 【0】 | Position | — |
| 1 | Velocity | — |
| 2 | Torque | — |
| 3 | Position | Velocity |
| 4 | Position | Torque |
| 5 | Velocity | Torque |
| 6 | PR internal command control | Position P00.22=1 |
| | | Velocity P00.22=1 |
| | | Torque P00.22=2 |
| 7~10 | Reserved | |

◆When 3, 4, 5, 6 combination hybrid mode, 1st and 2nd mode can be chosen accordingly with control mode switching input (C-MODE).
C-MODE: Invalid, select 1st mode.
C-MODE: Valid, select 2nd mode.
Please allow some time in between mode switching commands.

◆Please set P00.01 = 6 to switch to other modes from PR mod, then set 2nd mode using P00.22.

*C-MODE is defaulted to Normally Open*

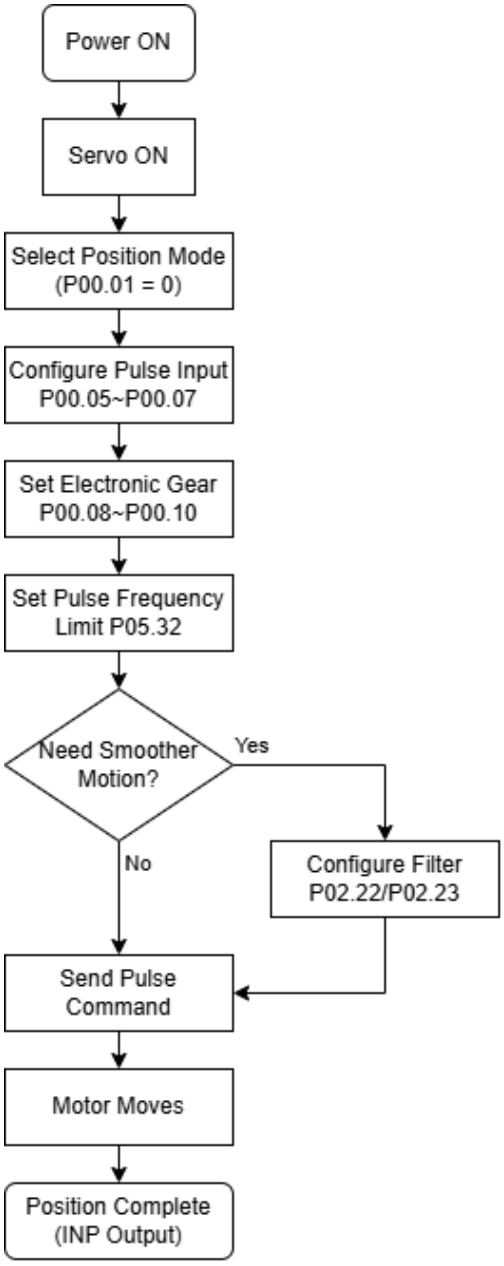
How to Select the Correct Control Mode



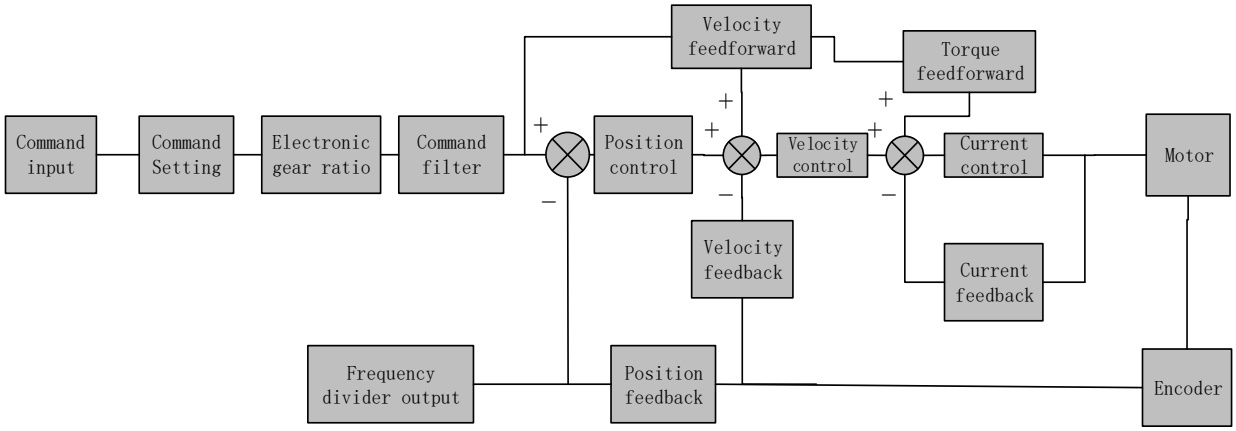
## 7.1 Position Control

Position control determines rotational speed by frequency of external input pulse and angle of rotation through pulse count using 5V pulse from motion controller, control card or 24V pulse for PLC. Applies where precise positioning is required.

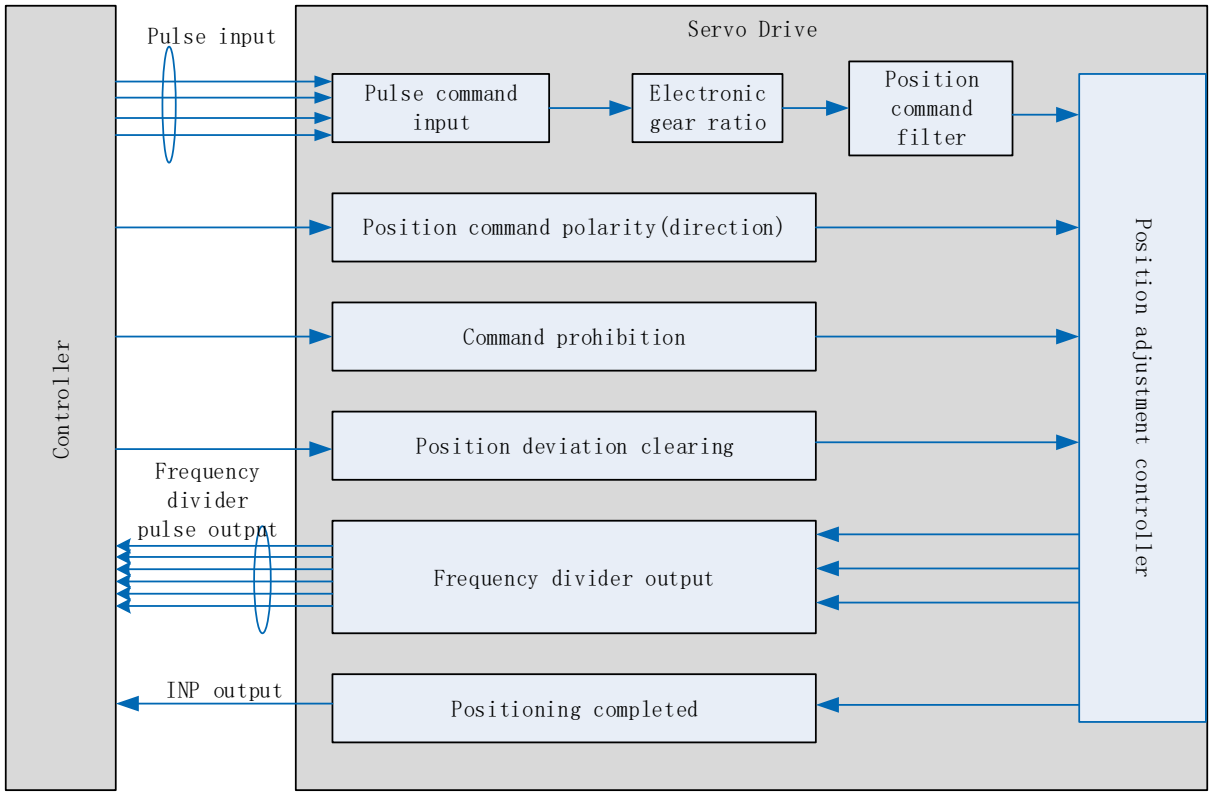
The basic position control flow chart shows as below:



Set P00.01 = 0 to activate position control mode.




Please set related servo parameters according to the following diagram.



### 7.1.1 Pulse Input and Direction Settings

Position command (pulse) input method:

1. A and B phase pulse
2. Positive/Negative direction pulse (CW / CCW)
3. Pulse and direction

Set pulse mode, rotational direction and max. pulse input frequency according to actual need

| CN1 PIN | Label | Definition | Description |
|---|---|---|---|
| 1 | PUL+24 | Pulse command input | Low speed pulse direction command input：<br>PUL+ / PUL-： 5V differential input（500KHz）<br>DIR+ / DIR-： 5V differential input（500KHz）<br>PUL+24 / PUL-： 24V single ended input (200KHz)<br>DIR+24 / DIR-： 24Vsingle ended input (200KHz) |
| 3 | PUL+ | | |
| 4 | PUL- | | |
| 2 | DIR+24 | Direction command input | |
| 5 | DIR+ | | |
| 6 | DIR- | | |
| 44 | PULSH+ | High speed pulse command input | 4MHz high-speed pulse command input: 5V differential input |
| 45 | PULSH- | | |
| 46 | SIGNH+ | High speed direction command input | 4MHz high-speed direction command input: 5V differential input |
| 47 | SIGNH- | | |

| P00.05 | Label | Command pulse input selection | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x000B | | |
| | Valid | After restart | | | | | | |

| Value | Description |
|---|---|
| 【0】 | Pulse input low speed channel (200/500kHz pulse input) |
| 1 | Pulse input high speed channel (4MHz pulse input) |

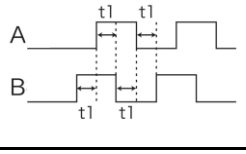
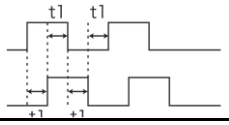
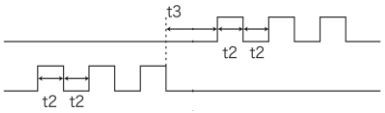
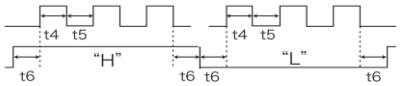
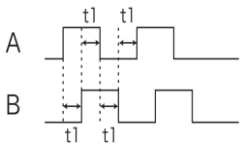
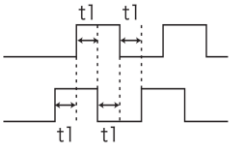
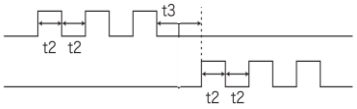
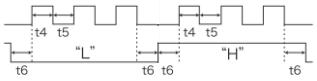
*Both channels cannot be used at the same time*.

| P00.06 | Label | Command pulse polarity inversion | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x000D | | |
| | Valid | After restart | | | | | | |

P00.06 and P00.07 set command pulse input inversion and mode correspondingly.

| P00.07 | Label | Command pulse input mode | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | — | Default | 3 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x000F | | |
| | Valid | After restart | | | | | | |

**Command pulse input**

| Command Polarity inversion (P00.06) | Command pulse input mode settings (P00.07) | Command Pulse Mode | Positive signal | Negative signal |
|---|---|---|---|---|
| 【0】 | 0 *or* 2 | 90°phase difference 2 phase pulse （Phase A+ Phase B） |  |  |
| | 1 | CW pulse sequence ＋ CCW pulse sequence |  | |
| | 【3】 | Pulse sequence ＋ Directional symbol |  | |
| 1 | 0 *or* 2 | 90°phase difference 2 phase pulse （Phase A＋Phase B） |  |  |
| | 1 | CW pulse sequence ＋ CCW pulse sequence |  | |
| | 3 | Pulse sequence ＋ Directional symbol |  | |

**Command pulse input signal max. frequency and min. duration needed**

| Command pulse input interface | | Max. Frequency | Min. duration needed（μs） | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | t1 | t2 | t3 | t4 | t5 | t6 |
| Pulse sequence interface | Differential drive | 500 kHz | 2 | 1 | 1 | 1 | 1 | 1 |
| | Open collector | 200 kHz | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| | High speed differential drive | 4Mhz | 0.25 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 |

Please set >0.1μs for the duration between rising and falling edge of command pulse input signal.
1 revolution with 2500 pulses 2-phase pulse input when P00.07=0 or 2, P00.08 = 10000;
1 revolution with 10000 pulses 1-phase pulse input when P00.07=1 or 3, P00.08 = 10000

| P05.32 | Label | Max. command pulse input frequency | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~8000 | Unit | kHz | Default | 4100 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0541 | | |
| | Valid | Immediate | | | | | | |
| | Please set the max. frequency required for command pulse input. Er1B0 will occur, if command pulse input frequency exceeds P05.32. | | | | | | | |

### 7.1.2 Electronic Gear Ratio

To realize correspondent motor rotational angle to arbitrarily set input command input by multiplying pulse command input from controller and coefficient of frequency divider/multiplier. Motor might not reach target velocity due to insufficient pulse output from controller. This function can be used to solve this issue by increasing pulse command frequency.

1. When P00.08 = 0, P00.09 and P00.10 will be valid. Other than that, P00.08 set value will be valid.
2. E-DHAS□□PF series supports 2 independent sets of electronic gear ratio. The 2 sets can be switched by delivering a command frequency divider/multiplier input DIV1. Both sets of electronic gear ratio is set up using P00.08, P00.09 and P00.10; P05.00, P05.01 and P05.02.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P00.08** | **Label** | 1st command pulse count per revolution | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0-67100864 | **Unit** | PULSE | **Default** | 10000 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0010<br>L: 0x0011 | | |
| | **Valid** | After restart | | | | | | |
| | Control will affect if value set is too low. Err1b1 might occur if value < 500.<br>(1) P00.08 valid when ≠ 0: Motor revolution = input pulse count / [P00.08 value]<br>(2) P00.08 invalid when = 0: P00.09 and P00.10 valid. | | | | | | | |
| **P00.09** | **Label** | 1st command frequency divider/multiplier numerator | | | **Valid mode(s)** | **P** | | |
| | **Range** | 1~2147483647 | **Unit** | — | **Default** | 1 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0012<br>L: 0x0013 | | |
| | **Valid** | After restart | | | | | | |
| | Valid when P00.08 = 0, please refer to description in P00.10. | | | | | | | |
| **P00.10** | **Label** | 1st command frequency divider/multiplier denominator | | | **Valid mode(s)** | **P** | | |
| | **Range** | 1~2147483647 | **Unit** | — | **Default** | 1 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0014<br>L: 0x0015 | | |
| | **Valid** | After restart | | | | | | |
| | 1. Settings：<br>(1) Driver command pulse input count: X<br>(2) Encoder pulse count after frequency divider/multiplier: Y<br>(3) Encoder pulse count per revolution: Z<br>(4) Motor revolution: W<br>2. Calculation：<br>（1）X, Y<br>Y = X * P00.09 / P00.10<br>Please keep the value of P00.09 and P00.10 to be smaller than $2^{24}$ (16777216).<br>（2）Z<br>Motor with 23-bit motor： Z= $2^{23}$ = 8388608<br>（3）Y, Z, W<br>W = Y / Z<br>*Performance cannot be guaranteed if frequency divider/multiplier ratio is set to extreme values. Err1b1 might occur if W < 500.* | | | | | | | |

### 7.1.3 Position Command Filter

Position command filter is to filter position command after electronic gear ratio frequency dividing/multiplying. Including position command smoothing filter and position command FIR filter.

Position command filter should be added for the following cases:

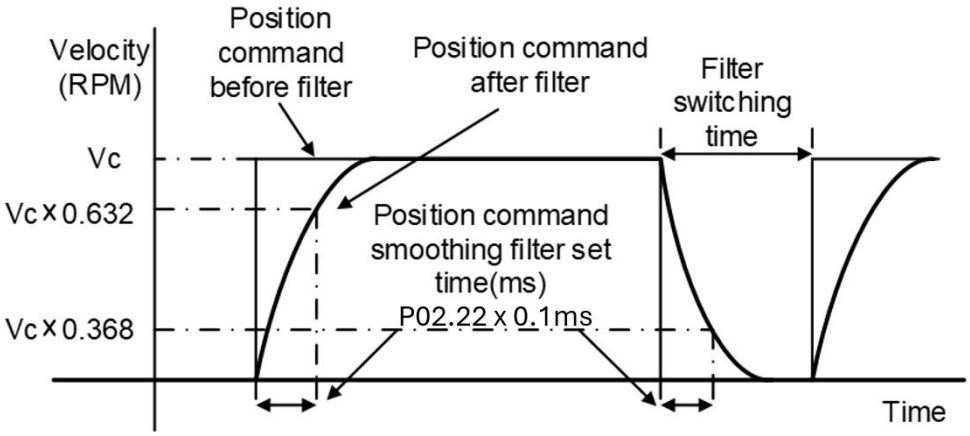
1. Position command pulse from controller has not yet to undergo acceleration/deceleration (with steep acceleration/deceleration).
2. Low command pulse frequency
3. Electronic gear ratio = 10 times or above

Position command filter can smoothen position command and motor rotation will be more stable

| P02.22 | Label | Position command smoothing filter | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | 0.1ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x022D | | |
| | Valid | At stop | | | | | | |

To set time constant of 1 time delay filter of position command.

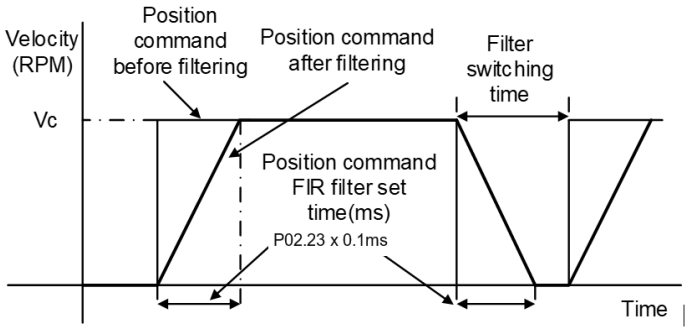
To set time constant of 1 time delay filter, according to target velocity Vc square wave command as show below.



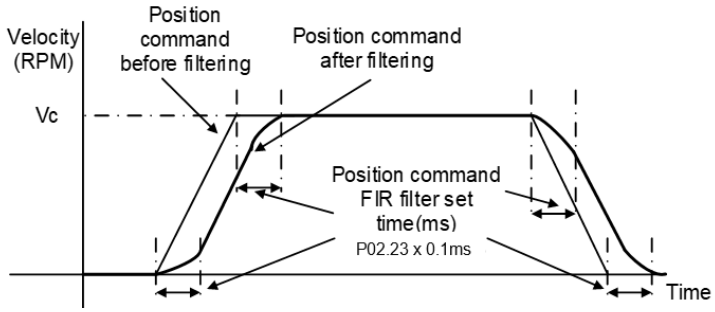

Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If P02.22 is set too high, overall time will be lengthened.

| P02.23 | Label | Position command FIR filter | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2500 | Unit | 0.1ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x022F | | |
| | Valid | At stop | | | | | | |

As shown below, when target velocity Vc square wave command reaches Vc, it becomes trapezoidal wave after filtering.




As shown below, when target velocity Vc trapezoidal command reaches Vc, it becomes S wave after filtering.




Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If P02.23 is set too high, overall time will be lengthened.

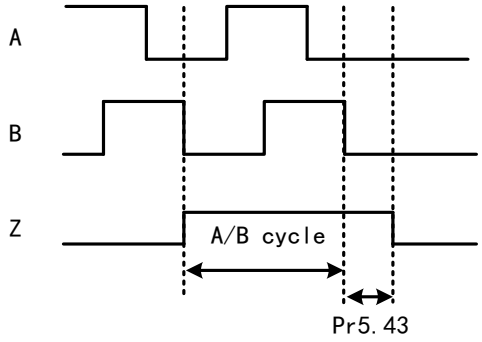
*Note: Please wait for command to stop and after filter idle time to modify P02.23.*
*Filter switching time = (P02.23 set value x 0.1ms + 0.25ms)*

## 7.1.4 Frequency Divider Output

Frequency divider output indicates position command pulse or encoder feedback position pulse which is A and B phase pulse output.
Frequency divider output delivers motor encoder or external encoder position feedback to controller using ABZ phase pulses

***Encoder Z-signal width ≥ 62.5ms, or equivalent to an A/B signal cycle. If frequency divider output Z-signal width has to be widened, set through P05.43.*
**When P05.43 = 0, frequency divider Z-signal width is similar to width of single A/B cycle. If P05.43 = 1~500, set delay based on A/B cycle width.*

| Value | Description |
|---|---|
| 【0】 | Z bandwidth equivalent to 1 cycle of A/B |
| 1~500 | Delay setting on top of A/B cycle width |

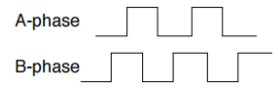
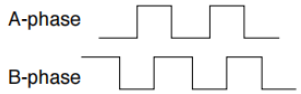
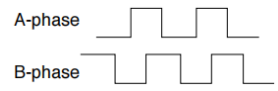
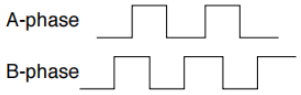



**Related parameters**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P00.11** | **Label** | Encoder output pulse count per revolution | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 1~32767 | **Unit** | P/r | **Default** | 2500 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0017 | | |
| | **Valid** | After restart | | | | | | |
| | If P00.11 = 1000, encoder differential output signal per revolution = 4000 pulses | | | | | | | |
| **P00.12** | **Label** | Pulse output logic inversion | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~1 | **Unit** | — | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0019 | | |
| | **Valid** | After restart | | | | | | |

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

**Pulse output logic inversion**

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

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P05.42** | **Label** | Frequency divider output – Z-signal polarity | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~7 | **Unit** | — | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0555 | | |
| | **Valid** | Disabled | | | | | | |

| Bit | Polarity | Description |
|---|---|---|
| Bit0 | 0 = Positive<br>1 = Negative | Z polarity setting of frequency divider output and position comparison |
| Bit1 | 0 = Positive<br>1 = Negative | Only valid in position comparison.<br>Polarity setting when phase A frequency divider as position comparison output |
| Bit2 | 0 = Positive | Only valid in position comparison.<br>Polarity setting when phase B frequency divider as position comparison output |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P05.44** | **Label** | Frequency divider output source | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~4 | **Unit** | — | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0559 | | |
| | **Valid** | After restart | | | | | | |

| Value | Description |
|---|---|
| 【0】 | Position feedback of encoder #1(motor encoder) |
| 1 | Position feedback of encoder #2(external encoder) |
| 2 | Reserved |
| 3 | Pulse input command position synchronous output; position comparison not available in this mode |
| 4 | Frequency divider output prohibited |

### 7.1.5 Positioning Completed INP Signal Output

INP signal output will be valid when position deviation is within the range when positioning is completed. Set unit in P05.20.

| P04.31 | | | | | | |
|---|---|---|---|---|---|---|
| **Label** | Positioning complete range | | | **Valid mode(s)** | **P** | |
| **Range** | 0～10000 | **Unit** | P05.21 set unit | **Default** | 20 | |
| **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x043F | |
| **Valid** | Immediate | | | | | |

To set position deviation range of INP1 positioning completed output signal. INP1 output signal will be valid once position is complete within the range of deviation set.
*Default unit: 0.00001rev. Can be set on P05.21 as command unit (pulse) or encoder unit (pulse)*

| P04.32 | | | | | | |
|---|---|---|---|---|---|---|
| **Label** | Positioning complete output setting | | | **Valid mode(s)** | **P** | |
| **Range** | 0~4 | **Unit** | — | **Default** | 1 | |
| **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0441 | |
| **Valid** | Immediate | | | | | |

To set conditions for INP1 output signal to be valid

| Value | Positioning completed signal |
|---|---|
| 0 | Signal valid when the position deviation is smaller than P04.31 |
| 1 | Signal valid when there is no position command and position deviation is smaller than P04.31 |
| 2 | Signal valid when there is no position command, zero-speed clamp detection (ZSP) signal is ON, and the positional deviation is smaller than P04.31 |
| 3 | Signal valid when there is no position command and position deviation is smaller than P04.31. Signal ON when within the time set in P04.33 otherwise OFF. |
| 4 | When there is no command, position detection starts after the delay time set in P04.33.<br>Signal valid when there is no position command and positional deviation is smaller than P04.31. |

| P04.33 | | | | | | |
|---|---|---|---|---|---|---|
| **Label** | INP positioning delay time | | | **Valid mode(s)** | **P** | |
| **Range** | 0~15000 | **Unit** | 1ms | **Default** | 0 | |
| **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0443 | |
| **Valid** | Immediate | | | | | |

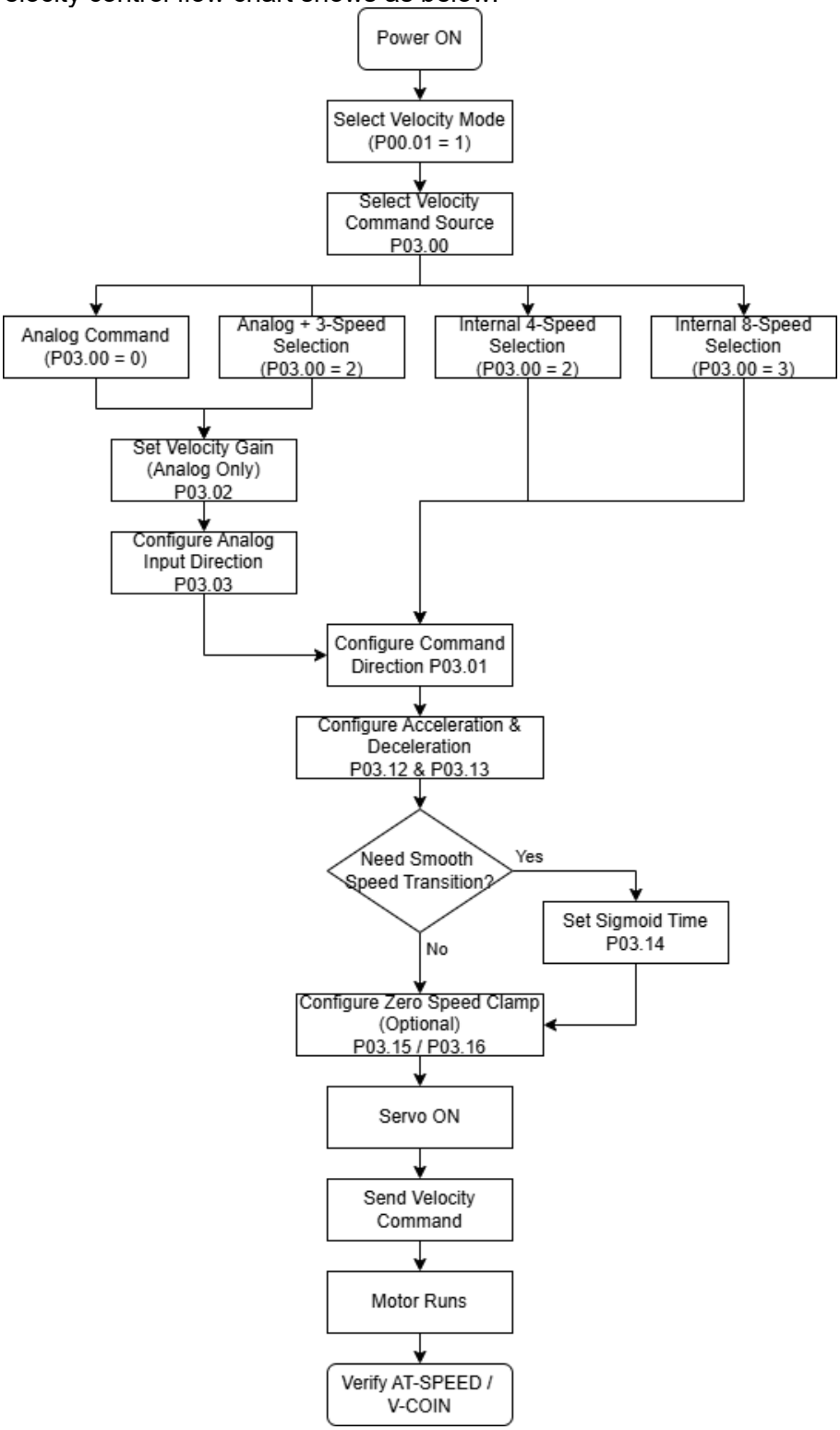
Valid when P04.32 = 3.

| Set value | Positioning completed signal |
|---|---|
| 0 | Indefinite delay time, signal ON until next position command |
| 1-15000 | OFF within the time set; ON after time set. Switch OFF after receiving next position command. |

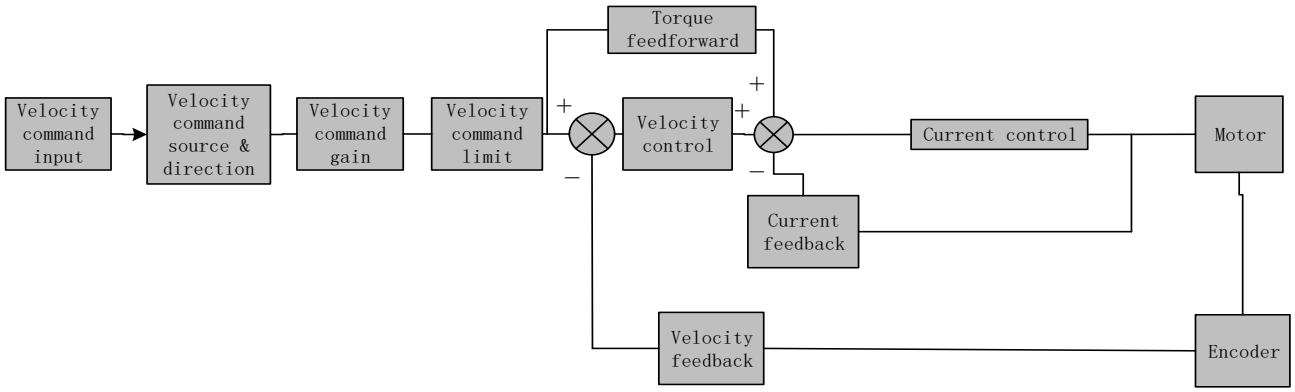
## 7.2 Velocity Control Mode

Velocity mode precisely controls motor rotational speed/direction using analog velocity command or internal related parameters. There are 4 types of velocity control modes for E-DHAS□□PF series AC Servo drivers: Analog control, internal velocity 4 speeds, internal velocity 8 speeds and analog + internal velocity control.

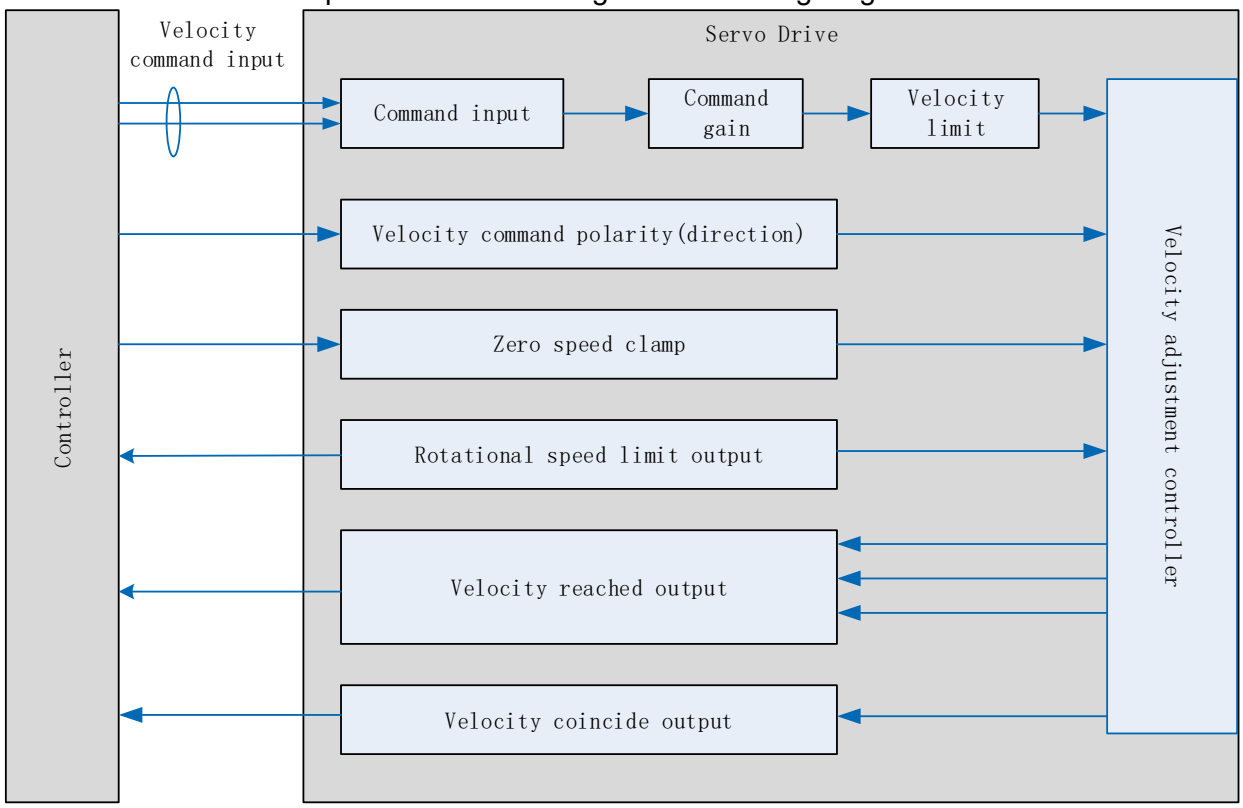
The basic velocity control flow chart shows as below:



Set P00.01 = 1 to activate velocity control mode.

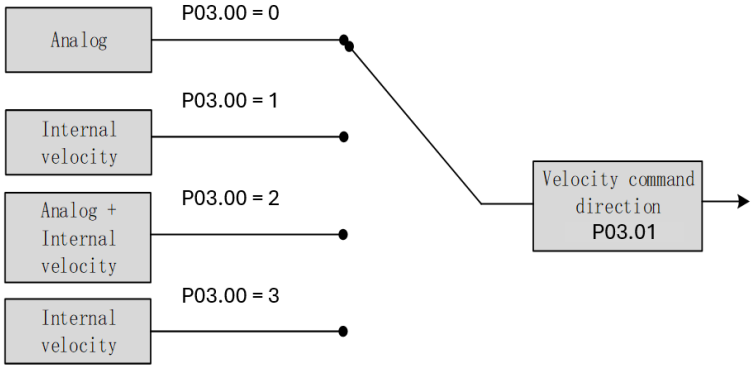



Please set related servo parameters according to the following diagram.



## 7.2.1 Velocity Command Input Control

Set velocity control mode in P03.00

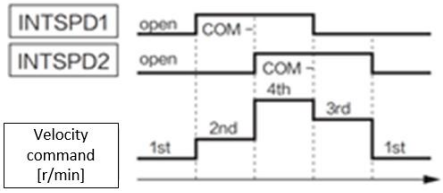
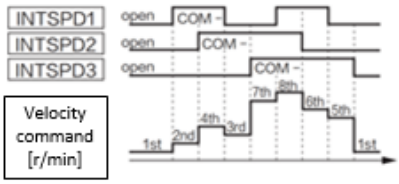



| P03.00 | Label | Velocity internal/external switching | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | — | Default | 1 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0301 |
| | Valid | Immediate | | | | |

Connect to the right DI to control internal command velocity settings.

| Value | Velocity settings |
|---|---|
| 0 | Analog - Velocity command（SPR） |
| 【1】 | Internal velocity settings 1st – 4th speed（P03.04～P03.07） |
| 2 | Internal velocity settings 1st – 3rd speed（P03.04～P3.06）、Analog velocity command（SPR） |
| 3 | Internal velocity settings 1st – 8th speed（P03.00～P03.11） |

| Value | Internal command velocity 1（INTSPD1） | Internal command velocity 2（INTSPD2） | Internal command velocity 3（INTSPD3） | Velocity command |
|---|---|---|---|---|
| 1 | OFF | OFF | No effect | 1st speed |
| | ON | OFF | | 2nd speed |
| | OFF | ON | | 3rd speed |
| | ON | ON | | 4th speed |
| 2 | OFF | OFF | No effect | 1st speed |
| | ON | OFF | | 2nd speed |
| | OFF | ON | | 3rd speed |
| | ON | ON | | Simulated speed |
| 3 | Similar to P03.00=1 | | OFF | 1st – 4th speed |
| | OFF | OFF | ON | 5th speed |
| | ON | OFF | ON | 6th speed |
| | OFF | ON | ON | 7th speed |
| | ON | ON | ON | 8th speed |

| | |
|---|---|
| | *Please change internal command velocity as per diagram below as unexpected axis movement might occur if 2 command velocities are changed at the same time.*<br><br><br>P03.00=1 / 2<br><br><br>P03.00=3 |

## Velocity command direction settings

Switch velocity command direction using I/O. Assign VC-SIGN to correspond DI terminal, velocity command direction will be in accordance with DI signal.

| P03.01 | Label | Velocity command rotational direction selection | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0303 |
| | Valid | Immediate | | | | |

To set positive/negative direction of velocity command

| Value | Velocity settings（Analog or internal velocity） | Velocity command sign selection (VC-SIGN) | Velocity command direction |
|---|---|---|---|
| 【0】 | ＋ | No effect | Positive |
| | — | No effect | Negative |
| 1 | No effect | OFF | Positive |
| | No effect | ON | Negative |

## Velocity command input inversion

Set Analog-Velocity command (SPR) voltage polarity

| P03.03 | Label | Velocity command input inversion | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0307 |
| | Valid | Immediate | | | | |

To set voltage polarity of analog velocity command.
Only valid when P03.01 = 0. When P03.01 = 1, rotational direction is only related to VC-SIGN.

| Value | Motor rotational direction | |
|---|---|---|
| 【0】 | Not inversed | 「Positive voltage」→「Positive direction」<br>「Negative voltage」→「Negative direction」 |
| 1 | Inversed | 「Positive voltage」→「Positive direction」<br>「Negative voltage」→「Negative direction」 |

If there is an external position sensor with different polarity from P03.03, motor might undergo abnormal motion.

## Velocity command input gain

Set Analog-Velocity command (SPR) voltage to motor velocity command switching gain

| P03.02 | Label | Velocity command input gain | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | (r/min)/V | Default | 500 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0305 |
| | Valid | Immediate | | | | |

To set gain changes from voltage added onto analog velocity command (SPR) to motor command velocity

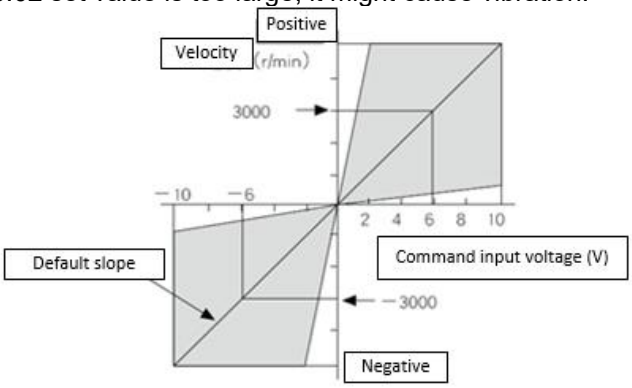
P03.02 sets command input voltage and rotational speed slope.

Factory default:

P03.02=500(r/min)/V.

Hence 6V input: 3000 r/min

1. Do not supply more than ±10V power for analog velocity command (SPR).
2. If P03.02 set value is too large, it might cause vibration.




### 7.2.2 Velocity Command Acceleration/Deceleration

Acceleration/Deceleration is added onto velocity command input to control velocity. This function is valid when entering step-like velocity command or internal velocity settings is used to realize motor soft start. Use Sigmoid acceleration/deceleration to reduce vibration and impact due to changes in velocity.

| P03.12 | Label | Acceleration time settings | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | ms/ (1000rpm) | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0319 |
| | Valid | Immediate | | | | |
| P03.13 | Label | Deceleration time settings | | | Valid mode(s) | S |
| | Range | 0~10000 | Unit | ms/ (1000rpm) | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x031B |
| | Valid | Immediate | | | | |

Set max acceleration/deceleration for velocity command.

If target velocity = *x* [rpm], max acceleration = *a* [unit: rpm/ms], acceleration time = *t* [ms]

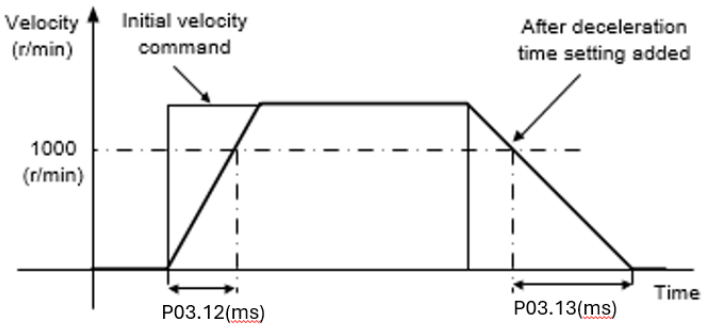
P03.12 = *1000/a (ms)*

P03.13 = *1000/a (ms)*

$a = x/t$

For example: If motor is to achieve 1500rpm in 30s, *a=1500/30=50rpm/ms*

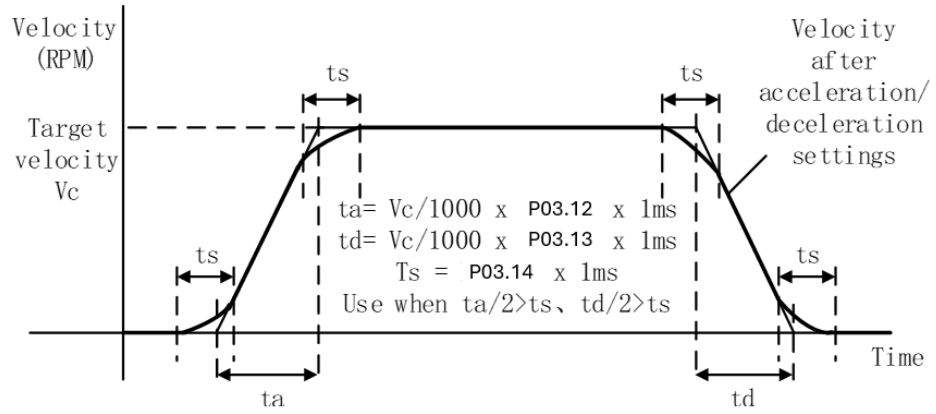
P03.12 = 1000/*a*= *20.* Hence when P03.12 = 20, motor can achieve 1500rpm in 30s.




Usually used when there is rapid acceleration or trapezoidal wave velocity command due to many different internal speed segments under velocity control mode which causes instability while motor in motion.
*Under velocity control mode, 6083 and 6084 is limited by P03.12 and P03.13 correspondingly.*

| P03.14 | Label | Sigmoid acceleration/deceleration settings | | | Valid mode(s) | | S |
|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | ms | Default | 0 | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x031D | |
| | Valid | After restart | | | | | |

To set sigmoid acceleration and deceleration turning point in accordance with P03.12 and P03.13.

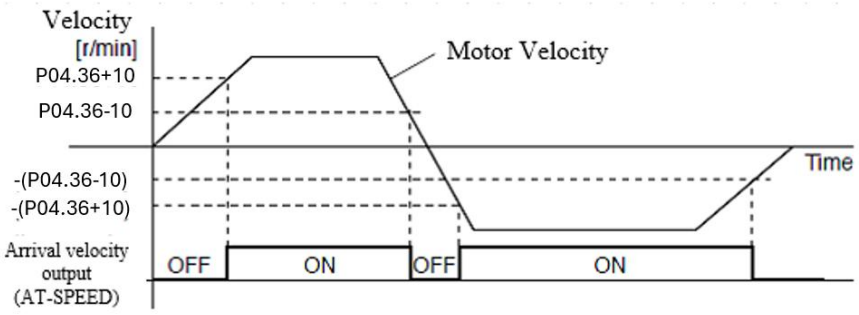


## 7.2.3 Velocity Reached Signal AT-SPEED Output

Velocity reached signal AT-SPEED output will be valid when motor velocity reached set speed in P04.36.
This output function can be assigned through I/O configurations, please refer to P04.10. When velocity matches set conditions, assigned I/O terminal will be ON, signal will be valid.

| P04.36 | Label | Arrival velocity | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 1000 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0449 |
| | Valid | Immediate | | | | |

When motor velocity > P04.36, AT-speed output signal is valid.
Detection using 10RPM hysteresis.




## 7.2.4 Velocity Coincidence V-COIN Signal Output

V-COIN signal output will be valid when velocity command (before acceleration/deceleration) coincides with motor velocity. Velocity is considered to be coincided if the difference between velocity command before acceleration/deceleration from servo driver and motor velocity is within the value set in P04.35.
This output function can be assigned through I/O configurations, please refer to P04.10. When velocity matches set conditions, assigned I/O terminal will be ON, signal will be valid.
In Position signal in PV mode is in synchronization with V-COIN signal.

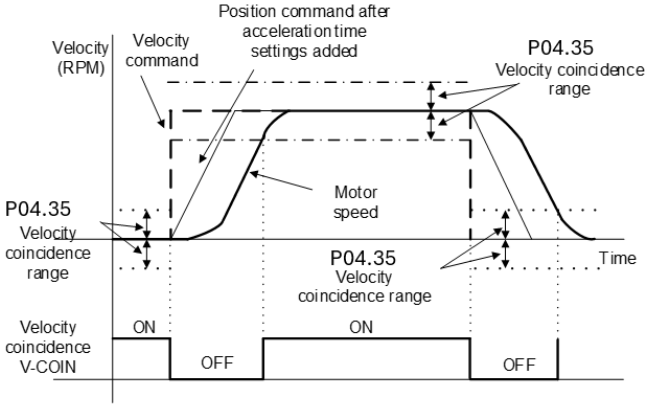
| P04.35 | Label | Velocity coincidence range | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 50 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0447 |
| | Valid | Immediate | | | | |

If the difference between velocity command and motor actual speed is below P04.35, Velocity coincidence (V-COIN) output signal valid.

Due to 10RPM hysteresis:

Velocity coincidence output OFF -> ON timing (P04.35 -10) r/min

Velocity coincidence output ON -> OFF timing (P04.35 +10) r/min



## 7.2.5 Zero Speed Clamp

Forced set velocity command to 0 using zero speed clamp to avoid servo axis from crawling at low velocity.
This input function can be assigned through I/O configurations, please refer to P04.00.

| P03.15 | Label | Zero speed clamp function selection | | | Valid mode(s) | S | |
|---|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | — | Default | 0 | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x031F | |
| | Valid | Immediate | | | | | |

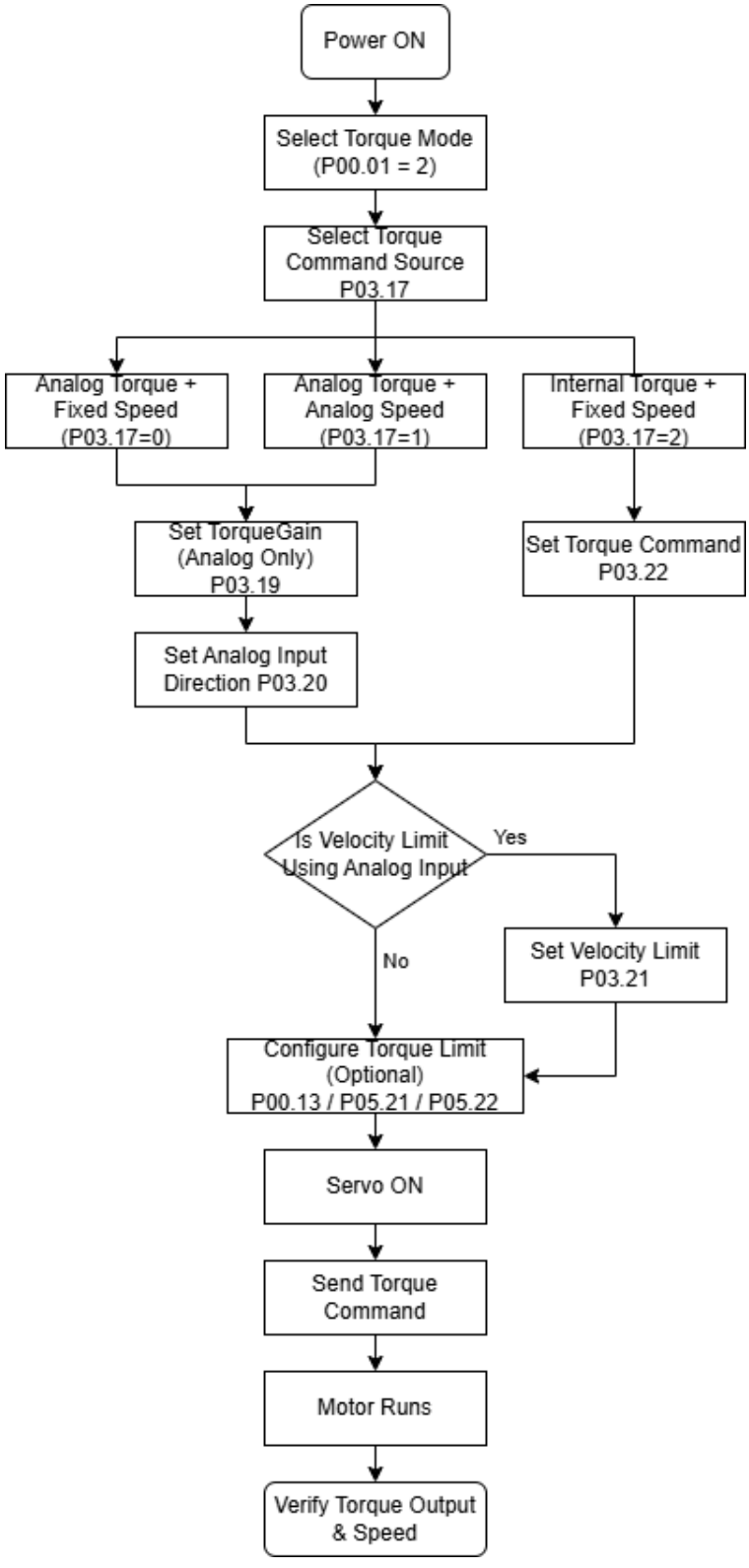
| Value | Zero speed clamp function |
|---|---|
| 0 | Invalid: zero speed clamp deactivated |
| 1 | Velocity command is forced to 0 when the zero speed clamp (ZEROSPD) input signal is valid. |
| 2 | Velocity command is forced to 0 when actual velocity is lower than P03.16. |
| 3 | Includes conditions from 1 and 2 |

| P03.16 | Label | Zero speed clamp level | | | Valid mode(s) | S | |
|---|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 30 | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0321 | |
| | Valid | Immediate | | | | | |
| | Valid when P03.15 = 2/3, velocity command is forced to 0 when actual velocity is lower than P03.16 and after static time set in P03.23. | | | | | | |

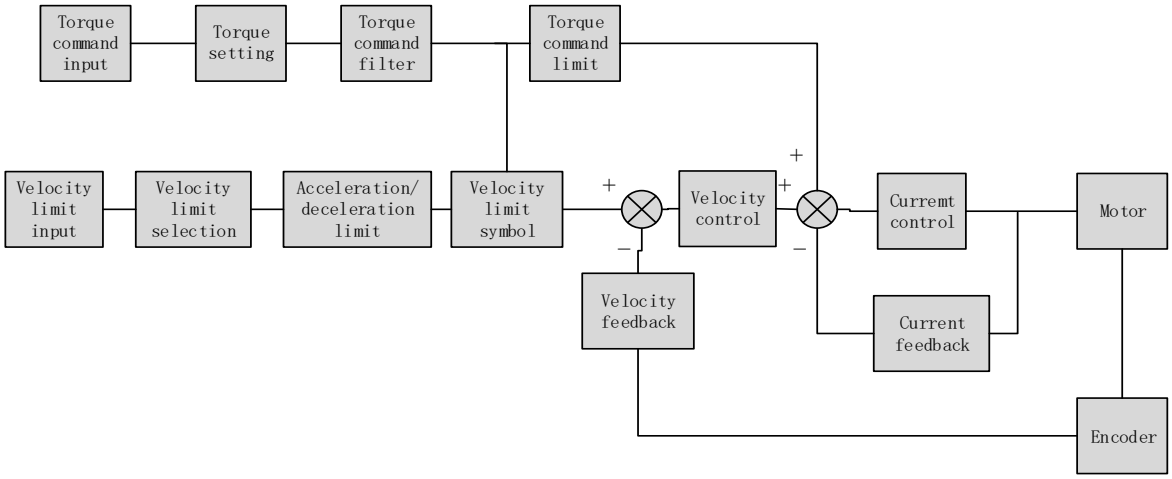
## 7.3 Torque Control

Torque control mode is the size of motor asserted torque through external analogue input or directly from set value internally. This control mode is applicable where torque is the main control and limiting factor.

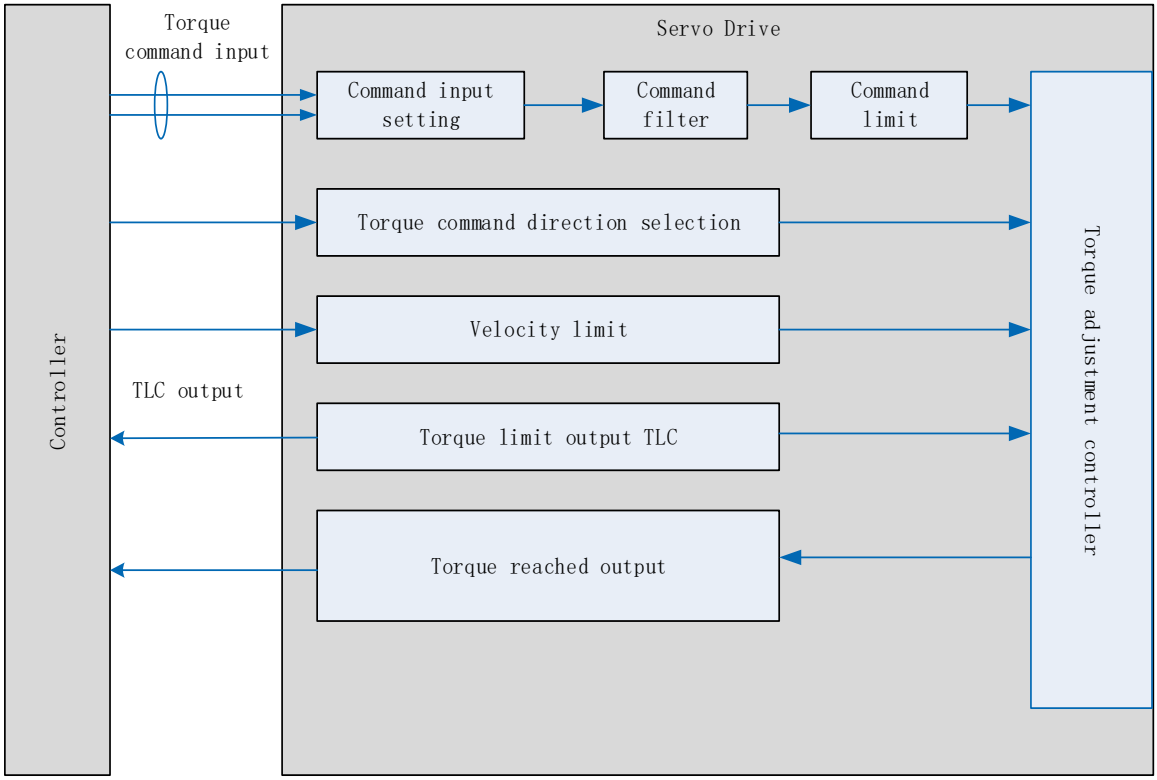
The basic torque control flow chart shows as below:



Set P00.01 = 2 to activate torque control mode.



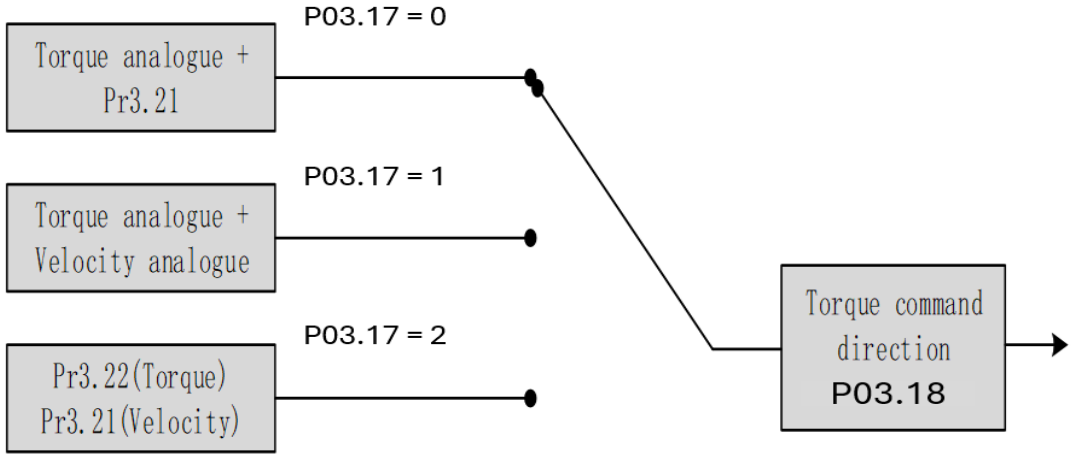

Using EDrive or front panel on servo driver, set P00.01 = 2 to activate torque control mode. Please set related servo parameters according with the following diagram.



## 7.3.1 Torque Command Input Control

### Torque control mode settings

Torque control mode includes 3 control modes as shown below. Set torque control mode in P03.17.




| P03.17 | Label | Torque internal/external switching | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0323 | | |
| | Valid | Immediate | | | | | | |

| Value | Torque command input | Velocity limit input |
|---|---|---|
| 【0】 | Analog input 3(AI 3) | P03.21 set value |
| 1 | Analog input 3(AI 3) | Analog input 1(AI 1) |
| 2 | P03.22 set value | P03.21 set value |

### Torque command direction settings

To switch velocity command direction through DI. Assign TC-SIGN signal to corresponding DI terminal and determine velocity command direction through digital input signal.

| P03.18 | Label | Torque command direction selection | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0325 | | |
| | Valid | Immediate | | | | | | |

To set torque command positive/negative direction

| Value | Direction settings |
|---|---|
| 【0】 | TC-SIGN ON/OFF has no effect on torque direction<br>Torque command input「Positive」→ Positive direction、<br>「Negative」→ Negative direction |
| 1 | Use TC-SIGN ON/OFF status for torque direction<br>OFF: *Positive direction* ON: *Negative direction* |

## Torque command input inversion

To set the voltage polarity added onto analogue torque command (TRQR)

| P03.20 | Label | Torque command input inversion | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0329 | | |
| | Valid | Immediate | | | | | | |

To set voltage polarity of analog torque command.
Only valid when P03.18 = 0.

| Value | Motor torque direction | |
|---|---|---|
| 【0】 | Not inversed | 「Positive voltage」→「Positive direction」<br>「Negative voltage」→「Negative direction」 |
| 1 | Inversed | 「Positive voltage」→「Positive direction」<br>「Negative voltage」→「Negative direction」 |

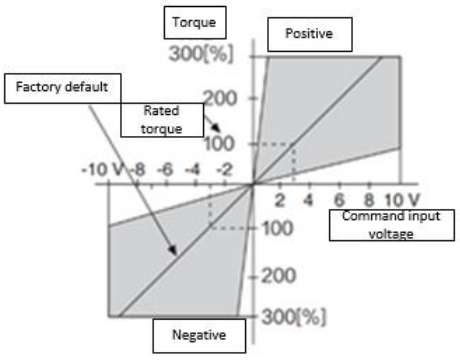
## Torque command input gain

To set voltage added on to switching gain of motor torque command from analog torque command(TRQR)

| P03.19 | Label | Torque command input gain | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 10~100 | Unit | 0.1V/100% | Default | 30 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0327 | | |
| | Valid | Immediate | | | | | | |

To set gain changes from voltage added onto analog torque command (TRQR) to torque command (%)

·Unit: (0.1V/100%)
·Set input voltage required for rated output torque.
·Default = 30， which is 3V/100%




## 7.3.2 Torque Velocity Limit

To set velocity limit in torque mode for safety reasons.

| P03.21 | Label | Velocity limit in torque mode | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x032B | | |
| | Valid | Immediate | | | | | | |
| | To set velocity limit in torque control mode. Only valid when P03.17 = 0 / 2. | | | | | | | |

| P03.22 | Label | Torque command | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~300 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x032D | | |
| | Valid | Immediate | | | | | | |
| | To set torque limit in torque control mode. Only valid when P03.17 = 2.<br>Please refer to P03.17. | | | | | | | |

### 7.3.3 Torque Limit (TL-SEL)

This input function can be assigned through I/O configurations, please refer to P04.00.
To set torque limiting method.

| P05.21 | Label | Torque limit selection | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~6 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x052B | | |
| | Valid | Immediate | | | | | | |

| Value | | Limit |
|---|---|---|
| 【0】 | | 1st torque limit P00.13 |
| 1 | | 2nd torque limitP05.22 |
| 2 | TL-SEL OFF | P00.13 |
| | TL-SEL ON | P05.22 |
| 3~4 | | Reserved |
| 5 | | P00.13 →Positive torque limit<br>P05.22 →Negative torque limit |

| P05.22 | Label | 2nd torque limit | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 300 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x052D | | |
| | Valid | Immediate | | | | | | |

P05.22 is limited by max. torque set in motor parameter.

| P00.13 | Label | 1st torque limit | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 350 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x001B | | |
| | Valid | Immediate | | | | | | |

1st torque limit is set according to ratio percentage of motor rated current. Do not exceed max driver output current.

Please refer to P05.21 on how to set torque limit.

## 7.4 Hybrid Control Mode

Hybrid control mode is for servo driver to be able to switch between different modes during operation. Hybrid control mode consists of the 3 listed below:

- Position-velocity mode
- Position-torque mode
- Velocity-torque mode

Set P00.01 to select the hybrid control mode needed through EDrive or servo driver front panel.

| P00.01 | Label | Control Mode Settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0003 | | |
| | Valid | After restart | | | | | | |

| Value | Description | |
|---|---|---|
| | 1st mode | 2nd mode |
| 【0】 | Position | — |
| 1 | Velocity | — |
| 2 | Torque | — |
| 3 | Position | Velocity |
| 4 | Position | Torque |
| 5 | Velocity | Torque |
| 6 | PR internal command control | Position P00.22=1 |
| | | Velocity P00.22=1 |
| | | Torque P00.22=2 |
| 7~10 | Reserved | |

◆When 3, 4, 5, 6 combination hybrid mode, 1st and 2nd mode can be chosen accordingly with control mode switching input (C-MODE).
C-MODE: Invalid, select 1st mode.
C-MODE: Valid, select 2nd mode.
Please allow some time in between mode switching commands.

◆Please set P00.01 = 6 to switch to other modes from PR mode, then set 2nd mode using P00.22.

*C-MODE is defaulted to Normally Open*

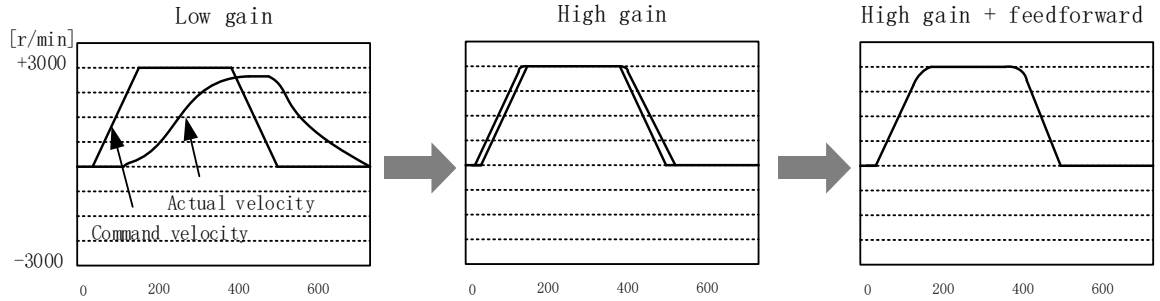
When P00.01 = 3/4/5, please set assign C-MODE mode switching signal to one of the DI terminal and make sure the logic is valid.

| Signal | Set value | Label | Description | | |
|---|---|---|---|---|---|
| | | | P00.01 | C-MODE | Control mode |
| C-MODE | 0x5 | Control mode switching | 3 | Invalid | Position mode |
| | | | | Valid | Velocity mode |
| | | | 4 | Invalid | Position mode |
| | | | | Valid | Torque mode |
| | | | 5 | Invalid | Velocity mode |
| | | | | Valid | Torque mode |

# Chapter 8 Tuning

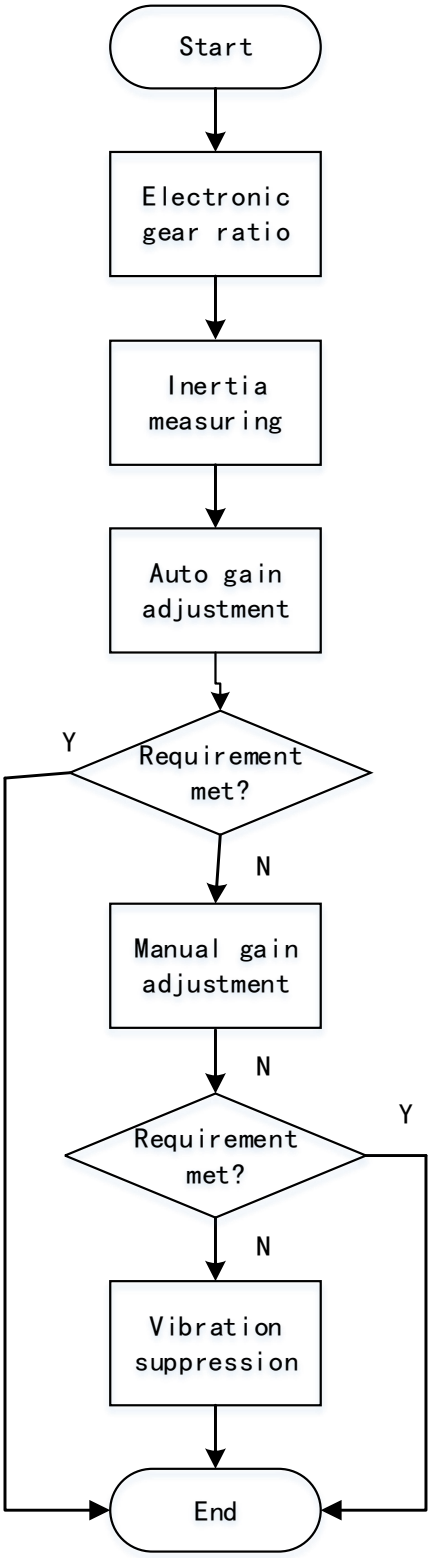
## 8.1 Gain Adjustment

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




| | | |
|---|---|---|
| **Position loop gain**: 320 (0.1/s)<br>**Velocity loop gain**: 180 (0.1Hz)<br>**Velocity loop integral time constant**: 31ms | **Position loop gain**: 900 (0.1/s)<br>**Velocity loop gain**: 500 (0.1Hz)<br>**Velocity loop integral time constant**: 31ms | **Position loop gain**: 900 (0.1/s)<br>**Velocity loop gain**: 500 (0.1Hz)<br>**Velocity loop integral time constant**: 31ms |

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




Gain adjustment flow chart

| Steps | Functions | Explanation |
|---|---|---|
| Inertia ratio identification | Online | Motor moves with command from controller, servo driver will automatically calculate load-inertia ratio |
| | Offline | Using servo driver inertia determining function, servo driver can automatically calculate load-inertia ratio |
| Auto gain adjustment | Auto gain adjustment | Real time determining of mechanical load, gain value is set accordingly.<br>6. One-click tuning (Can be realized using EDrive. Auto tuning of gain and inertia according to actual data)<br>7. Real time auto adjustment (Set by selecting mechanical stiffness level, related gain parameters will be automatically adjusted accordingly) |
| Manual gain adjustment | Basic gain | On top of auto gain adjustment, manually adjust related parameters so that machine can have better responsiveness and following |
| | Basic steps | 1. Gain related parameters tuning under position mode<br>2. Gain related parameters tuning under velocity mode<br>3. Gain related parameters tuning under torque mode |
| | Gain switching | • Gain switching through internal data or external signal. Lower vibration at stop, shorten tuning time, improve command following. |
| | Model following control | • Improve responsiveness, shorten positioning time (Only available in position mode) |
| | Command pulse filter | Set filter for position, velocity and torque command pulse. |
| | Gain feedforward | Enable feedforward function to improve following behavior |
| | Friction compensation | Reduce the effect of mechanical friction |
| | 3rd gain switching | Based on usual gain switching function. Can be set to switch gain at stopping and reduce positioning time. |
| Vibration supP0Ession | Mechanical resonance | Using notch filtering function to supP0Ess mechanical resonance. |
| | End vibration supP0Ession | To supP0Ess low frequency vibration of mechanical end |

## 8.2 Inertia Ratio Identification Function

Inertia ratio = Total mechanical load rotational inertia / Motor rotational inertia

Inertia ratio is an important parameter. Setting a suitable value can help with the P0Ecise tuning of the servo system. Inertia ratio can be set manually and also be determined automatically through servo driver

To make sure accurate inertia ratio identification

1. Max rotational velocity at 400rpm
2. Acceleration/deceleration time above 100ms
3. Stable load torque without large variation.

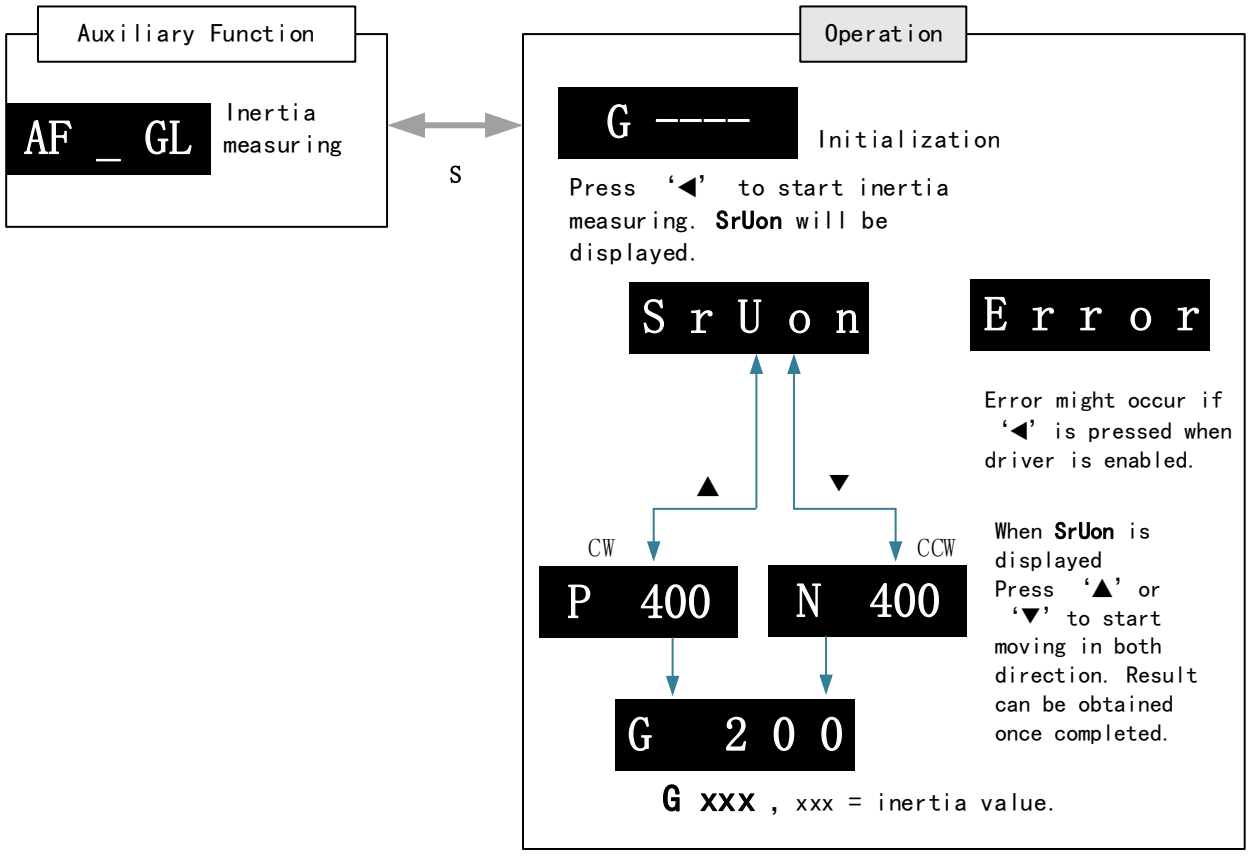
### 8.2.1 Online Inertia Determination

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 EDrive system monitoring page. Enter the calculated value into P00.04 and save.

### 8.2.2 Offline Inertia Determination

Can be achieved through driver front panel or on EDrive
Please make sure: 1. Servo driver is disabled.
2. Axis is within safe and allowed range and limit switch is not triggered to P0Event axis from over travelling.

Auxiliary function to determine inertia on front panel

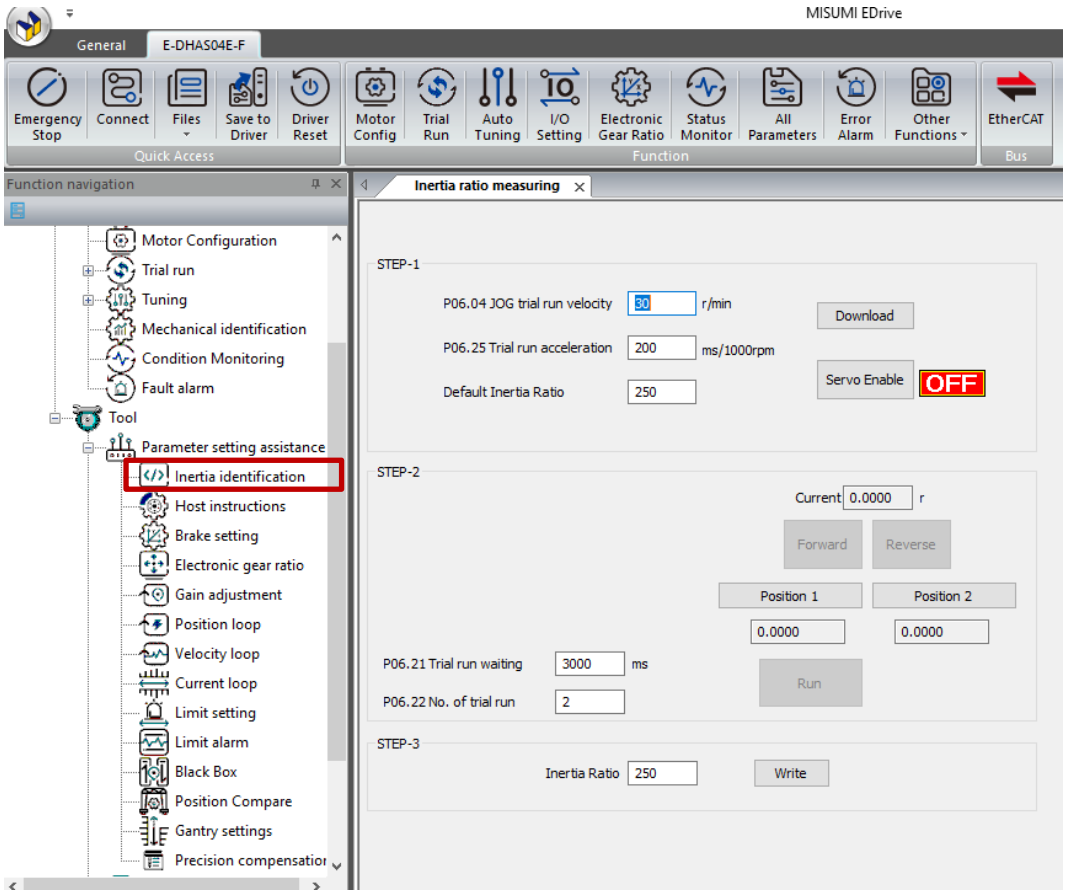


**Steps:**

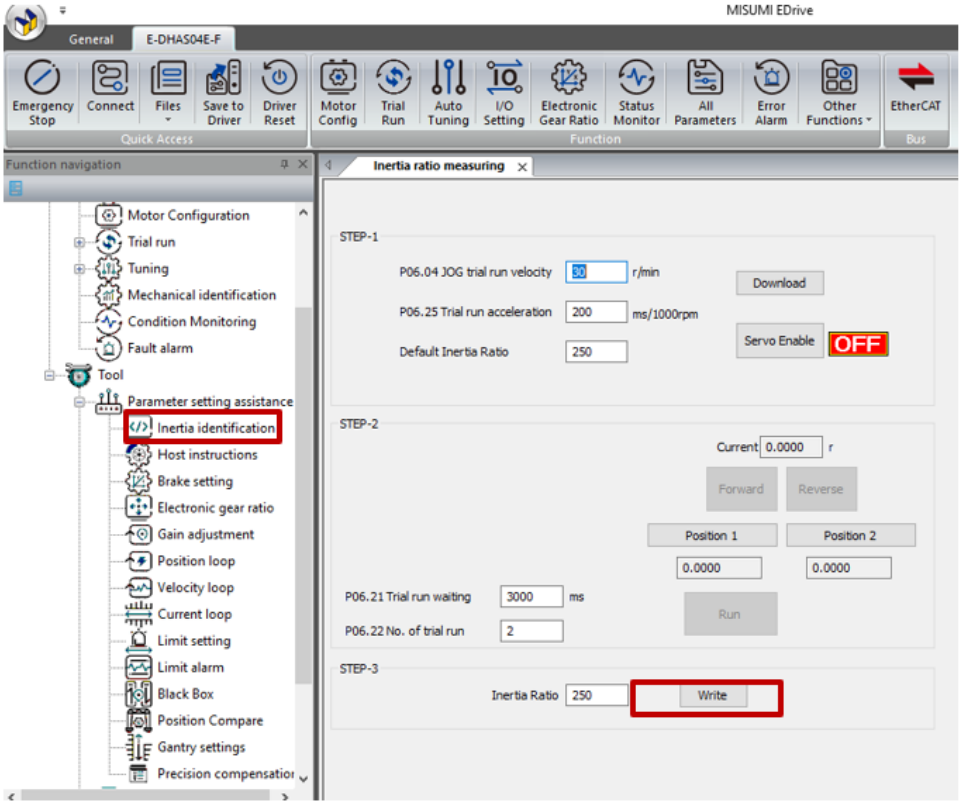
1. Set the trial run velocity **P06.04**. Value set shouldn't be too large, please keep it at around **400 r/min**.
2. Enter **AF_GL** for auxiliary function – Inertia ratio determination into front panel
3. P0Ess S once to enter. "**G---**" will be displayed on the front panel.
4. P0Ess ◀ once to display "**StUon**"
5. P0Ess ▲ 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 parameter saving on servo driver.

## Inertia measuring using EDrive

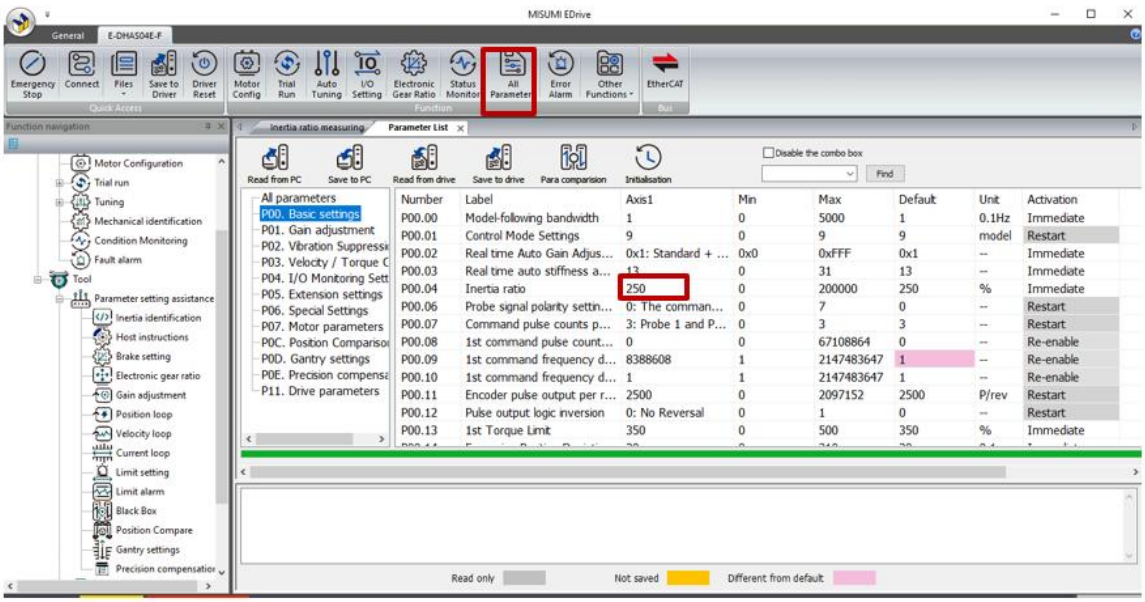
1. Open the inertia identification page, set jog speed (P06.04) and acceleration time (P06.25), then click **Download**.
2. Enable "Disable external enable", click **Servo Enable** to turn ON.
3. Use **Forward** and **Reverse** to move motor; click **Position 1** and **Position 2** to record two positions.
4. Set wait time (P06.21) and cycle count (P06.22), then click **Run** to execute movement.




5. After completion, the system auto-calculates inertia ratio. Click **Write** to store.




6. Open **Parameter Management**, confirm value saved to P00.04, then click **Save to Drive**




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.

| P00.04 | Label | Inertia ratio | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | % | Default | 250 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0009 | | |
| | Valid | Immediate | | | | | | |

**P00.04=( 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, P00.04 can be left unfilled but optimal setting of P00.04 could improve system performance

Common issues

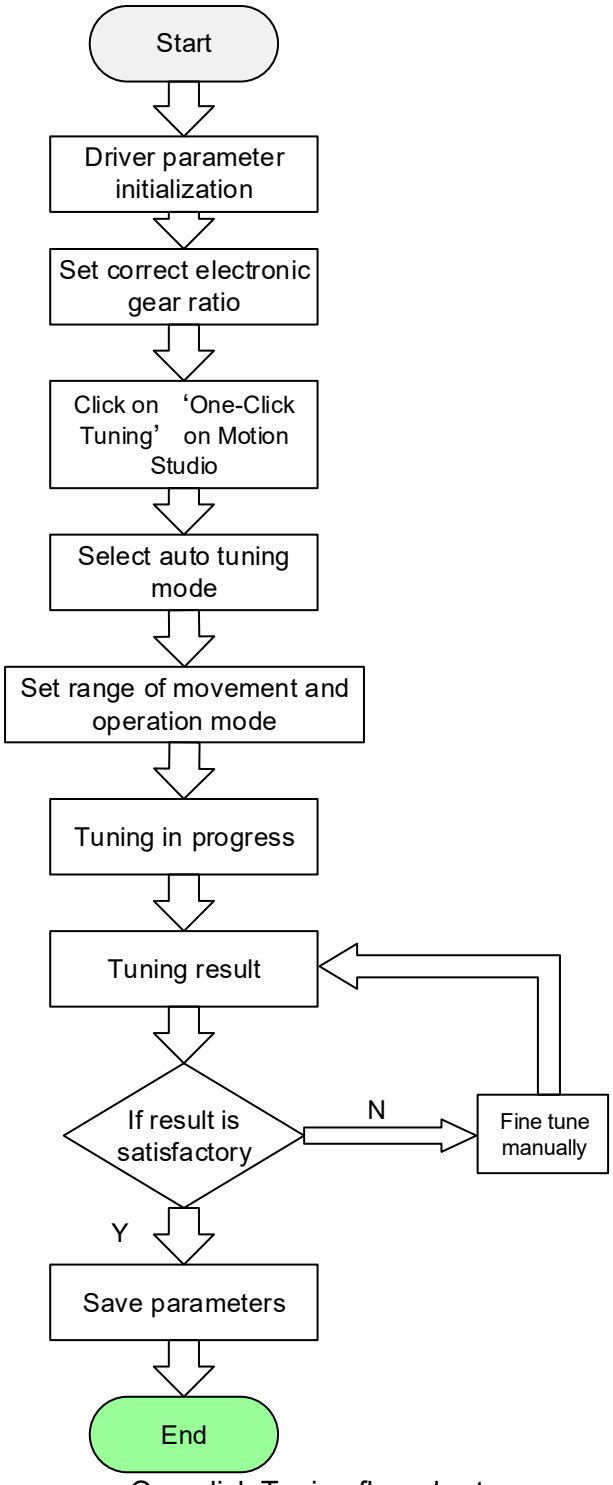
| Error | Cause | Solution |
|---|---|---|
| Inertia measuring failure | Loose load connection | Check for mechanical failure |
| | Measuring distance is too short | Increase measuring distance |
| | Belt load | Please P0E-set an inertia ratio when using a belt to P0Event jolt due to low inertia. |

# 8.3 Easy Tuning

## 8.3.1 One-click Tuning

This function is able to automatically tune the most optimal gain parameters for the specific applications after the axis is in operation and learning. Corresponding paths and responsiveness level need to be set before using this function. Please refer to the flow chart below. Parameter will be saved to parameters file and can be used on similar axes.
Recommended for applications where inertia changes is minute.

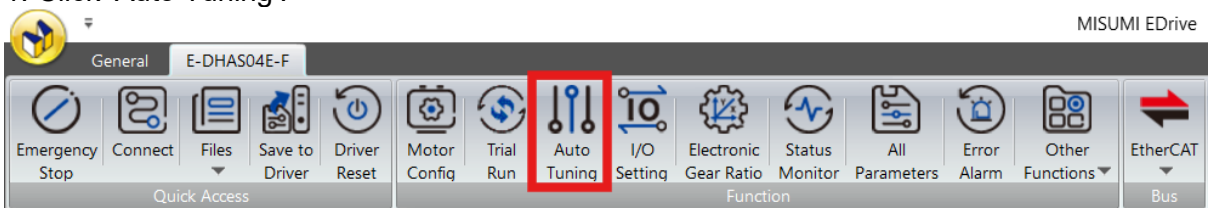
| | Recommended application scenarios |
|---|---|
| Control mode | Suitable in position mode (Not applicable in other modes) |
| Others | ➢ Make sure servo driver can't be enabled externally or any external command that can rotate the motor. Set range of movement, velocity and acceleration/deceleration time for one-click tuning.<br>➢ Prohibit external command. Make sure there is no obstacle within the range of movement of the axis and motor can rotate freely. |
| | Factors affecting one-click tuning |
| Load inertia | ➢ External load smaller or 30 times larger than rotor inertia<br>➢ Drastic changes in load inertia during motion.<br>*Under heavy load (more than 30 times inertia), please make sure of safety* |
| Load | ➢ Mechanical loads are loosely connected.<br>➢ Existence of gear backlash or any other non-linear factors<br>➢ Complicated mechanical load structure |
| Motion | ➢ Range of movement is too short or too long which cost the time to be overdue.<br>➢ Not smaller than 0.5R |



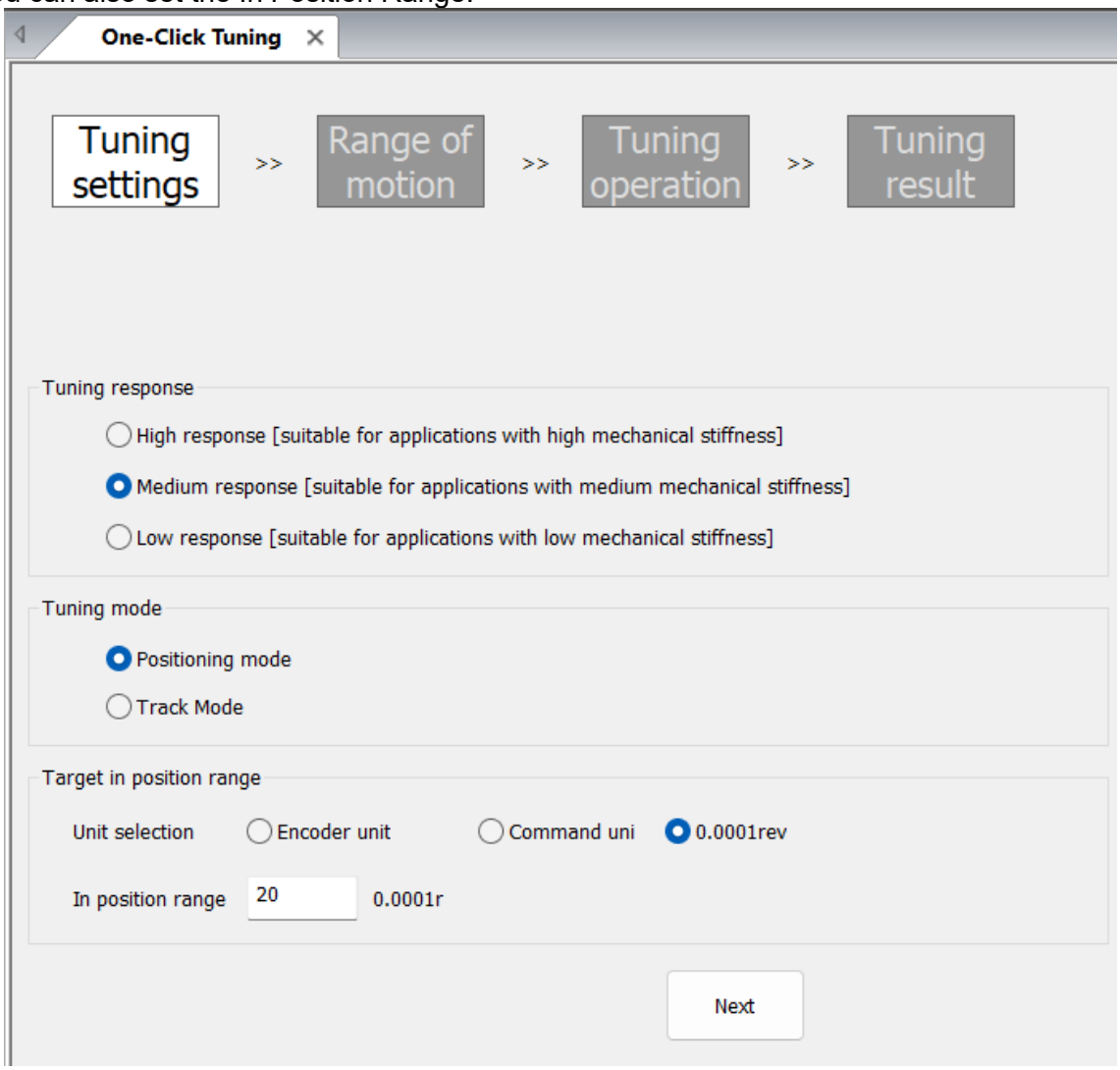

One-click Tuning flow chart

## Operation Steps

1. Click ‘Auto Tuning’.



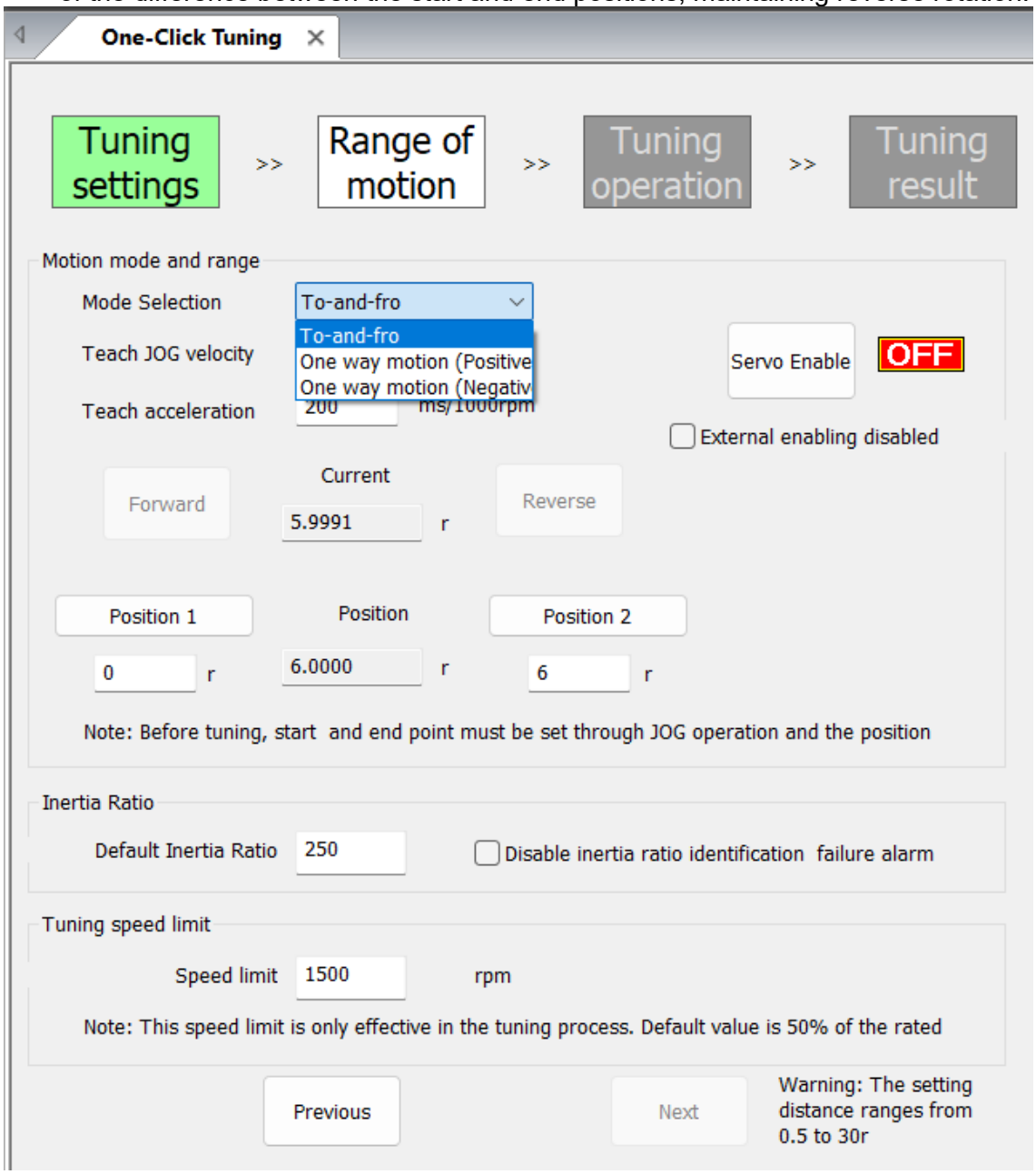

2. The first interface is for Tuning settings, which is mainly used to set the execution criteria for the auto-tuning process.
Tuning response: There are three types. Choose based on the actual mechanical conditions.
Tuning Mode: Two options are available — Positioning Mode and Track Mode.
You can also set the In Position Range.




3. Clicking ‘Next’ go to the Range of motion interface, and define the motion range for auto-tuning.
1) There are three mode selections. Choose based on the allowable movement 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 moves a distance equal to the absolute value of the difference between the start and end positions, maintaining forward rotation.

- One way motion (Negative): The motor moves a distance equal to the absolute value of the difference between the start and end positions, maintaining reverse rotation.




2) There are two methods to set the start and end positions:

- After Servo Enable, use the forward/reverse buttons to adjust the position. Click the “Position 1/2” button to complete the setup.

*Note:*

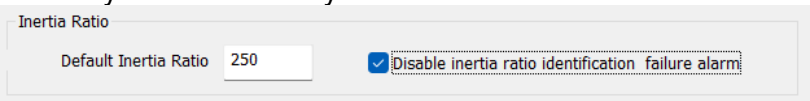
- *During motion range setting, jog speed should be between 0–200 rpm. Acceleration time should not be too short to avoid collisions. After setting speed properties, disable external enable signals. Before enabling the servo, ensure no commands are being sent to avoid unintended movement. Then click servo enable.*

- Directly input the start and end positions. After entering the values, press Enter to apply the changes. (In reciprocating motion, the motor will first move to the set start position before beginning the reciprocating motion. When manually entering positions, ensure there is no risk of collision.)

*Note:*

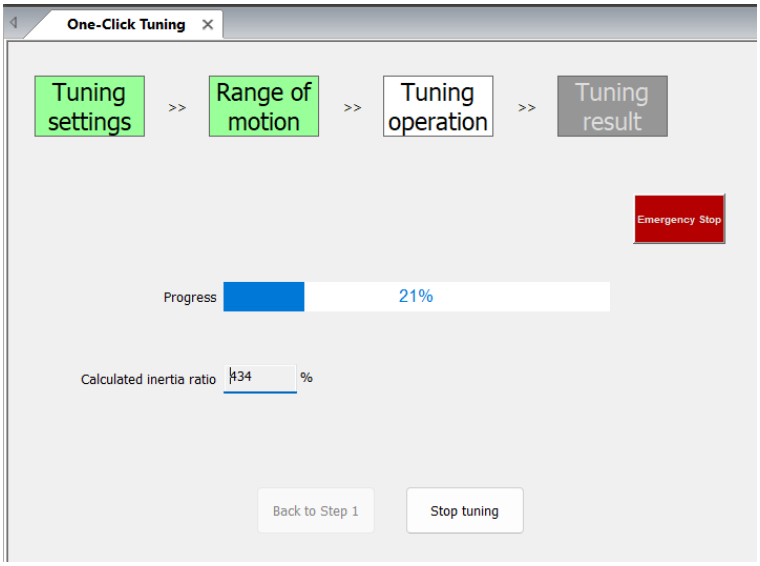
- *The difference between start and end positions must be greater than 0.5 revolutions. The closer the start/end points match the actual application stroke, the better the tuning adaptability. However, tuning time may increase accordingly.*

3) Inertia Ratio:
Can choose to ignore inertia identification failures to prevent tuning failure due to unsuccessful identification.
The inertia ratio can be manually entered or preset to a suitable value. This helps avoid shaking in belt-driven systems caused by low inertia.

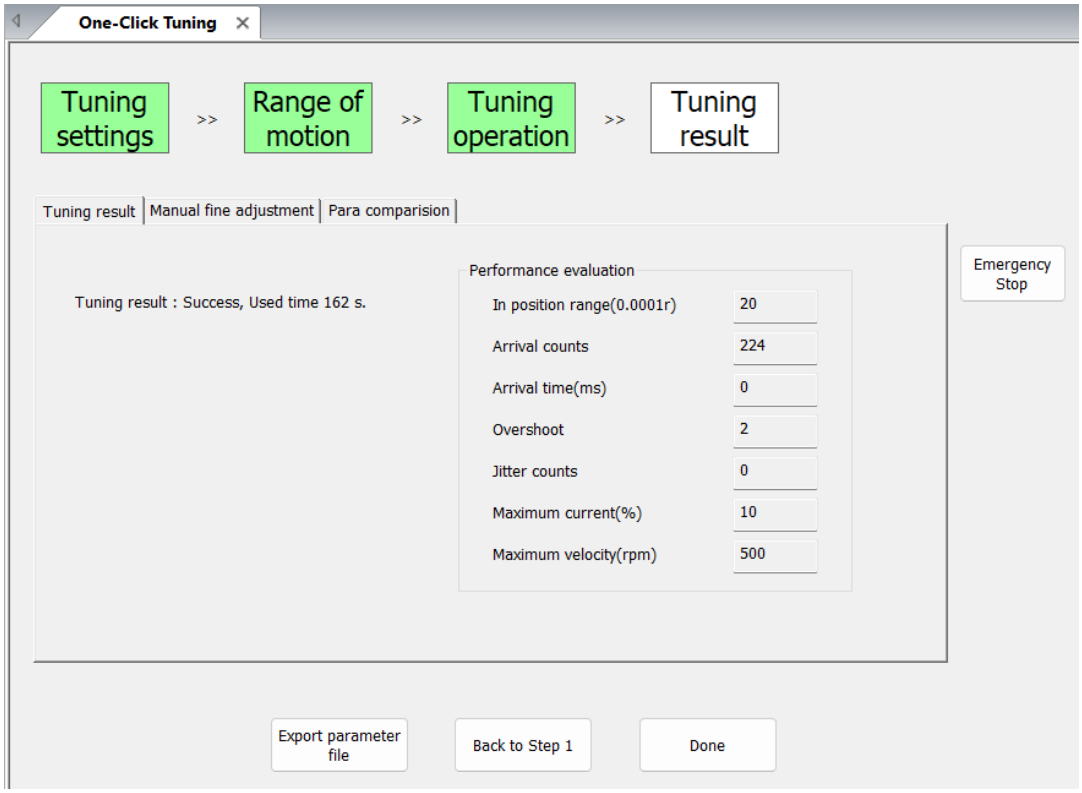



4) Tuning Speed Limit:
The speed during tuning must be no less than 400 rpm.

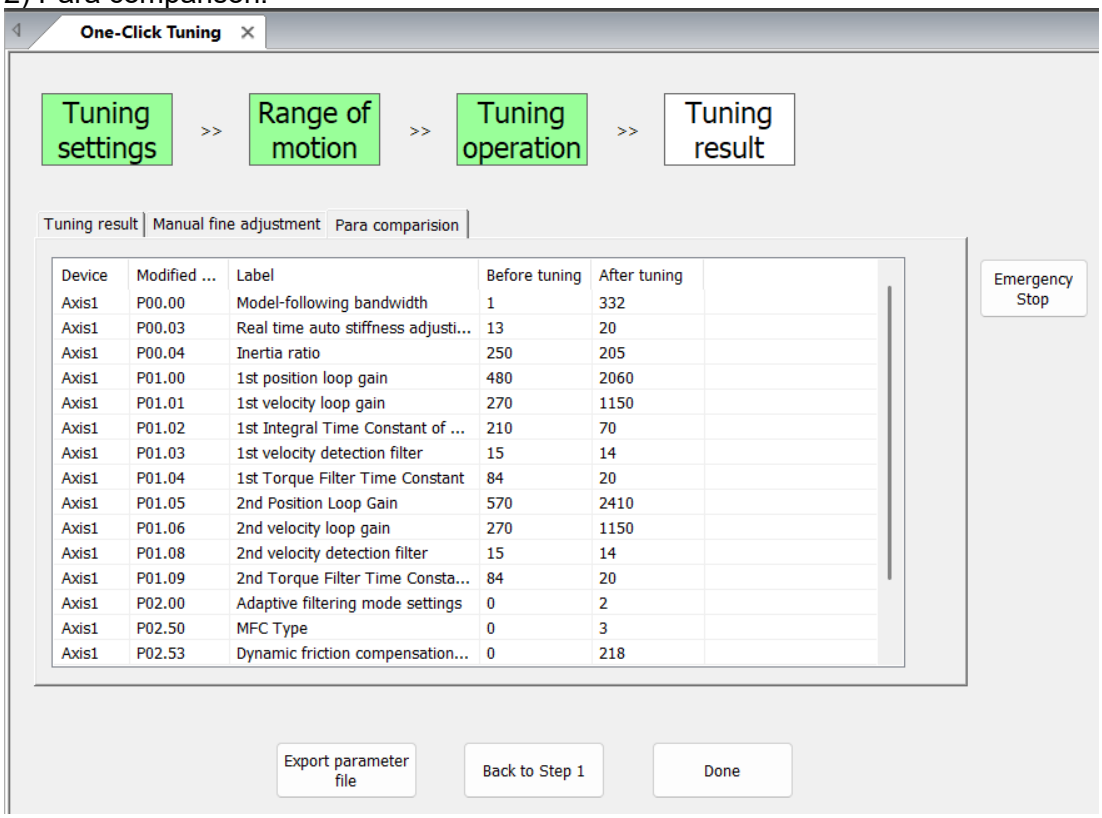
4. Click ‘Next’ and confirm that the motion is safe to enter the Tuning Operation interface. The tuning process will begin, with progress display and an emergency stop button available during the operation.




5. After tuning is complete, the system will transition to the Tuning Results interface, shows the tuning results and parameters comparison before and after tuning.
1) Tuning result:

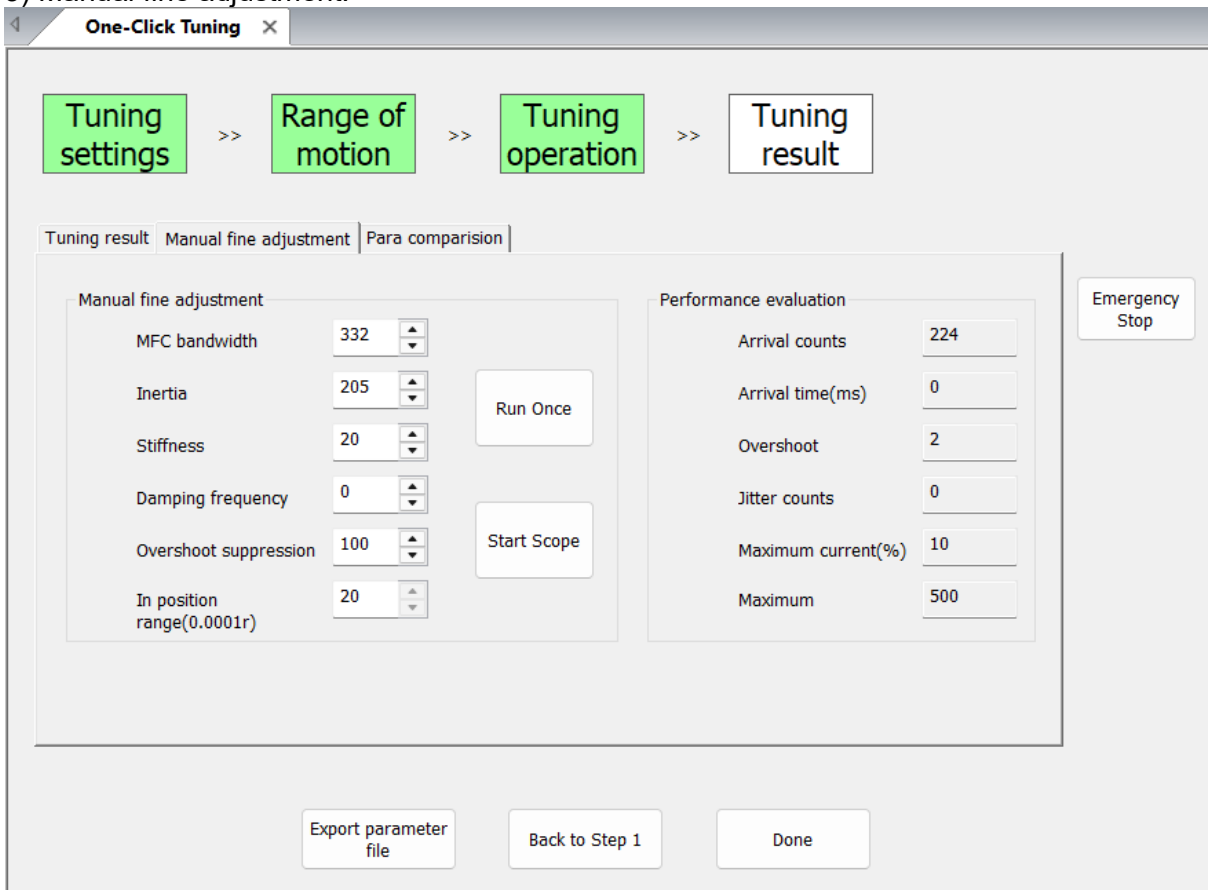



2) Para comparison:



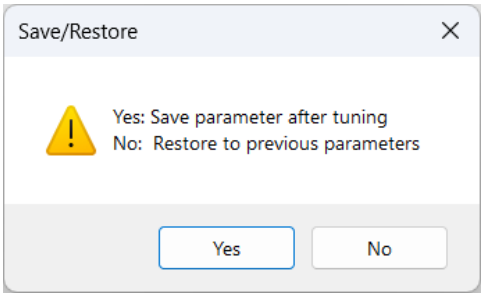
If fine-tun is needed, can enter Manual fine adjustment to modify the gain.

3) Manual fine adjustment:




After modifying parameters, run the motor again to evaluate performance or use the oscilloscope to check if the results meet actual requirements.

If satisfied with the tuning results, click ‘Done’, and a prompt will appear asking whether to save the parameters.




Click ‘Yes’ to save the tuned parameters. Click ‘No’ to revert to the parameters before tuning.

*Note:*

- *Regardless of whether you click Yes or No, clicking ‘Done’ will exit the One-Key Auto Tuning Interface.*

## Precautions

- Vertical Axis Applications: Ensure anti-drop measures are in place before executing any actions.
- Belt Applications: Pre-setting a moderate inertia ratio can prevent shaking caused by low inertia at the start of auto-tuning.
- Ball Screw Applications: If tuning takes too long, consider shortening the stroke.

Common Tuning Failures

| Issue | Cause | Solution |
|---|---|---|
| Inertia Identification Failure | Lose mechanical connections | Inspect and fix mechanical issues |
| | Stroke too short, inertia identification fails | Increase stroke appropriately |
| | Belt-driven load | Pre-set a suitable inertia ratio to avoid low inertia causes shaking and identification failure |

If the tuning results are not satisfactory, you can switch to Single parameter tuning for more advanced adjustments to achieve optimal gain settings.

### 8.3.2 Single Parameter Tuning

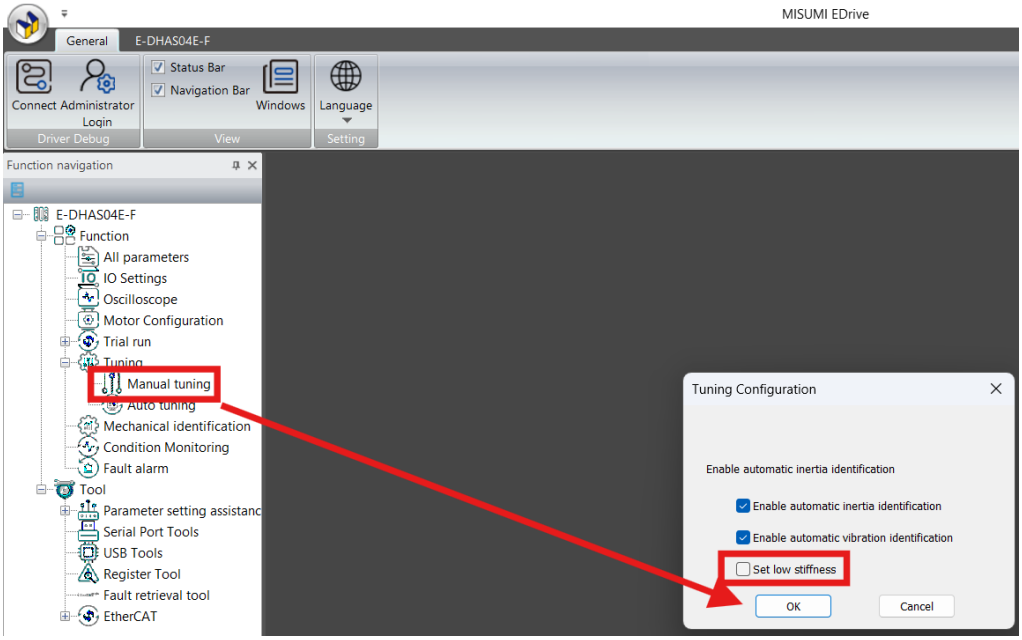
Set a mechanical stiffness level and the driver will automatically tune the parameters accordingly, including inertia measuring and vibration supP0Ession to fulfill responsiveness and stability needs. At same time, more advanced functions can be applied, for example: Command pulse filter, low frequency vibration supP0Ession, etc.
Recommended for applications where inertia changes is minute. Single parameter tuning is more complicated to set up compared to one-click tuning. Use single parameter tuning when one-click tuning doesn't fulfill the needs.

| | Recommended application scenarios |
|---|---|
| Control mode | Suitable in position mode (Not applicable in other modes) |
| Others | ➢ Servo ON (SRV-ON) status<br>➢ Set suitable position/torque limit so that motor can run normally<br>➢ Use trial run or any external controller to make sure no clash of axes |

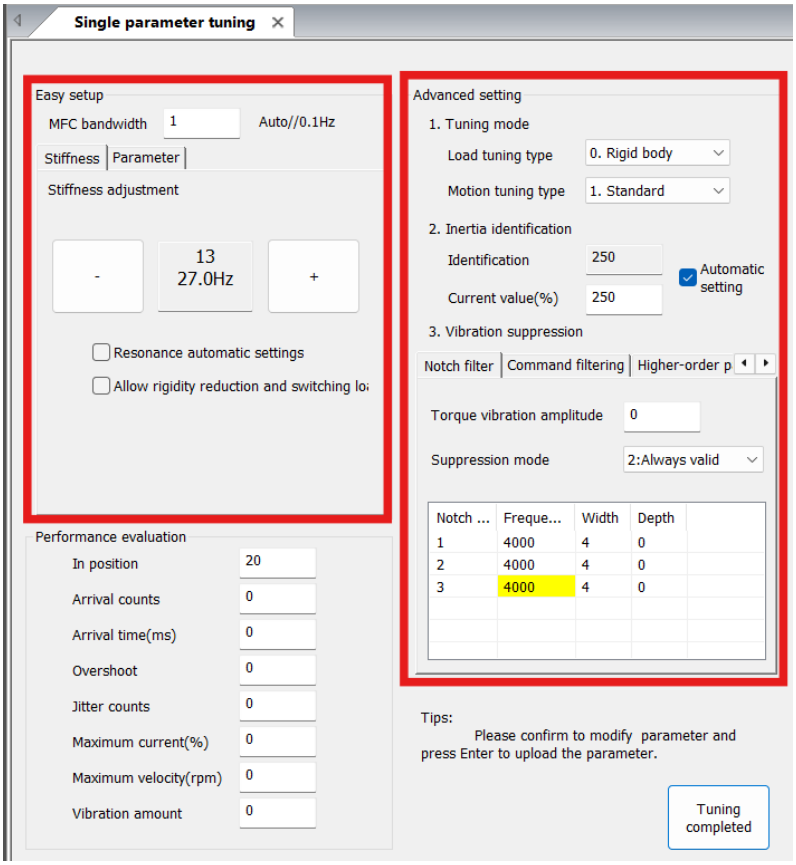
| | Factors affecting single parameter tuning |
|---|---|
| Load inertia | ➢ External load smaller or 30 times larger than rotor inertia<br>➢ Inertia measuring might fail upon changes in load inertia<br>➢ Load torque changes drastically |
| Load | ➢ Mechanical stiffness is too low<br>➢ Existence of gear backlash or any other non-linear factors<br>➢ Complicated mechanical load structure |
| Motion | ➢ Low speed, no more than 300[r/min].<br>➢ Acceleration/deceleration time too long, more than = 600ms<br>➢ Speed > 300r/min, acceleration/deceleration time < 600ms but travelling time duration < 50ms. |

Operation Steps

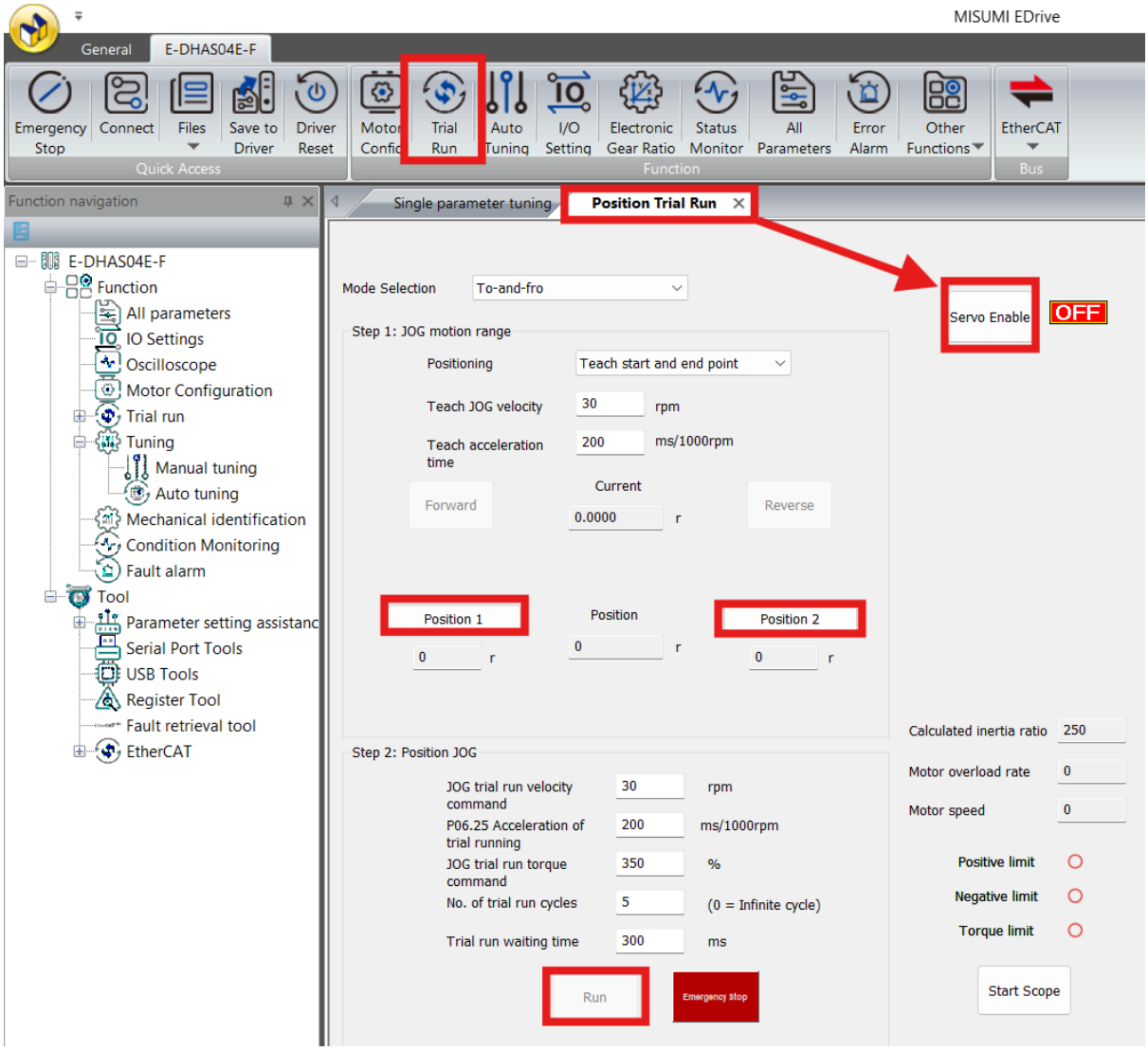
1. Open the wizard. Select the Manual Tuning function. The interface will appear as shown, with Inertia Auto Identification and Vibration Auto Identification enabled by default.
If rigidity parameter P00.03 is greater than 11, and low rigidity is selected, the initial rigidity will be set to 11 upon entering manual tuning.




2. Manual tuning interface. In Simple Settings, set MFC Bandwidth to 1 for automatic model-following bandwidth adjustment. You can also manually set other values.
If no advanced parameters need adjustment, you can use the Trial Run function or send commands from the host to rotate the motor.




3. Manual tuning requires motor movement. Use the Trial Run function to configure motion path, speed, and acceleration.

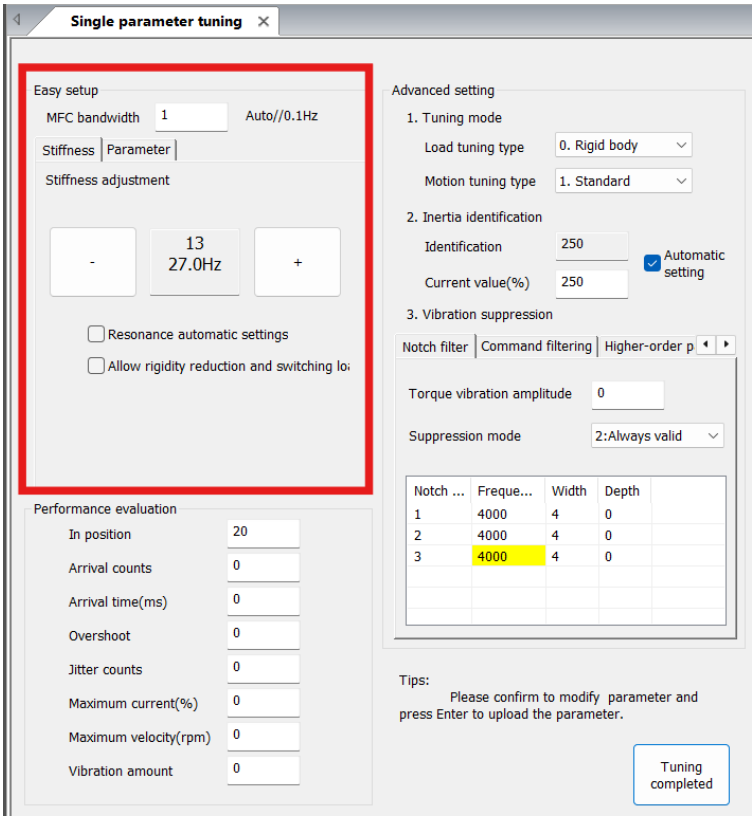



For E-DHAS□□P, there are three methods to teach the motion range:

1) Teach Start and End Point: After enabling the servo, use forward/reverse buttons to adjust position. Click “Position 1/2” to complete setup.
2) Input Start and End Point: Directly input positions in the fields. The motor will move to the start point and then perform reciprocating motion.
3) Input distance: Input the travel distance in the position difference field. The motor will perform reciprocating motion from the current position.

Note: Teaching speed should not be too fast to avoid collisions!
After setting the motion range, configure JOG motion properties:
Jog trial run velocity command: >300 rpm during manual tuning.
Acceleration of trial running: <600 ms/1000rpm during manual tuning.
No. of trial run cycles: Set an appropriate number of runs to assist manual tuning.

4. Automatic parameter setting.
Manual Tuning includes Easy Setup and Advanced Setting:
1) Easy Setup: Adjust rigidity simply to achieve auto-tuning. Inertia identification is enabled by default and will auto-set the inertia ratio.



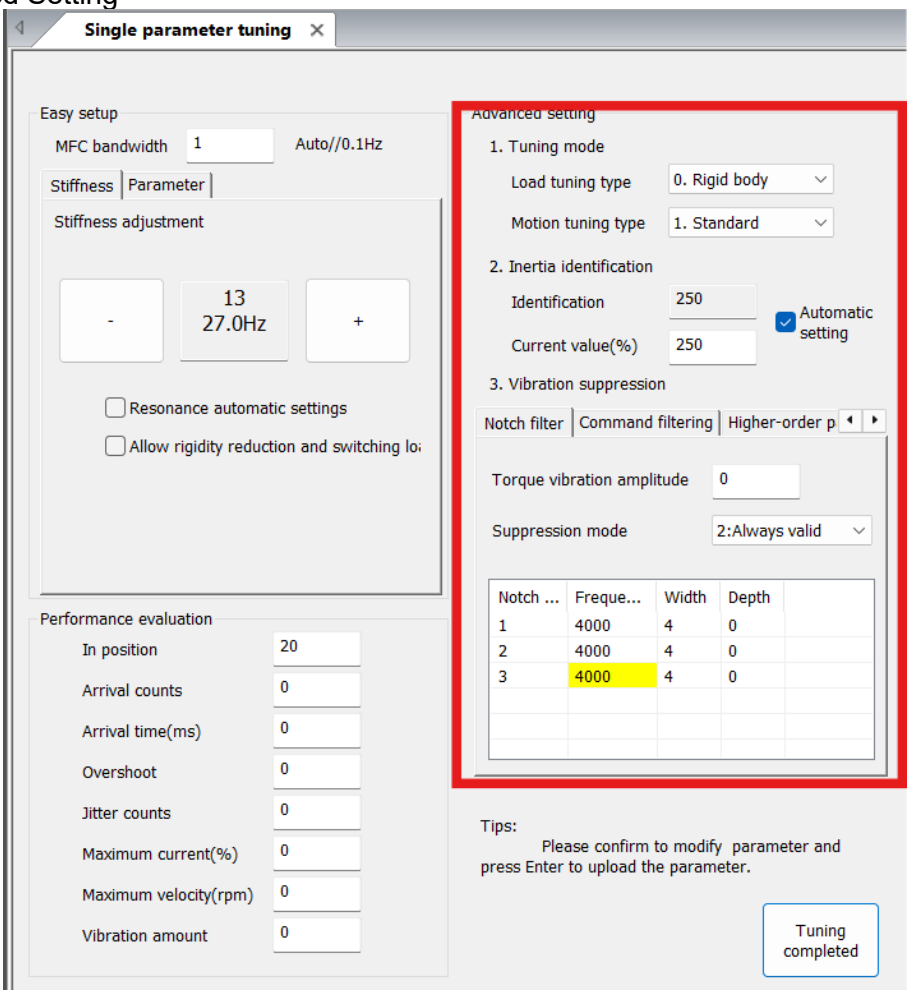

Easy Setup content:
MFC Bandwidth: Sets the model following bandwidth. MFC, also known as model following control, is used in position loop control to improve command response, accelerate positioning time, and reduce tracking error.

| MFC Function | Description |
|---|---|
| 0 | Disable MFC |
| 1 | Auto-adjust MFC bandwidth |
| 2 ~ 9 | Invalid |
| 10 ~ 2000 | Manual setting (recommended 30–100 for belt applications) |

Stiffness Adjustment:
Range: 0–31. Press '+' to increase stiffness, press '-' to decrease stiffness.
Higher values increase speed response but may cause vibration.
Set based on mechanical structure strength. If vibration count exceeds 10, reduce rigidity by 2 levels to prevent loosening of fasteners.
For belts or long rods prone to deformation, reduce rigidity and apply vibration suppression.

Resonance Automatic Settings:
If checked: cyclic vibration detection under current rigidity; resets to default if no vibration is detected.

2) Advanced Setting




<1> Tuning mode

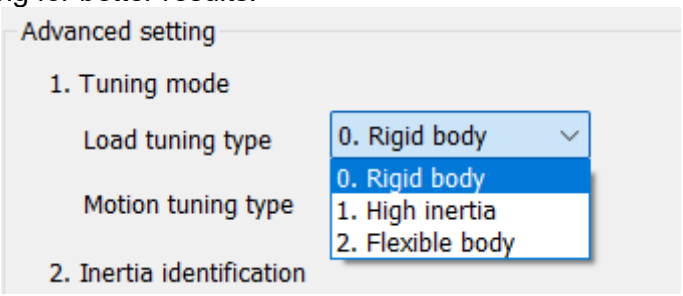
Load Tuning Type: The default is Rigid body, Standard. If vibration occurs during operation, it will automatically change to adapt to different transmission methods.

0: Rigid body (e.g., ball screw)

1: High inertia (load inertia >30–40× motor inertia)

2: Flexible body (e.g., belt drive)

Set the correct load setting type according to the actual situation and then perform debugging and setting for better results!



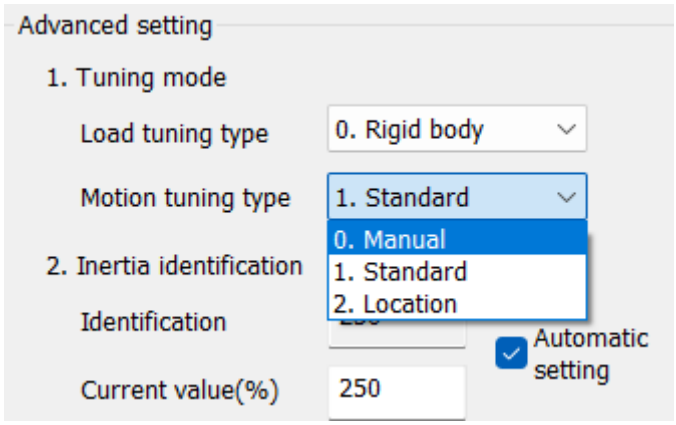

Motion Tuning Type:

0: Manual (disables real-time auto adjustment)

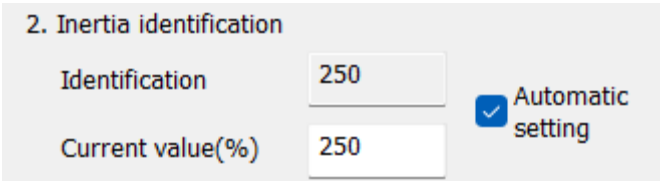
1: Standard (stable mode, no gain switching)

2: Location (for variable loads, e.g., horizontal axis)

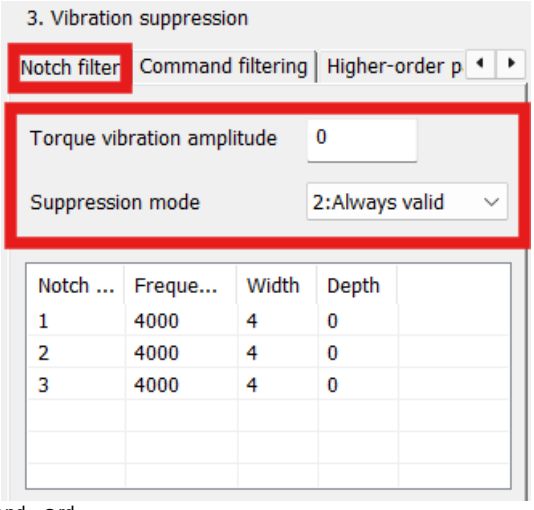
The main difference between standard and positioning is that there is no gain switching in standard mode.




<2> Inertia identification:
Enabled by default.
Identified %: flashes yellow when successful
Current Value %: syncs with identified value if auto-set is checked; otherwise, manual input is allowed
If 'Automatic setting' is unchecked, the identification value will not be synchronized. You can manually set the current inertia ratio and press Enter to submit.
When 'Automatic setting' is checked, P00.04 is filled in based on the actual inertia identification value.
Unchecking 'Automatic setting' allows you to manually enter the inertia ratio based on the current value and press Enter to submit.




<3> Vibration suppression:
Notch Filter:
Torque Vibration Amplitude, 0 = sensitive, 100% = no detection. Adjust the value based on on-site judgment to determine whether it is vibration.
Suppression Mode, range from 0 to 2:
0: Close
1: Valid once
2: Always valid

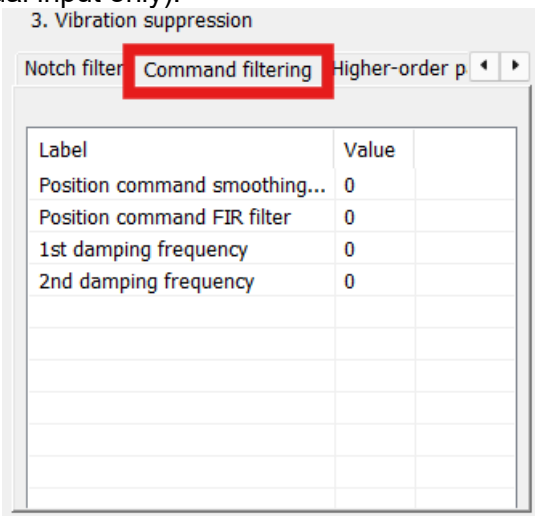



- Notch Filters: 1st, 2nd, 3rd

- Frequency: 50–2000
- Width: 0–20
- Depth: 0–99

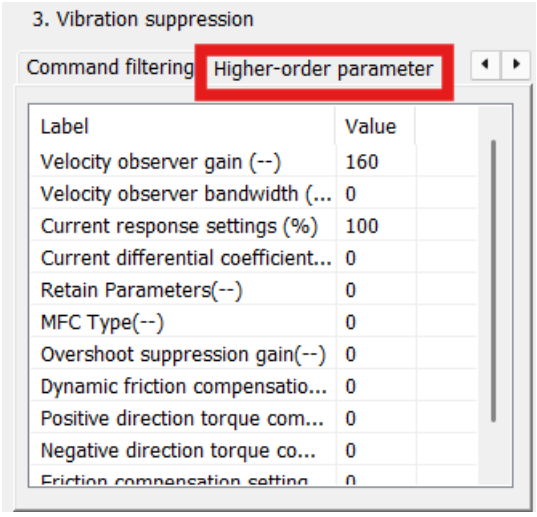
Frequency changes flash yellow.

Command Filtering (manual input only):



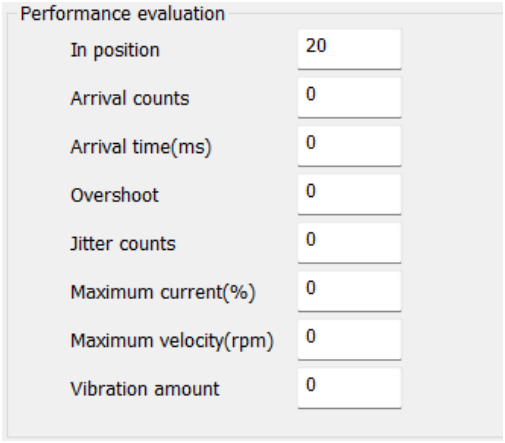

Position Command Smoothing Filter: 0–32767 (unit: 0.1 ms). Setting this parameter too high may prolong the setting time.
Position Command FIR Filter: 0–10000 (unit: 0.1 ms). Setting this parameter too high may prolong the setting time.
1st Damping Frequency: 10–2000 (unit: 0.1 Hz). Set the damping frequency to suppress end vibration.
2nd Damping Frequency: 10–2000 (unit: 0.1 Hz). Set the damping frequency to suppress end vibration.

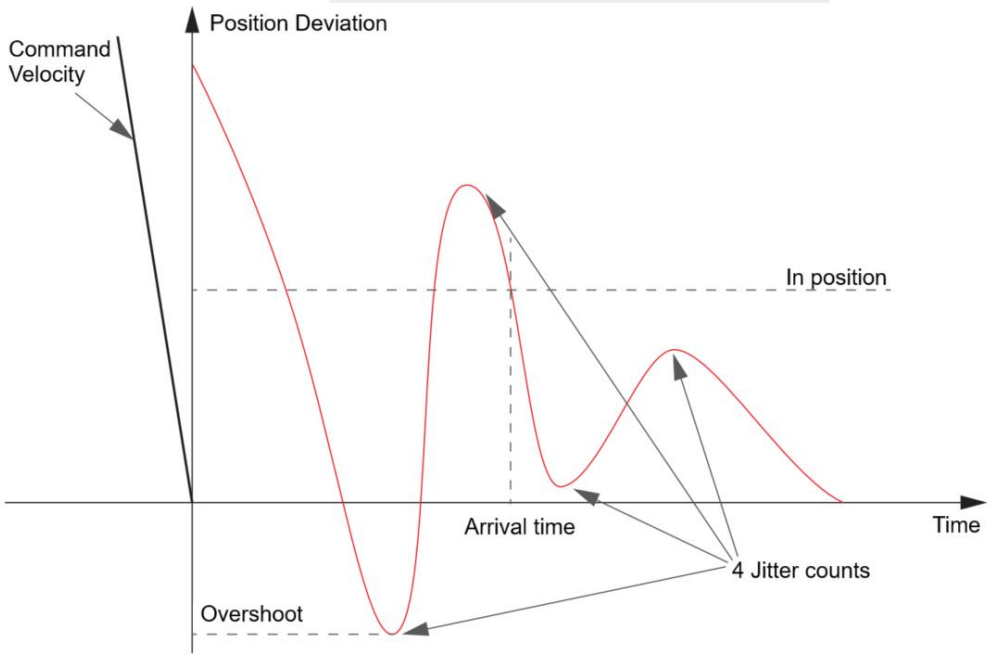
High-Order Parameter:




Velocity Observer Gain: The default stable gain, set to 1 to disable the observer.
Velocity Observer Bandwidth: The default is stable filtering, set to 1 to turns off the observer.
Current Response Settings: Ratio of effective values of driver current loop related parameters, range 50~100, unit %

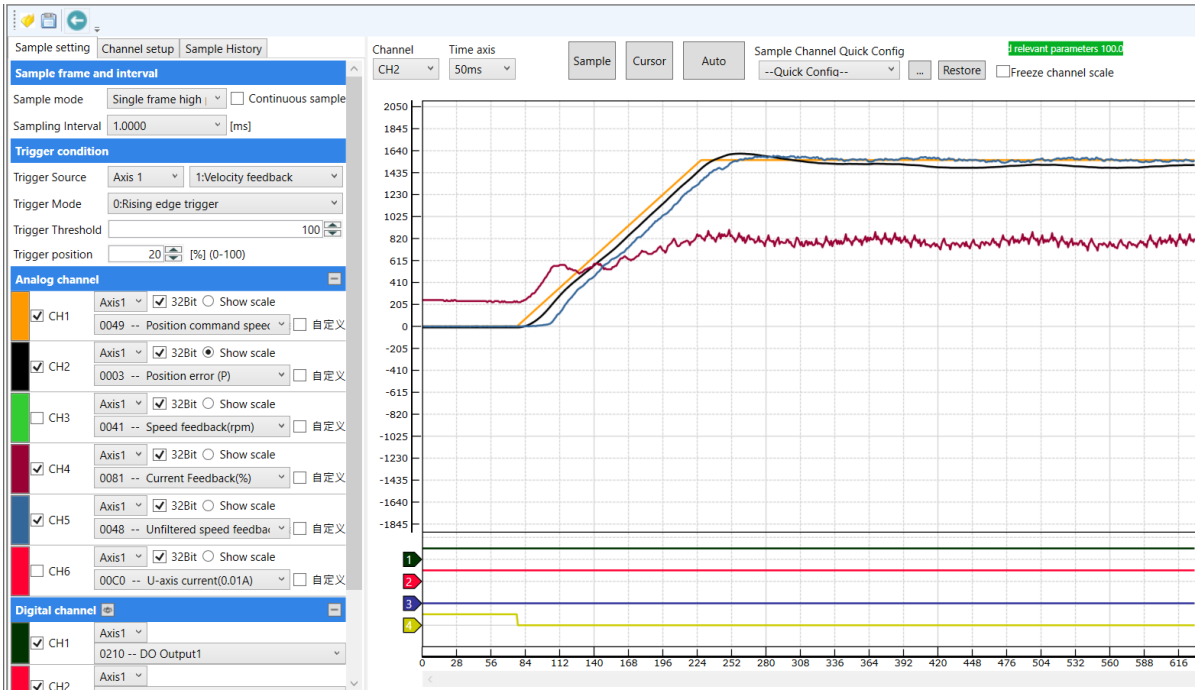
5. Performance Evaluation
Check overshoot and jitter count:



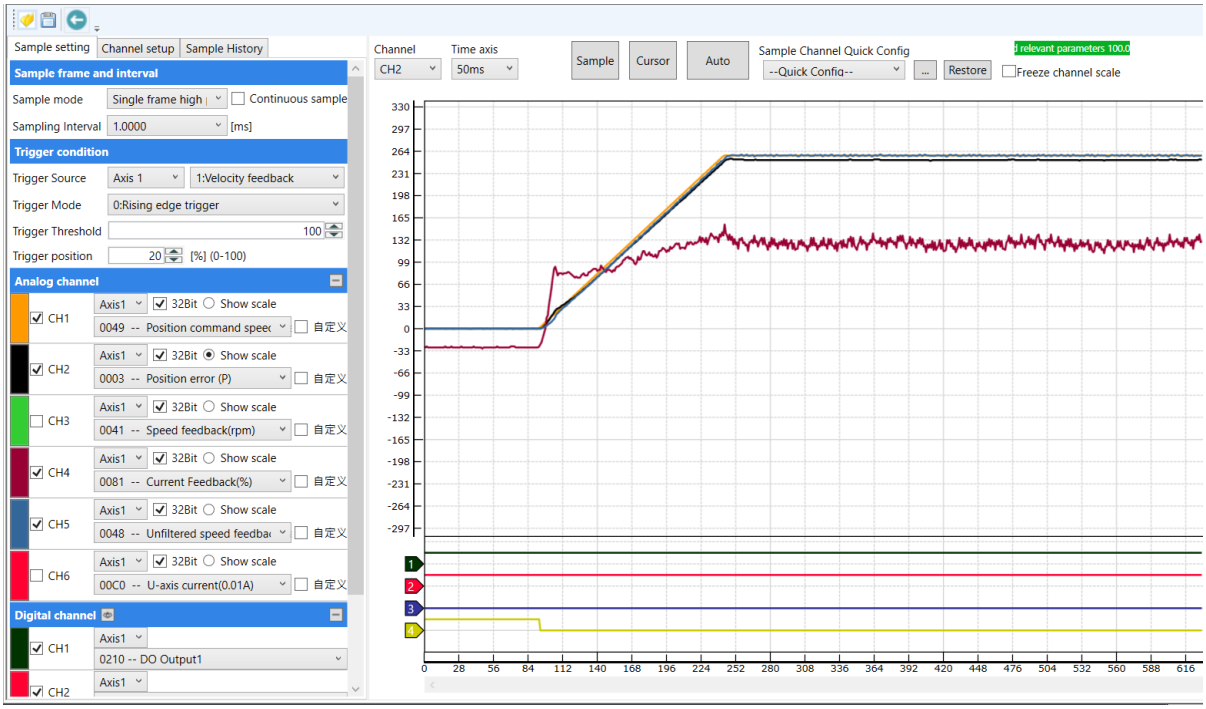




In position: allowable deviation between target and actual speed.
Aval counts: number of times target is reached.
Overshoot: overshoot between the target value and the actual measured value. <10% is displayed in white, 10% ~ 100% is displayed in yellow, >100% is displayed in red.
Jitter counts: the number of vibrations detected. If the number of vibrations = 1, the color turns yellow; if the number of vibrations > 1, the color turns red. The default color is white.
Maximum current: percentage of maximum current.
Increase stiffness and gain, use simple or advanced settings, and observe waveform to achieve optimal results.

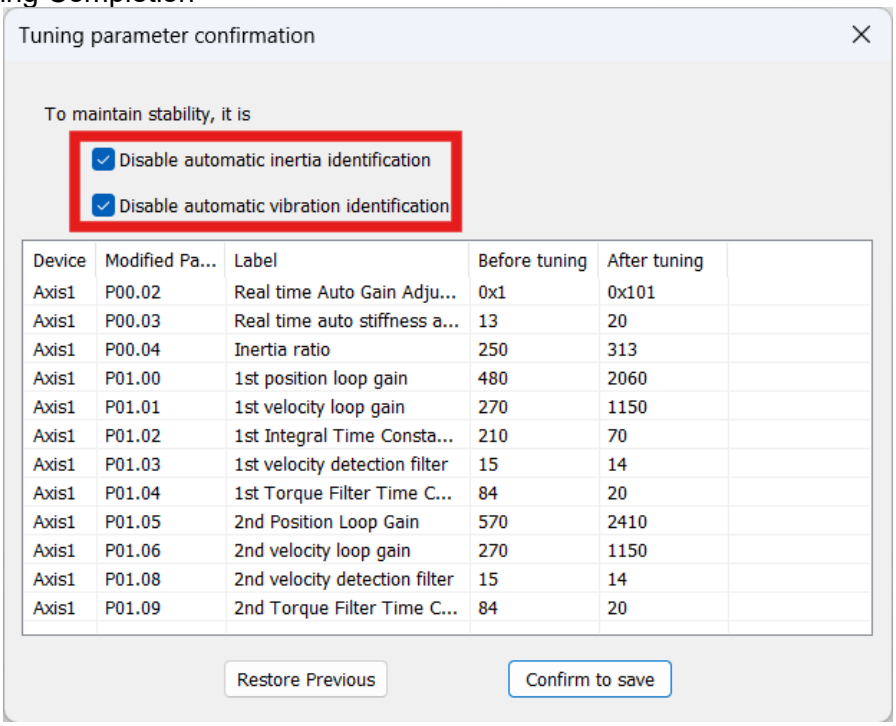
Stiffness = 11:




Stiffness = 20:



6. After Tuning Completion




| Device | Modified Pa... | Label | Before tuning | After tuning |
|---|---|---|---|---|
| Axis1 | P00.02 | Real time Auto Gain Adju... | 0x1 | 0x101 |
| Axis1 | P00.03 | Real time auto stiffness a... | 13 | 20 |
| Axis1 | P00.04 | Inertia ratio | 250 | 313 |
| Axis1 | P01.00 | 1st position loop gain | 480 | 2060 |
| Axis1 | P01.01 | 1st velocity loop gain | 270 | 1150 |
| Axis1 | P01.02 | 1st Integral Time Consta... | 210 | 70 |
| Axis1 | P01.03 | 1st velocity detection filter | 15 | 14 |
| Axis1 | P01.04 | 1st Torque Filter Time C... | 84 | 20 |
| Axis1 | P01.05 | 2nd Position Loop Gain | 570 | 2410 |
| Axis1 | P01.06 | 2nd velocity loop gain | 270 | 1150 |
| Axis1 | P01.08 | 2nd velocity detection filter | 15 | 14 |
| Axis1 | P01.09 | 2nd Torque Filter Time C... | 84 | 20 |

Disable automatic inertia identification: After automatic parameter tuning, turn off automatic inertia identification.
Disable automatic vibration identification: After automatic parameter tuning, turn off automatic vibration identification.
Restore Previous: Do not save the parameters after automatic tuning
Confirm to save: Save the parameters after automatic tuning

## 8.4 Auto Gain Adjustment

This function will measure real time mechanical properties and set gain values in accordance to mechanical stiffness. Can be used in any control mode

### Scope of application

Auto gain adjustment can be used in any control mode

| Conditions to implement | |
|---|---|
| Control mode | Please refer to P00.02 for detailed explanations. Auto gain adjustment is different for each control mode. |
| Other | ・Servo driver needs to be enabled<br>・Set up input signals such as deviation counter clearing and command input; Torque limit and other motion control parameters to enable motor to move normally without obstacles. |

### Precautions

Under certain conditions, external factors might affect automatic gain adjustment functions. If the conditions as listed exist or unfavorable, please disable the automatic gain adjustment function.

| Affecting conditions | |
|---|---|
| Load inertia | ・If inertia is less than 3 times or over 30 times of rotor inertia.<br>・Changes in load inertia |
| Load | ・Very low mechanical stiffness<br>・If gear backlash is a non-linear property |
| Motion | ・Velocity less than 100r/min or continuously in low velocity mode<br>・Acc-/deceleration to 2000r/min within 1s. 。<br>・Acc-/deceleration torque lower than eccentric load, frictional torque.<br>・Velocity < 100r/min, acc-/deceleration to 2000r/min within 1s but not longer than 50ms |

### Operation Method

To enable automatic gain adjustment:

1) Disable the servo driver.
2) Set P00.02 = 0x01/0x11 or 0x02/0x12. Then, set P00.03
3) Servo enabled. Run motion as normal to start measuring load properties. Related parameters will be automatically set.
4) Increase motor responsiveness by increasing P00.03. Please check if there is any vibration before setting P00.03 to max. value.
5) Save the parameters.

Please take note:
- Please stop the motor before modifying any parameter. P00.02 only takes effect after saving modified parameter values into EEPROM and restarting the driver.
- After enabling the servo driver for the first time or when increasing P00.03, mechanical noise or vibration might occur for the first run, it is normal. If it persists, please set P00.03 to lower value.

### Parameters that change in accordance to real time gain adjustment

There are 2 types of auto gain adjustment methods:
Standard mode (P00.02 = 0x__1): Basic mode, prioritizing on stability, gain switching is disabled. Actual gain auto adjustment as accordance to P00.03.

Gain related parameters that change as shown below.

| Parameter | Label | Remarks |
|---|---|---|
| P01.00 | 1st position loop gain | When stiffness setting is valid, parameters will be updated to match stiffness value |
| P01.01 | 1st velocity loop gain | |
| P01.02 | 1st velocity integral time constant | |
| P01.03 | 1st velocity detection filter | |
| P01.04 | 1st torque filter | |

Gain related that doesn't change

| Parameter | Label | Reference value | Remarks |
|---|---|---|---|
| P01.10 | Velocity feedforward gain constant | 300（0.1%） | Doesn't change according to changes in stiffness |

Positioning mode (P00.02=0x2): Prioritizing positioning. Usually applies on horizontal axis without variable load, ball screws with lower friction, gain switching enabled. Stiffness level of 2nd position loop gain is 1 level higher than 1st position.

| Parameters | Label | Remarks |
|---|---|---|
| P01.00 | 1st position loop gain | When stiffness setting is valid, parameters will be updated to match stiffness value |
| P01.01 | 1st velocity loop gain | |
| P01.02 | 1st velocity integral time constant | |
| P01.03 | 1st velocity detection filter | |
| P01.04 | 1st torque filter | |
| P01.05 | 2nd position loop gain | |
| P01.06 | 2nd velocity loop gain | |
| P01.08 | 2nd velocity detection filter | |
| P01.09 | 2nd torque filter | |

If auto gain adjustment is valid, the parameters listed above can't be manually modified. Only when P00.02 = 0x00 or 0x10, can the gain related parameters be modified manually.

Gain related parameters that don't change with the real time gain adjustment

| Parameter | Label | Reference value |
|---|---|---|
| P01.07 | Second velocity loop integral constant | 1000ms |
| P01.10 | Velocity feedforward gain constant | 30% |
| P01.11 | Velocity feedforward filter time constant | 0.50ms |
| P01.12 | Torque feedforward gain | 0 |
| P01.13 | Torque feedforward filter time constant | 0 |
| P01.15 | Position control gain switching mode | 10 |
| P01.17 | Position control switching level | 50 |
| P01.18 | Position control switching hysteresis | 33 |
| P01.19 | Position gain switching time | 33ms |

Standard mode + large inertia free adjustment (P00.02 = 0x 11)

The standard mode large inertia free adjustment mode in real-time automatic gain adjustment is to add the function of large inertia free adjustment on the basis of the original standard mode. Before setting the rigidity, there is no need to set the inertia ratio. According to P00.03 "Machine Rigidity Setting", update the following basic gain setting parameters.

| Parameter | Label | Remarks |
|---|---|---|
| P01.00 | 1st position loop gain | When stiffness setting is valid, parameters will be updated to match stiffness value |
| P01.01 | 1st velocity loop gain | |
| P01.02 | 1st velocity integral time constant | |
| P01.03 | 1st velocity detection filter | |
| P01.04 | 1st torque filter | |

Gain related that doesn't change

| Parameter | Label | Reference value | Remarks |
|---|---|---|---|
| P01.10 | Velocity feedforward gain constant | 300（0.1%） | Doesn't change according to changes in stiffness |

Positioning mode large inertia free adjustment (P00.02 = 0x12)

The standard mode large inertia free adjustment mode in real-time automatic gain adjustment is to add the function of large inertia free adjustment on the basis of the original standard mode, which can be more than 30 times the inertia and the inertia ratio parameter free adjustment. Before setting the rigidity, it is not necessary to set the inertia ratio. Update the following basic gain setting parameters according to P00.03 "machine rigidity setting.

| Parameters | Label | Remarks |
|---|---|---|
| P01.00 | 1st position loop gain | When stiffness setting is valid, parameters will be updated to match stiffness value |
| P01.01 | 1st velocity loop gain | |
| P01.02 | 1st velocity integral time constant | |
| P01.03 | 1st velocity detection filter | |
| P01.04 | 1st torque filter | |
| P01.05 | 2nd position loop gain | |
| P01.06 | 2nd velocity loop gain | |
| P01.08 | 2nd velocity detection filter | |
| P01.09 | 2nd torque filter | |

Gain related parameters that don't change with the real time gain adjustment

| Parameter | Label | Reference value |
|---|---|---|
| P01.07 | Second velocity loop integral constant | 1000ms |
| P01.10 | Velocity feedforward gain constant | 30% |
| P01.11 | Velocity feedforward filter time constant | 0.50ms |
| P01.12 | Torque feedforward gain | 0 |
| P01.13 | Torque feedforward filter time constant | 0 |
| P01.15 | Position control gain switching mode | 10 |
| P01.17 | Position control switching level | 50 |
| P01.18 | Position control switching hysteresis | 33 |
| P01.19 | Position gain switching time | 33ms |

Types of mechanical load

Please select mechanical load according to load-inertia ratio and mechanical structures:

| Load types | Description |
|---|---|
| **0x00_**: Rigid structure | When load is **rigid** with relatively **low inertia**. Gain adjustments prioritize **system responsiveness**. Structures including high P0Ecision reducer, lead screws, mechanical gears, etc. |
| **0x01_**: High inertia | **High load inertia** (10 times or above). Gain adjustments prioritize **operation stability and responsiveness**. Recommended mechanical stiffness level **not more than 15**. |
| **0x02_**: Flexible structure | When load is **flexible** with relatively **high inertia**. Gain adjustments prioritize **operation stability**. Structures including long transportation belt or chain. |

*Structures with high inertia can have better performance if inertia ratio is set accurately.*

| P00.02 | Label | Real time Auto Gain Adjusting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0x0~0xFF | Unit | — | Default | 0x1 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0005 | | |
| | Valid | Immediate | | | | | | |

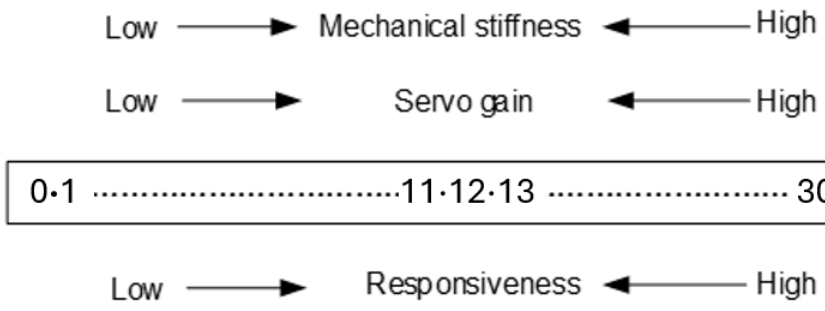
| Data bits | Category | Settings | Application |
|---|---|---|---|
| 0x00_ | Motion setting mode | Used to set motion setting mode, which can be selected according to the motion characteristics or setting requirements. Generally, it is recommended to select mode 1 with good generality when there is 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 | P00.03 invalid. Gain value must be adjusted manually and accordingly. |
| | | 1: Standard | P00.03 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 | P00.03 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 P06.07 |
| x0_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-P0Ecision 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 |

| P00.03 | Label | Real time auto stiffness adjusting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0 ~ 31 | Unit | — | Default | 11 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0007 | | |
| | Valid | Immediate | | | | | | |



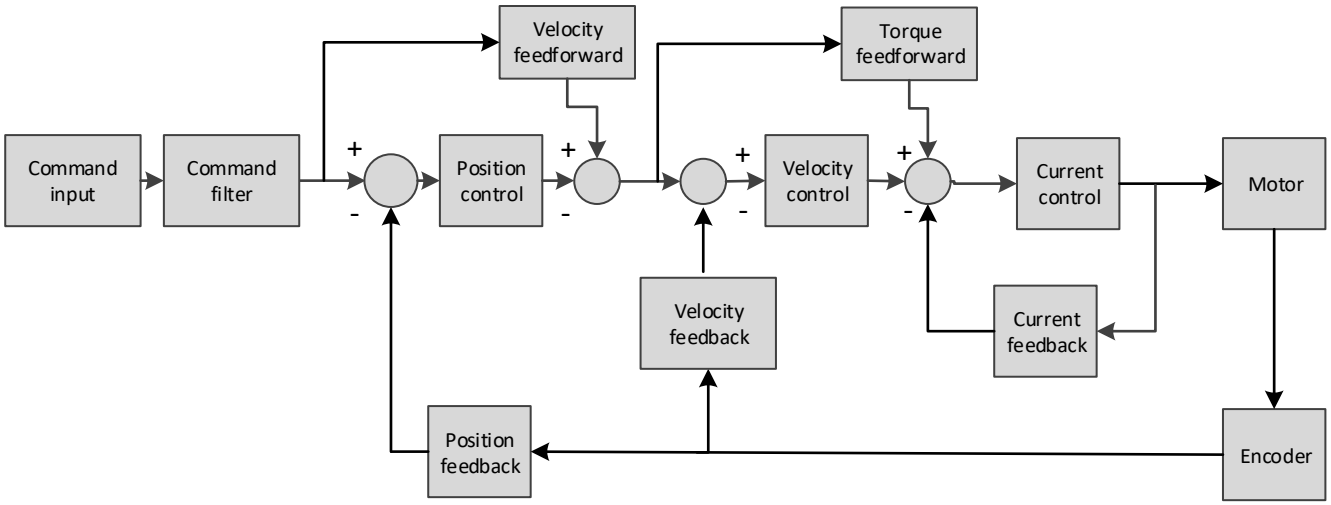

Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Recommend to set to around 15 with motor with high inertia.

Gain parameters settings table

| Stiffness | 1st gain | | | | 2nd gain | | | |
|---|---|---|---|---|---|---|---|---|
| | P01.00 | P01.01 | P01.02 | P01.04 | P01.05 | P01.06 | P01.07 | P01.09 |
| | 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) |
| 0 | 20 | 15 | 3700 | 1500 | 25 | 15 | 10000 | 1500 |
| 1 | 25 | 20 | 2800 | 1100 | 30 | 20 | 10000 | 1100 |
| 2 | 30 | 25 | 2200 | 900 | 40 | 25 | 10000 | 900 |
| 3 | 40 | 30 | 1900 | 800 | 45 | 30 | 10000 | 800 |
| 4 | 45 | 35 | 1600 | 600 | 55 | 35 | 10000 | 600 |
| 5 | 55 | 45 | 1200 | 500 | 70 | 45 | 10000 | 500 |
| 6 | 75 | 60 | 900 | 400 | 95 | 60 | 10000 | 400 |
| 7 | 95 | 75 | 700 | 300 | 120 | 75 | 10000 | 300 |
| 8 | 115 | 90 | 600 | 300 | 140 | 90 | 10000 | 300 |
| 9 | 140 | 110 | 500 | 200 | 175 | 110 | 10000 | 200 |
| 10 | 175 | 140 | 400 | 200 | 220 | 140 | 10000 | 200 |
| 11 | 320 | 180 | 310 | 126 | 380 | 180 | 10000 | 126 |
| 12 | 390 | 220 | 250 | 103 | 460 | 220 | 10000 | 103 |
| 13 | 480 | 270 | 210 | 84 | 570 | 270 | 10000 | 84 |
| 14 | 630 | 350 | 160 | 65 | 730 | 350 | 10000 | 65 |
| 15 | 720 | 400 | 140 | 57 | 840 | 400 | 10000 | 57 |
| 16 | 900 | 500 | 120 | 45 | 1050 | 500 | 10000 | 45 |
| 17 | 1080 | 600 | 110 | 38 | 1260 | 600 | 10000 | 38 |
| 18 | 1350 | 750 | 90 | 30 | 1570 | 750 | 10000 | 30 |
| 19 | 1620 | 900 | 80 | 25 | 1880 | 900 | 10000 | 25 |
| 20 | 2060 | 1150 | 70 | 20 | 2410 | 1150 | 10000 | 20 |
| 21 | 2510 | 1400 | 60 | 16 | 2930 | 1400 | 10000 | 16 |
| 22 | 3050 | 1700 | 50 | 13 | 3560 | 1700 | 10000 | 13 |
| 23 | 3770 | 2100 | 40 | 11 | 4400 | 2100 | 10000 | 11 |
| 24 | 4490 | 2500 | 40 | 9 | 5240 | 2500 | 10000 | 9 |
| 25 | 5000 | 2800 | 35 | 8 | 5900 | 2800 | 10000 | 8 |
| 26 | 5600 | 3100 | 30 | 7 | 6500 | 3100 | 10000 | 7 |
| 27 | 6100 | 3400 | 30 | 7 | 7100 | 3400 | 10000 | 7 |
| 28 | 6600 | 3700 | 25 | 6 | 7700 | 3700 | 10000 | 6 |
| 29 | 7200 | 4000 | 25 | 6 | 8400 | 4000 | 10000 | 6 |
| 30 | 8100 | 4500 | 20 | 5 | 9400 | 4500 | 10000 | 5 |
| 31 | 9000 | 5000 | 20 | 5 | 10500 | 5000 | 10000 | 5 |

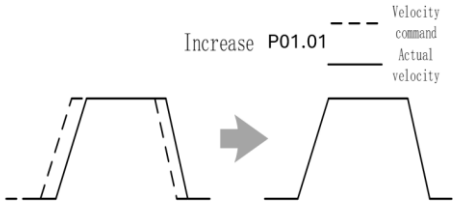
## 8.5 Manual Gain Adjustment

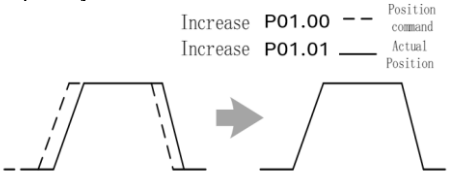
Due to limitation of load conditions, automatic gain adjustment might not achieve expected performance. Control can be improved through manual gain adjustment
The servo system is made up of 3 control loops. From outer to inner: position loop, velocity loop, current loop as shown in the diagram below.




Inner control loop demands higher responsiveness. In order to avoid system instability, please tune in accordance with 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)

| Step | Parameter | Label | Tuning method |
|---|---|---|---|
| 1 | P01.01 | Velocity loop gain | Determine if velocity loop is able to follow the changes in velocity command at highest frequency. If P00.04 is set correctly, velocity loop highest following frequency = P01.01<br><br><br>Increase P01.01 provided there is no noise or vibration to reduce positioning time, better velocity stability and following. Reduce P01.01 if there is mechanical noise.<br>Set up vibration suppression if there is mechanical vibration. |

| Step | Parameter | Label | Tuning method |
|---|---|---|---|
| 2 | P01.02 | Velocity loop integral time constant | To eliminate velocity loop deviation<br><br>Velocity loop integral time constant (ms) = 4000 /（2*π*Velocity loop gain(Hz)）<br>Reduce P01.02 to reduce positioning time. Mechanical vibration might occur if set value is too low; Velocity loop deviation can't be zeroed if set value is too high.<br>Reduce P01.02 to increase systemic stiffness, reduce deviation, provided that there is no resonance or noise in the system. If load-inertia ratio is high or resonance exists in mechanical system, increase P01.02. |
| 3 | P01.00 | Position loop gain | Determine if position loop is able to follow the changes in position command at highest frequency. Position loop highest following frequency = P01.00<br><br>Increase P01.00 to reduce position following deviation, reduce positioning time provided that there is no resonance or noise in the system. If P01.00 is set too high, it might cause trembling in the mechanical system or positioning overshoot |
| 4 | P01.04 | 1st torque filter time constant | Eliminate high frequency noise, suppress mechanical resonance.<br><br>System response improves with lower set value but there is mechanical limitations; High frequency resonance suppression improves with higher set value, but it might cause reduction in response bandwidth and phase margin, resulting in system turbulence.<br>Torque filtering frequency is 4 times higher than velocity loop max following frequency:<br>1000000/(2π×P01.04) ≥ P01.01×4<br>For example, when P01.01=180（0.1 Hz）,<br>P01.04 should satisfy： P01.01≤221（0.01ms） |

1. If vibration occurs with increasing P01.01, please modify P01.04 to suppress vibration.
2. If the parameters are set too high, it might cause current loop response to reduce.
3. To suppress vibration at stop, increase P01.01 and decrease P01.04.
4. Decrease P01.04 if motor vibrates too much at rest.
5. P01.04 cannot be set to overly high value as it might cause control system instability because the torque loop response is much higher than velocity loop.

For servo gain, if any one of the parameters is changed, please modify other gain related parameters accordingly. Make sure to change at around 5% and follow the rules as below.

1. Increase responsiveness
   1) Reduce torque command filter time
   2) Increase velocity loop gain
   3) Decrease velocity loop integral time
   4) Increase position loop gain
2. Decrease responsiveness, prevent vibration and overshoot
   1) Reduce position loop gain
   2) Increase velocity loop integral time
   3) Reduce velocity loop gain
   4) Increase torque filter time

### 8.5.1 Parameters Adjustment Under Different Control Modes

Under different control modes, parameters adjustment must be adjusted in this order: “Inertia measuring” -> “Auto gain adjustment”-> “Manual gain adjustments”

Position control mode

Set load-inertia ratio P00.04 after inertia determination.

| No. | Parameter | Label |
|---|---|---|
| 1 | P01.00 | 1st position loop gain |
| 2 | P01.01 | 1st velocity loop gain |
| 3 | P01.02 | 1st velocity integral time constant |
| 4 | P01.03 | 1st velocity detection filter |
| 5 | P01.04 | 1st torque filter time constant |
| 6 | P01.05 | 2nd position loop gain |
| 7 | P01.06 | 2nd velocity loop gain |
| 8 | P01.07 | 2nd velocity integral time constant |
| 9 | P01.08 | 2nd velocity detection filter |
| 10 | P01.09 | 2nd torque filter time constant |
| 11 | P01.10 | Velocity feedforward gain constant |
| 12 | P01.11 | Velocity feedforward filter time constant |
| 13 | P01.12 | Torque feedforward gain |
| 14 | P01.13 | Torque feedforward filter time constant |
| 15 | P01.15 | Position control gain switching mode |
| 16 | P01.17 | Position control switching level |
| 17 | P01.18 | Position control switching hysteresis |
| 18 | P01.19 | Position gain switching time |

1st and 2nd gain initial values are obtained by automatic gain adjustment

| No. | Parameter | Label |
|---|---|---|
| 1 | P01.00 | 1st position loop gain |
| 2 | P01.01 | 1st velocity loop gain |
| 3 | P01.02 | 1st velocity integral time constant |
| 4 | P01.03 | 1st velocity detection filter |
| 5 | P01.04 | 1st torque filter time constant |
| 6 | P01.05 | 2nd position loop gain |
| 7 | P01.06 | 2nd velocity loop gain |
| 8 | P01.07 | 2nd velocity integral time constant |
| 9 | P01.08 | 2nd velocity detection filter |
| 10 | P01.09 | 2nd torque filter time constant |

Manually adjusted gain parameters

| No. | Parameter | Label |
|---|---|---|
| 1 | P01.00 | 1st position loop gain |
| 2 | P01.01 | 1st velocity loop gain |
| 3 | P01.02 | 1st velocity integral time constant |
| 4 | P01.04 | 1st torque filter time constant |
| 5 | P01.10 | Velocity feedforward gain constant |
| 6 | P01.11 | Velocity feedforward filter time constant |

Velocity control mode

Velocity control mode parameters adjustment is pretty similar to position control mode. Except for position loop gain P01.00 and P01.05, velocity feedforward gain (P01.10)

Torque control mode

Parameters adjustment for torque control mode has to be differentiated into 2 conditions:

1. When actual velocity reaches velocity limit, adjustment will be as per velocity control mode. Motor will switch from torque control to velocity limit as velocity control.
2. When actual velocity doesn't reach velocity limit yet, Except for position loop gain, velocity loop gain and feedforward gain, parameter adjustments as per velocity control mode.

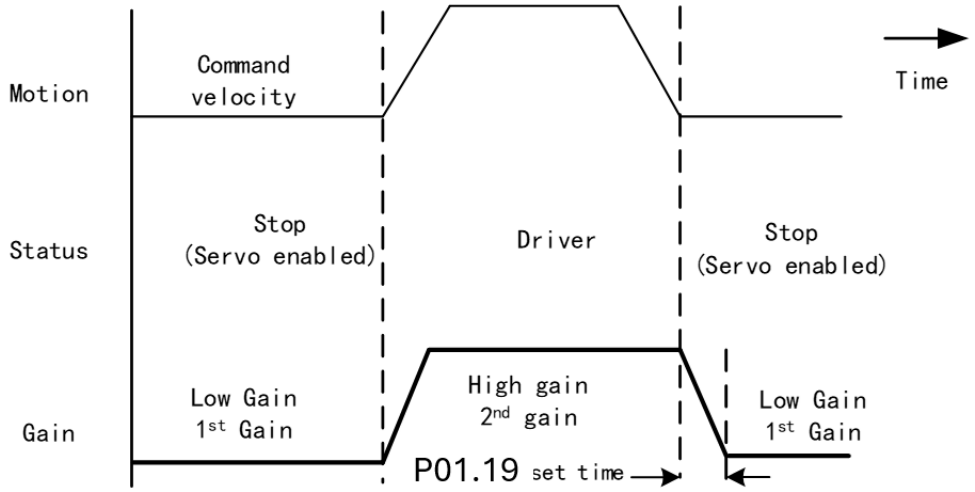
If there is no velocity limit and control is through torque command, please deactivate torque and notch filter, set velocity limit to max. value and increase velocity loop gain to as high as possible.

## 8.5.2 Gain Switching

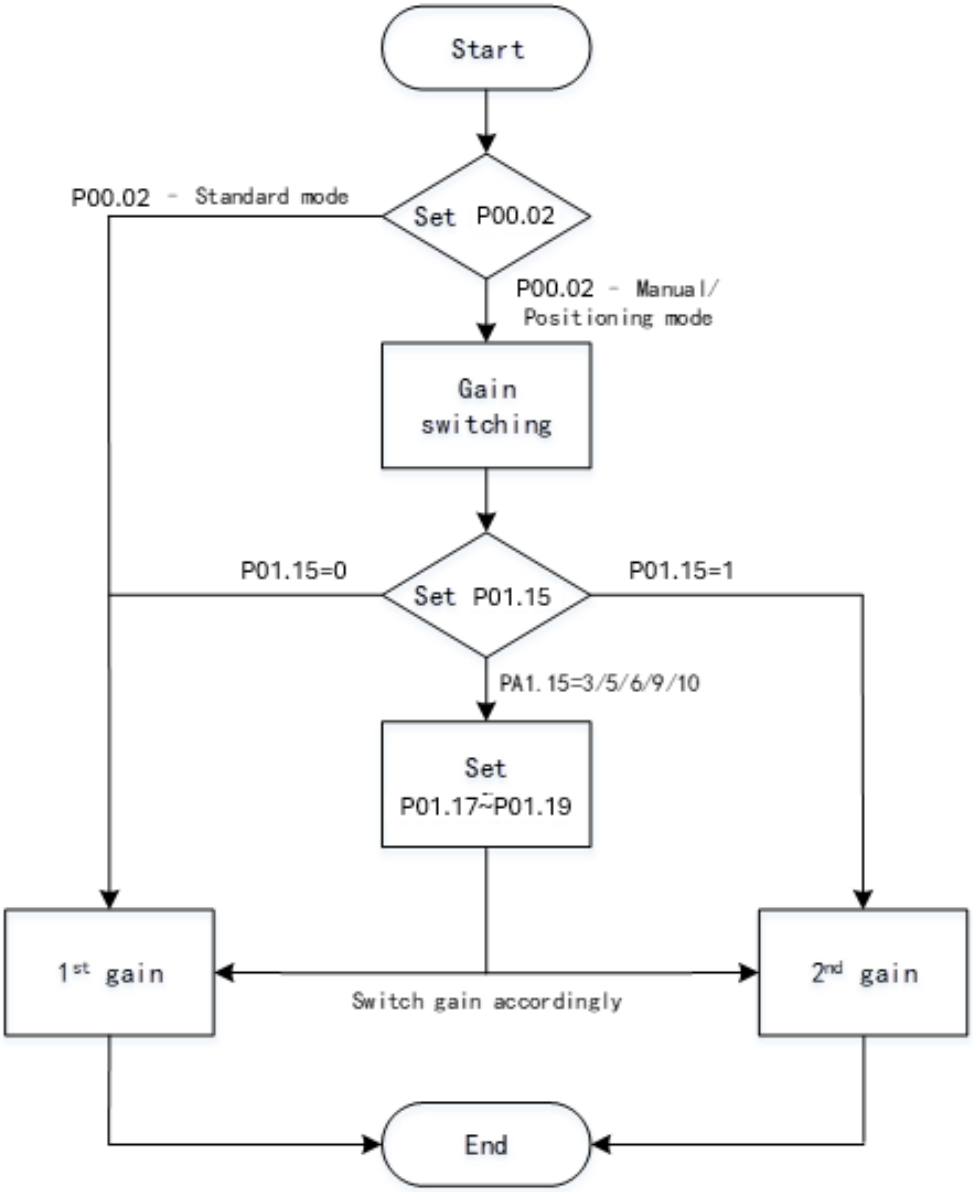
Gain switching function can be triggered internally in servo driver. Only valid under position or velocity control mode. Following effects can be realized by gain switching:

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.

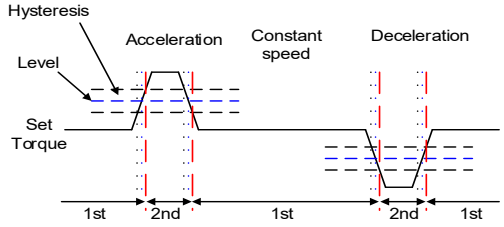
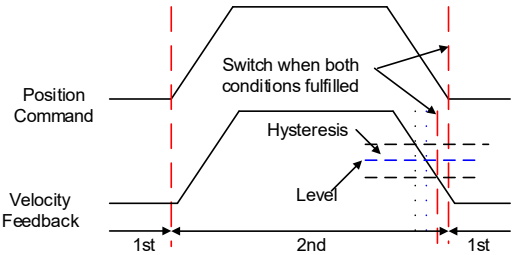



Related parameters on gain switching

| No. | Parameter | Label | Remarks |
|---|---|---|---|
| 1 | P01.15 | Position control gain switching mode | In position control, set P01.15=3、5、6、9、10.<br>In velocity control, set P01.15=3、5、9 |
| 2 | P01.17 | Position control level switching | Please set P01.17≥P01.18 |
| 3 | P01.18 | Position control hysteresis switching | If P01.17＜P01.18, driver will set P01.17＝P01.18 |
| 4 | P01.19 | Position gain time switching | |

| P01.15 | Label | Position control gain switching mode | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0～10 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x011F | | |
| | Valid | Immediate | | | | | | |

In position control, set the conditions for gain switching to be valid.

| Value | Condition | Gain switching condition |
|---|---|---|
| 【0】 | 1st gain fixed | Fixed on using 1st gain(P01.00-P01.04) |
| 1 | 2nd gain fixed | Fixed on using 2nd gain (P01.05-P01.09) |
| 2 | Gain switching input valid | · Gain switching input （GAIN）invalid: 1st gain.<br>· Gain switching input （GAIN）valid: 2nd gain.<br>**Default: 1st gain* |
| 3 | High command torque | Switch to 2nd gain when set torque command absolute value larger than (level + hysteresis) [%]<br>Switch to 1st gain when set torque command absolute value smaller than (level + hysteresis) [%]<br> |
| 4-9 | Reserved | Reserved |
| 10 | Pending position command +actual velocity | Valid for position control.<br>Switch to 2nd gain if position command ≠ 0<br>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)<br> |

*** Above 'level' and 'hysteresis' are in correspondence to P01.17 Position control gain switching level and P01.18 Hysteresis at position control switching.*

| P01.17 | Label | Position control gain switching level | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | Mode dependent | Default | 50 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0123 | | |
| | Valid | Immediate | | | | | | |

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

| Switching condition | Unit |
|---|---|
| Position | Encoder pulse count |
| Velocity | RPM |
| Torque | % |

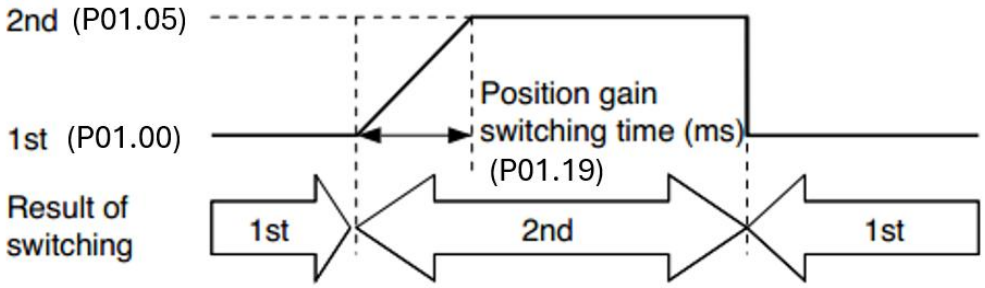
*Please set level ≥ hysteresis*

| P01.18 | Label | Hysteresis at position control switching | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | Mode dependent | Default | 33 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0125 | | |
| | Valid | Immediate | | | | | | |

To eliminate the instability of gain switching. Used in combination with P01.17 using the same unit.
If level< hysteresis, drive will set internally hysteresis = level.

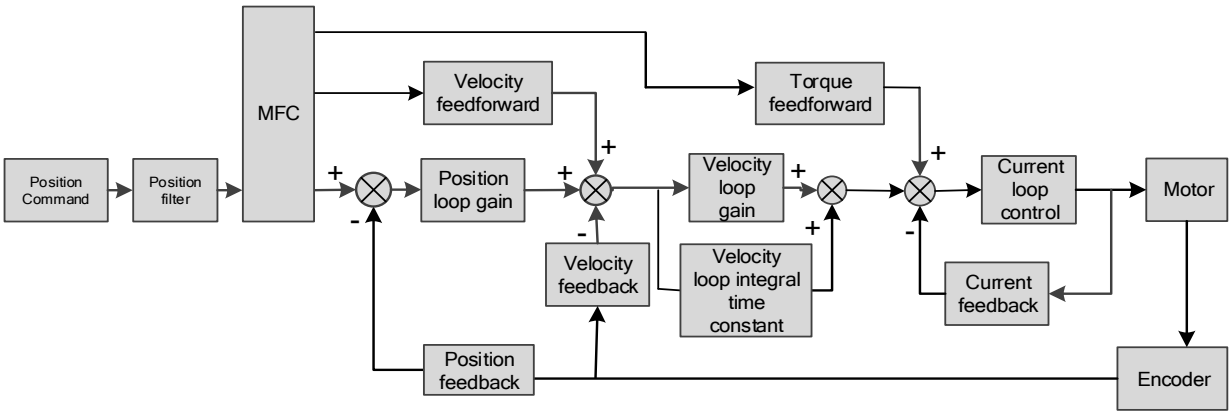
| P01.19 | Label | Position control switching time | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 33 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0127 | | |
| | Valid | Immediate | | | | | | |

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 (P01.00) <-> 2nd (P01.05)



## 8.5.3 Model Following Control (MFC)

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: Model reference 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.




**To adjust model following control**

Automatic adjustment

8. Set model following bandwidth P00.00 = 1 for automatic adjustment. Now, P00.00 = P01.01, model following bandwidth is adjusted automatically according to different velocity loop gain.

2. Manual adjustment

Please use 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.

**Steps to manually adjust**

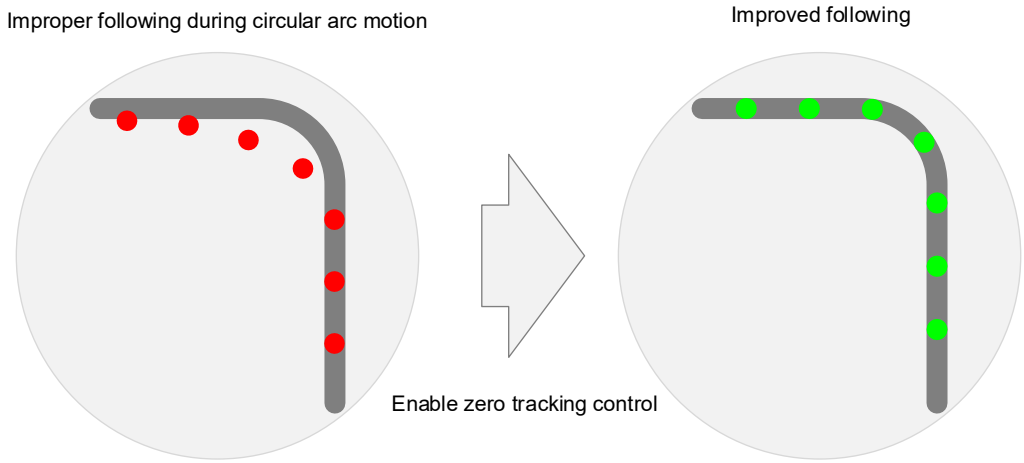
| Step | Content |
|---|---|
| 1 | Set up vibration suppression. |
| 2 | Set up the right inertia ratio. |
| 3 | Manually adjust gain. |
| 4 | Increase P00.00 provided that there is no overshoot and vibration. Usually, P00.00 ≥ P01.01 is recommended. |

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.

## 8.5.4 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.

9. ZTC is only available under position control mode.
10. ZTC can only be enabled when P00.00 is valid.
11. 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 |
|---|---|
| Electronic gear ratio | Electronic gear ratio should be lower to prevent current noise. |
| Mechanical structure | Better structural rigidity to prevent vibration. |
| Motion | 1. Command acceleration should be continuously low to prevent deviation change during drastic changes in acceleration.<br>2. Callback or overtravel might exist in positioning; sigmoid signal command might improve the problem. |

**Related parameters**

| Parameter | Label | Description |
|---|---|---|
| P02.50 | Model following control | 0：Model following control - Default<br>1：Zero tracking control |
| P02.53 | Dynamic friction compensation coefficient | Range: 0-1000, unit: 0.1%<br>Unit：Changes in torque with the effect of friction on rotational speed.<br>Only valid when MFC is activated |
| P00.00 | Model following bandwidth | If P00.00 = 0, MFC and ZTC is deactivated.<br>When P02.50 = 1 (Zero tracking control), higher bandwidth will improve following performance, but noise will be higher. |
| Set the following parameters to default | | |
| P02.51 | Velocity feedforward compensation coefficient | Default value = 0 for zero tracking control. |
| P02.52 | Torque feedforward compensation coefficient | |
| P02.54 | Overtravel time constant | |
| P02.55 | Overtravel suppression gain | |

### 8.5.5 Feedforward Gain

In position control or full closed loop control, velocity feedforward is calculated by comparing the velocity control command calculated internally and velocity command calculated from position feedback. Comparing to control only using feedback, this will reduce position deviation and increase responsiveness. Besides, by comparing the torque needed during motion from velocity control command in comparison with velocity feedback, torque feedback can be calculated to improve system responsiveness.

Servo driver uses 2 kinds of feedforward gain: Velocity feedforward and torque feedforward. Velocity feedforward can be used in position control mode. By using it, it can reduce position deviation during constant velocity and increase responsiveness to velocity command.
In position control mode, using feedforward gain, able to reduce position deviation during constant acceleration/deceleration and increase responsiveness to torque command.
In velocity control mode, using feedforward gain, able to reduce velocity deviation during constant velocity and increase responsiveness to torque command.

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.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P01.10** | **Label** | Velocity feed forward gain | | | **Valid mode(s)** | **P** | | |
| | **Range** | 0~1000 | **Unit** | 0.10% | **Default** | 300 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0115 | | |
| | **Valid** | Immediate | | | | | | |
| | Used for decreasing following error caused by low responsiveness of velocity loop. Might cause overshoot or increase in noise if set value is too high. | | | | | | | |
| **P01.11** | **Label** | Velocity feed forward filter time constant | | | **Valid mode(s)** | **P** | | |
| | **Range** | 0~6400 | **Unit** | 0.01ms | **Default** | 50 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0117 | | |
| | **Valid** | Immediate | | | | | | |

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 refer to the equation below.
Reduce P01.11 value to suppress velocity overshoot during deceleration;
Increase P01.11 value to suppress noise or vibration due to long driver control cycle or position command uneven pulse frequency.

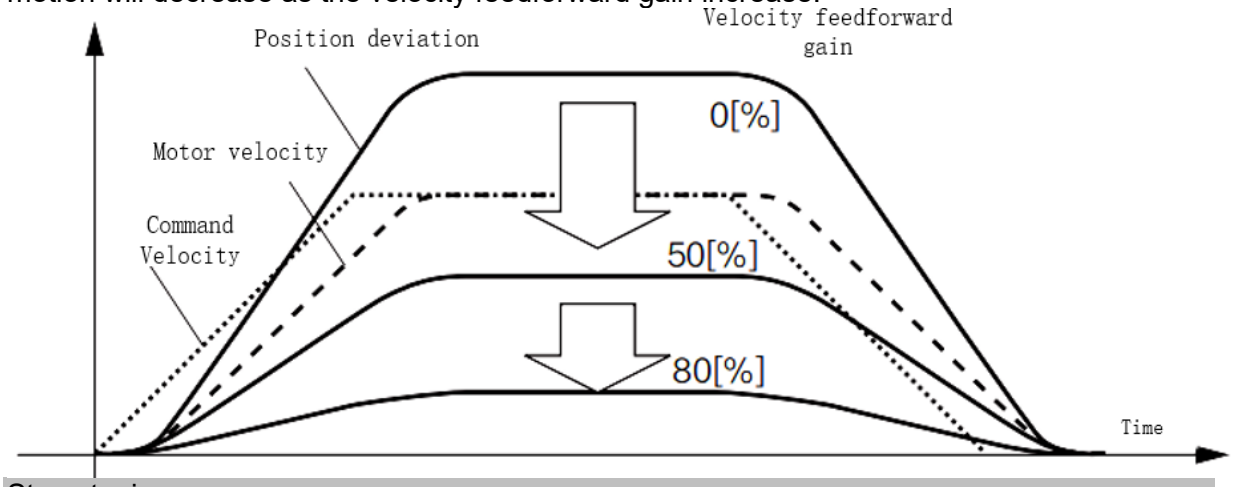
**<Application>**

Set P01.11 = 50（0.5ms）, improve feedforward effect by gradually increasing P01.10. The equation below can be used to determine the position deviation due to velocity feedforward gain under constant velocity.

Position deviation [Unit]= $\frac{Set\ velocity[\frac{Uint}{s}]}{Position\ loop\ gain[Hz]} x \frac{100 - Velocity\ feed\ foward\ gain[\%]}{100}$

## Velocity feedforward application

Set P01.11 to around 50 (0.5ms), then tune P01.10 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 tuning:

1. Increase P01.10 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
2. By reducing P01.11, 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 P01.11 or use position command filter (1 time delay/ FIR smoothing filter)

## Torque feedforward

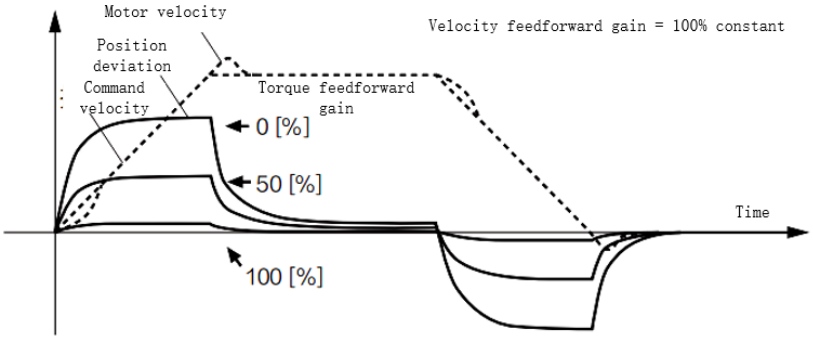
Position control mode: Torque feedforward can increase the responsiveness of torque command, decrease position deviation during constant acc-/deceleration.
Velocity control mode: Torque feedforward can increase the responsiveness of torque command, decrease velocity deviation during constant velocity.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **P01.12** | **Label** | Torque feed forward gain | | | **Valid mode(s)** | **P** | **S** |
| | **Range** | 0~1000 | **Unit** | 0.1% | **Default** | 0 | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0119 | |
| | **Valid** | Immediate | | | | | |
| | Before using torque feed forward, please set correct inertia ratio P00.04. 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. | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **P01.13** | **Label** | Torque feed forward filter time constant | | | **Valid mode(s)** | **P** | **S** |
| | **Range** | 0~6400 | **Unit** | 0.01ms | **Default** | 0 | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x011B | |
| | **Valid** | Immediate | | | | | |
| | Low pass filter to eliminate abnormal or high frequencies in torque feed forward command. Usually used when encoder has lower resolution or precision.<br>Noise reduces if torque feed forward filter time constant is set higher, but position deviation will increase at acceleration varied points.<br>**<Application>**<br>・ Set P01.13 = 50ms, please increase torque forward gain gradually to enable torque feedforward.<br>・By increasing P01.13, noise will reduce but position deviation will become larger. | | | | | | |

## Torque feedforward application

Set P01.13 to around 50 (0.5ms), then tune P01.10 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.



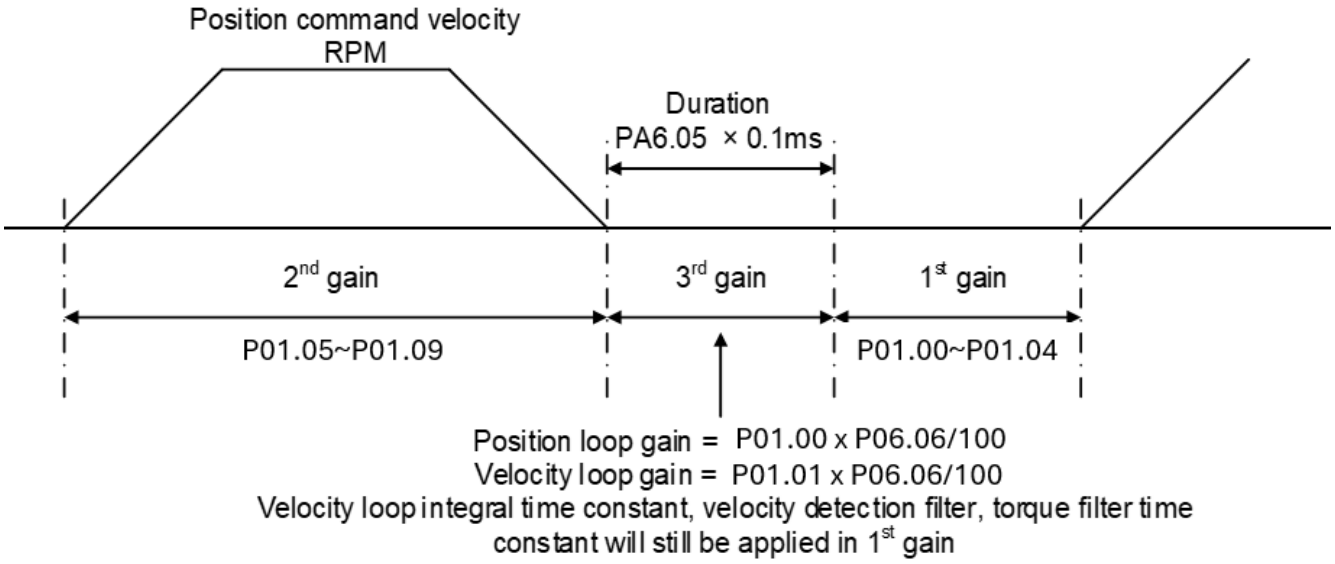

**Steps to tuning:**

1. Increase P01.12 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
2. By reducing P01.13, torque feedforward would be more effective and vice versa. P01.12 and P01.13 need to be tuned to a balance and reduce noise.

## 8.5.6 3rd Gain Switching

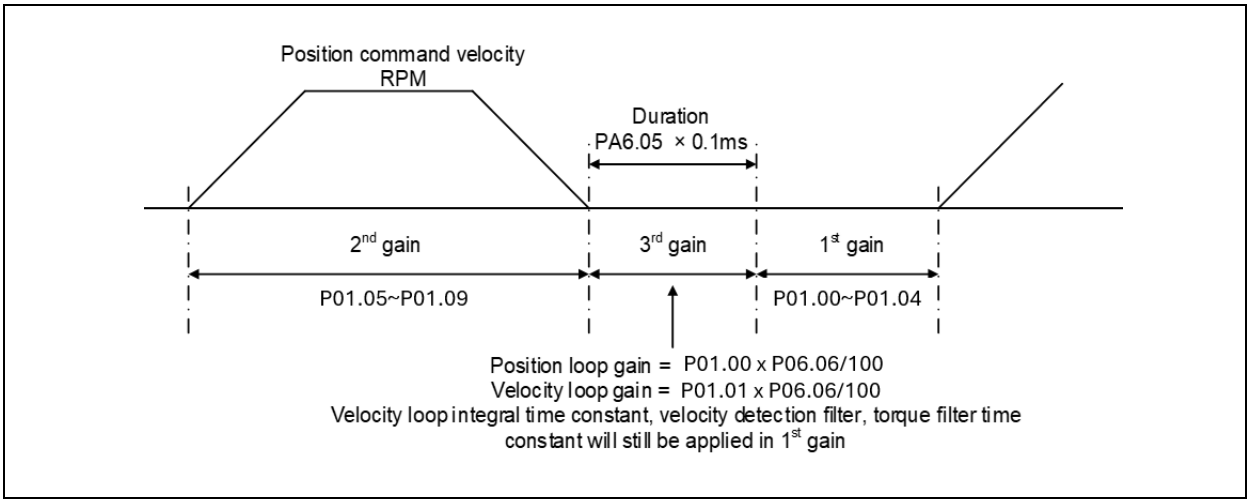
Besides switching between 1st and 2nd gain, a 3rd gain switching is added to set gain at the moment of stopping to reduce positioning time.
Only available under position mode and P06.05 ≠ 0, set P06.06 for 3rd gain value. When 2nd gain switches to 1st gain, it has to go through 3rd gain, switching time is set in P01.19.

Diagram below shows when P01.15 = 7.



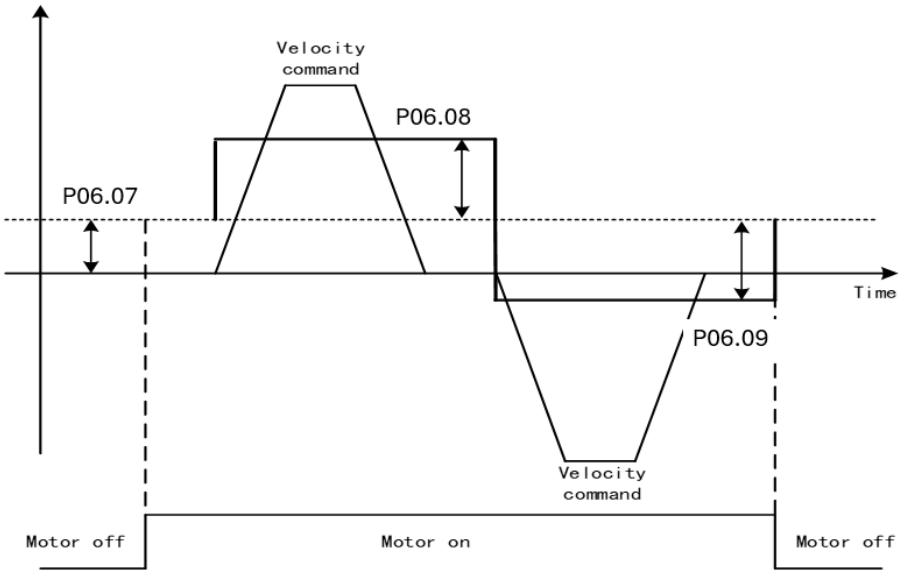

Related parameters

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P06.05** | **Label** | Position 3rd gain valid time | | | **Valid mode(s)** | **P** | | |
| | **Range** | 0~10000 | **Unit** | 0.1ms | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x060B | | |
| | **Valid** | Immediate | | | | | | |
| | To set time for 3rd gain to be valid<br>Only available in position mode<br>When not in use, set P06.05=0, P06.06=100 | | | | | | | |
| **P06.06** | **Label** | Position 3rd gain scale factor | | | **Valid mode(s)** | **P** | | |
| | **Range** | 50~1000 | **Unit** | 100% | **Default** | 100 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x060D | | |
| | **Valid** | Immediate | | | | | | |
| | Set up the 3rd gain by multiplying factor of the 1st gain<br>Below diagram is illustrated using P01.15 = 7.<br>3rd gain= 1st gain * P06.06/100<br>Only effective under position control mode. 3rd gain valid when P06.05 ≠ 0. Set 3rd gain value in P06.06. When 2nd gain switches to 1st gain, it will go through 3rd, switching time is set in P01.19. | | | | | | | |


Position command velocity
RPM
Duration
PA6.05 × 0.1ms
2nd gain
3rd gain
1st gain
P01.05~P01.09
P01.00~P01.04
Position loop gain = P01.00 x P06.06/100
Velocity loop gain = P01.01 x P06.06/100
Velocity loop integral time constant, velocity detection filter, torque filter time constant will still be applied in 1st gain

### 8.5.7 Friction Compensation Function

This function is to compensate for changes in load to reduce the effect of friction in motion. The compensation value is directional.




Vertically loaded axis: A constant eccentric load torque is applied on the motor. By adjusting P06.07, 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 P06.08 and P06.09.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P06.07** | **Label** | Torque command additional value | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | -100~100 | **Unit** | % | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x060F | | |
| | **Valid** | Immediate | | | | | | |
| | To set torque forward feed additional value of vertical axis.<br>Applicable for loaded vertical axis, compensate constant torque.<br>Application: When load move along vertical axis, pick any point from the whole motion and stop the load at that particular point with motor enabled but not rotating. Record output torque value from d04, use that value as torque command additional value (compensation value) | | | | | | | |
| **P06.08** | **Label** | Positive direction torque compensation value | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | -100~100 | **Unit** | % | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0611 | | |
| | **Valid** | Immediate | | | | | | |
| **P06.09** | **Label** | Negative direction torque compensation value | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | -100~100 | **Unit** | % | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0613 | | |
| | **Valid** | Immediate | | | | | | |
| | To reduce the effect of mechanical friction in the movement(s) of the axis.<br>Compensation values can be set according to needs for both rotational directions. | | | | | | | |

Applications:
1. When motor is at constant speed, d04 will deliver torque values.
Torque value in positive direction = T1;
Torque value in negative direction = T2

P06.08/P06.09 = $T_f = \frac{|T1 - T2|}{2}$

*Positive/Negative compensation corresponds to actual position feedback.*
*Positive torque compensation value = +(P06.08=+$T_f$)*
*Negative torque compensation value = -(P06.08=+$T_f$)*
*P06.08 =x, P06.09=y; friction compensation value = |x-y|/2*

## 8.6 Vibration Suppression

### 8.6.1 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:

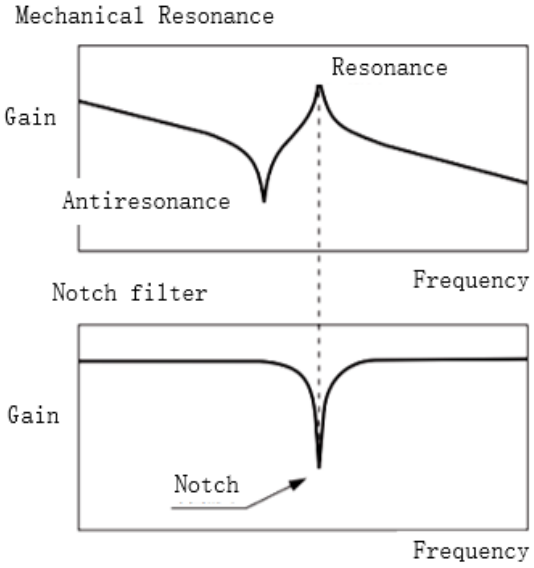
1. Torque command filter time constant

Set filter time constant to reduce gain at around resonant frequencies

Torque command filter blocked frequencies（Hz） fc=1/ [2π×PA1.04(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.




Notch filter bandwidth

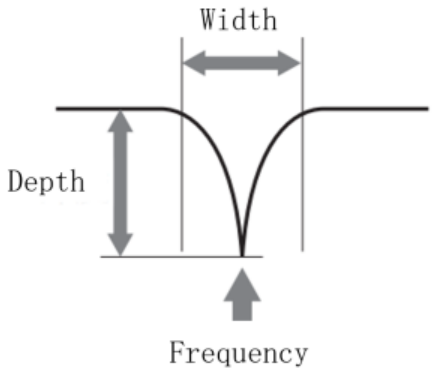
Center frequency of the notch filter, frequency bandwidth with reduction of -3dB.

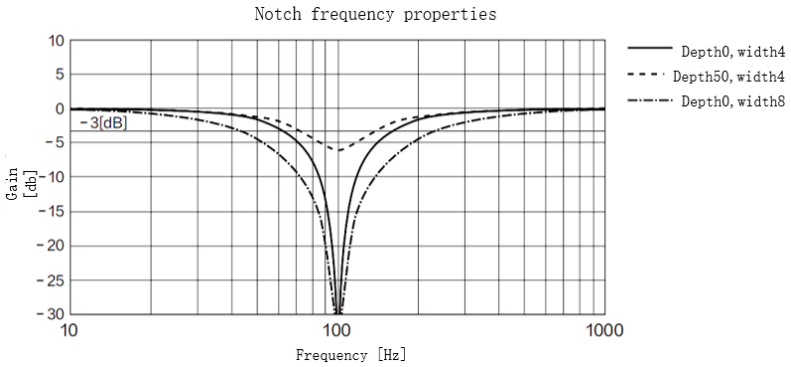
Notch filter depth

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 analytic result 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.

- To use notch filter

Automatic notch filter

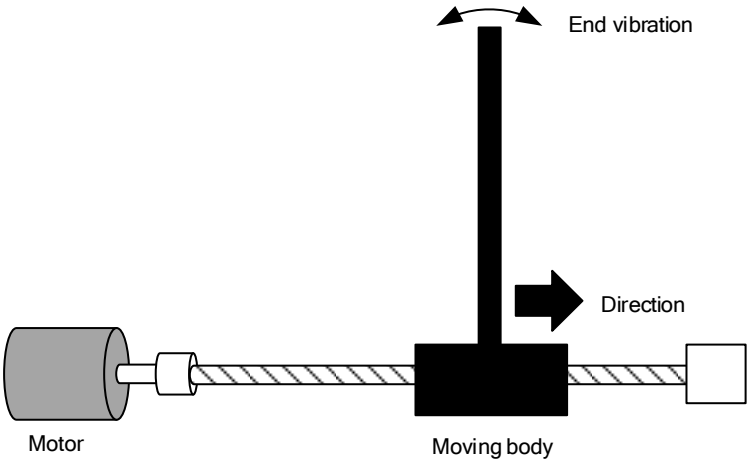
1. Set P02.00 = 1 for auto notch filter adjustment
2. If P00.03 stiffness increases, 3rd group of notch filter (P02.07/P02.08/P02.09) updates automatically when driver is enabled. P02.00 = 0, auto adjustments stop.
   If resonance is suppressed, it means self-adjusting notch filter is working. If resonance occurs when mechanical stiffness increases, please use manual notch filter, set filter frequency to actual resonant frequency.

Manual notch filter

There are 2 ways to use manual notch filter.

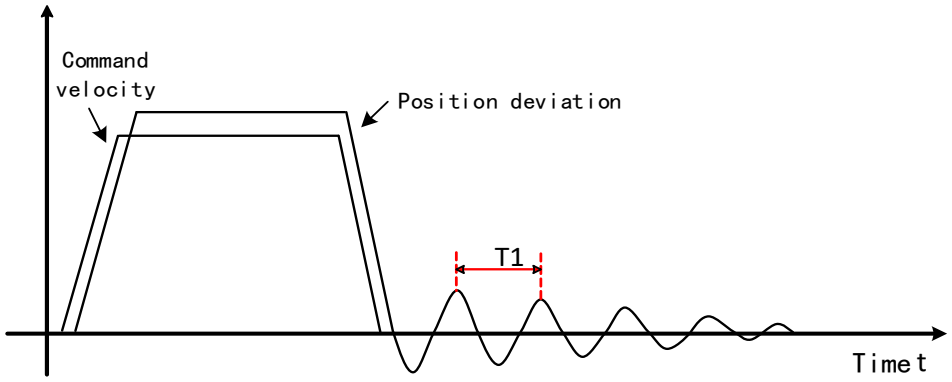
1. After enabling self-adjusting notch filter, set the values from 3rd group of filters to 1st group of notch filter (P02.01/P02.02/P02.03), see if resonance is suppressed. If there is other resonance, set P02.00 = 1, then set the values from 3rd group of filters to 2nd group of notch filter (P02.04/P02.05/P02.06)
2. Get resonant frequency, notch filter bandwidth and depth and set it into the corresponding parameters through EDrive.

### 8.6.2 End Vibration Suppression

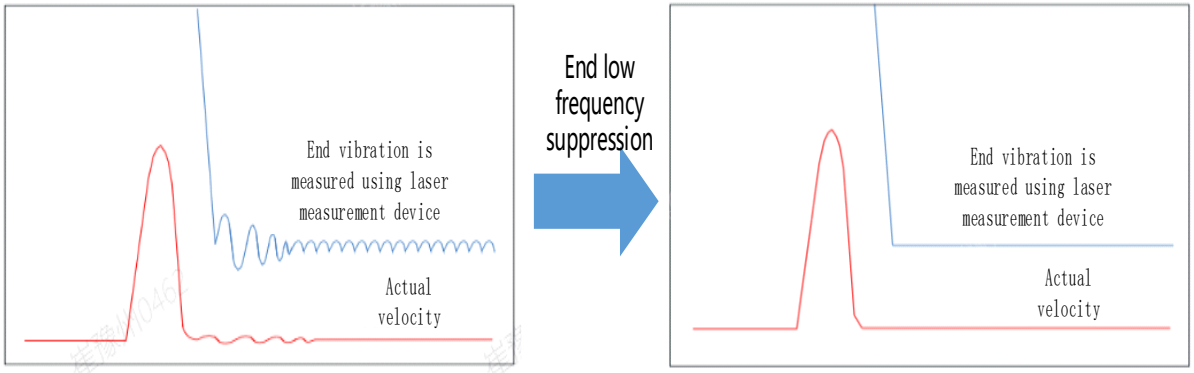


If the mechanical has an end that is long and heavy, it might cause end vibration at emergency stop and affect the positioning. Usually happens on long armed axis with loose end. The frequency is usually within 100Hz which is lower than mechanical resonant frequencies. It is called low-frequency resonance 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 P02.14
  5. If some other low frequency resonance occurs, please repeat step 1-3 and write F2 into P02.16.

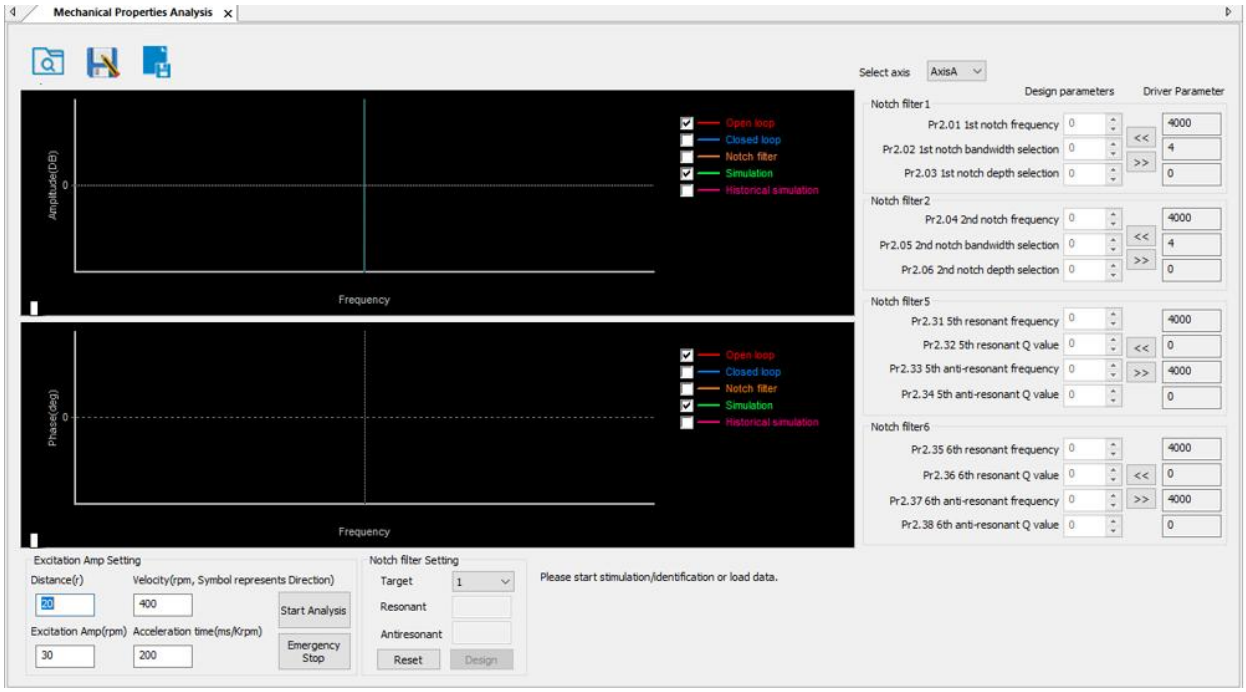



The result of suppressing low frequency resonance



### 8.6.3 Mechanical Properties Analysis

To determine mechanical and set up notch filter parameters to suppress vibration caused by resonance.

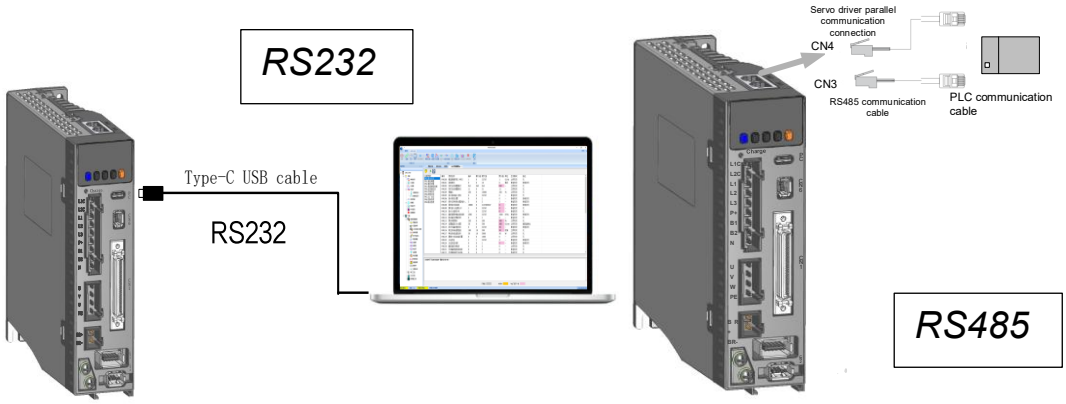



To avoid strong vibration, please first set lower excitation amplitude. However, if the set value is too low, data waveform will include some degree of distortion.
If vibration occurs during tests which can't be reduced through lowering electrical current excitation, it might be due to excessive gain. Please lower velocity gain and set notch filter as accordance with the mechanical properties analysis. Or might be due to inertia settings (P00.04) is too large, please use optimal inertia ratio value.

# Chapter 9 Modbus Communication

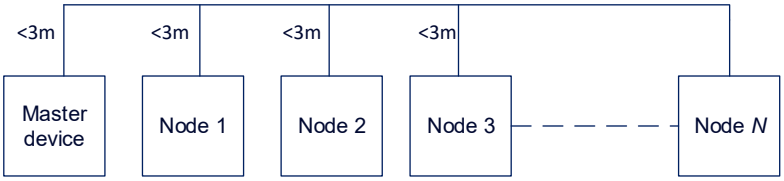
There are 2 types of Modbus communication on E-DHAS□□P series servo drivers: RS485 and RS232. RS232 is used for point-to-point communication connecting the driver to PC through a USB type-C cable for tuning using EDrive. RS485 can be set to communicate with multiple slave devices as a single master. Network control of drivers can be achieved through CN3/CN4 ports.

## 9.1 RS232 and RS485 Connection Diagram.



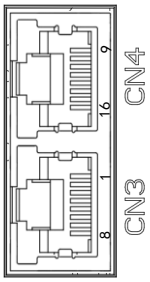

### RS485 network of multiple servo drivers

If there is a need to connect multiple E-DHAS□□P series servo drivers together, it is recommended to connect the drivers in series and no longer than 3 meters of LAN cable between each nodes (drivers) as shown below.




12. Keep the connection cable between each node as short as possible. Not longer than 3m.
13. Install a terminal resistor each end. Recommended resistance: 120 Ohm.
14. Please use shielded twisted pair connection cables.
15. Connect to reference ground of the driver.
16. Connect shielded foil of the cables to Protective Earth PE terminal.
17. Please separate them from power cable or any cable with strong interference.

## 9.2 RS485 communication port

| Port | Diagram | Pin | Signal | Description |
|---|---|---|---|---|
| CN3<br>CN4 |  | 1，9 | RDO+ | RS485 Differential signal+ |
| | | 2，10 | RDO - | RS485 Differential signal- |
| | | 3，11 | GND | Ground（RS485） |
| | | 4，12 | TXD+ | RS485 Differential signal+ |
| | | 5，13 | TXD- | RS485 Differential signal- |
| | | 6 | VCC5V | Reserved，5V positive（50mA） |
| | | 7，15 | GND | Ground |
| | | 8，16 | / | / |
| | | Frame | PE | Shield grounding |

Parameters related to RS485 communication

| P05.29 | Label | RS485 communication mode | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~255 | Unit | — | Default | 5 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x053B | | |
| | Valid | After restart | | | | | | |

| Value | Bit | Checksum | Stop |
|---|---|---|---|
| 0 | 8 | Even | 2 |
| 1 | 8 | Odd | 2 |
| 2 | 8 | Even | 1 |
| 3 | 8 | Odd | 1 |
| 4 | 8 | Null | 1 |
| 【5】 | 8 | Null | 2 |

| P05.30 | Label | RS485 communication Baud rate | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~15 | Unit | — | Default | 4 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x053D | | |
| | Valid | After restart | | | | | | |

| Value | Baud rate |
|---|---|
| 0 | 2400bps |
| 1 | 4800bps |
| 2 | 9600bps |
| 3 | 19200bps |

| Value | Baud rate |
|---|---|
| 【4】 | 38400bps |
| 5 | 57600bps |
| 6 | 115200bps |

Baud rate tolerance: 2400～38400bps±0.5%, 57600～115200bps±2%

| P05.31 | Label | RS485 axis address | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~127 | Unit | — | Default | 1 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x053F | | |
| | Valid | After restart | | | | | | |

When controller is connected to multiple axis and controller needs to identify the axis, P05.31 can be used to set the axis ID/address.
Please set to a max of 31 if the communication is between RS232 and RS485

## 9.3 Modbus Protocol

E-DHAS□□P series servo drivers contain 16-bit and 32-bit parameters. The parameters supports read and write functions in the Modbus-RTU protocol with function codes as listed in the table below.

| Operation | Function code |
|---|---|
| Read 16/32 bit parameters | 0x03 |

| | |
|---|---|
| Write 16 bit parameters | 0x06 |
| Write 32 bit parameters | 0x10 |

Parameters class 0 – 7 are 32 bits data but mostly only applicable up to 16 bit. To make it convenient for users to read the data, any byte length written in the parameters list only shows that the data is using 16 bit lower-level data, but it is actually a 32 bit data.

*Using P00.00 as an example, the 485 address shows 0x0001. It is actually high 0x0000 and low 0x0001 data.*

| P00.00 | **Label** | Model-following/Zero tracking control | | | **Valid mode(s)** | **P** | | |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 0-2000 | **Unit** | 0.1Hz | **Default** | 1 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0001 | | |
| | **Valid** | At stop | | | | | | |

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.

| Value | Description |
|---|---|
| 0 | Disable model following/zero tracking control |
| 1 | Set bandwidth automatically |
| 2~9 | Reserved |
| 10~2000 | Manually set control bandwidth. 30~100 recommended for belt application |

### 9.3.1 Read Data 0x03

The function code for reading data from the drive is **0x03**, which allows reading from **1 to 100** 16-bit data units.
Example: Assuming the slave ID of the drive is 1, and we want to read 2 data units. (H = high 8 bits, L = low 8 bits)

| No. | Request frame data（Master->Slave） | | | | Reply frame data（Slave->Master） | | |
|---|---|---|---|---|---|---|---|
| 1 | **ID** | Slave | 0x01 | | **ID** | Slave | 0x01 |
| 2 | **FC** | Function code | 0x03 | | **FC** | Function code | 0x03 |
| 3 | **ADDR** | Starting address | H | | **NUM** | Data count（byte） | 0x00(H) |
| 4 | | | L | | | | 0x04(L) |
| 5 | **NUM** | Data count（word） | 0x00(H) | | **DATA1** | Data 1 | H |
| 6 | | | 0x02(L) | | | | L |
| 7 | **CRC** | Checksum | L | | **DATA2** | Data 2 | H |
| 8 | | | H | | | | L |
| 9 | | | | | **CRC** | Checksum | L |
| 10 | | | | | | | H |

*Communication Example:*

| | |
|---|---|
| Send | 01 03 00 00 00 02 C4 0B |
| Receive | 01 03 04 00 00 00 01 3B F3 |

**Send frame** asks slave ID 1 to return 2 words (32-bit total) from address 0x0000. CRC = 0x0BC4.
**Received frame** returns 4 bytes of data 0x00000001. CRC = 0xF33B.

### 9.3.2 Write Single Data Function Code 0x06

The function code for writing a single data item to the drive is **0x06**, which writes one 16-bit data word. Example: Write one word of data to slave ID 1 (H = high byte, L = low byte).

| No. | Request frame data（Master->Slave） | | | | Reply frame data（Slave->Master） | | |
|---|---|---|---|---|---|---|---|
| 1 | **ID** | Slave | 0x01 | | **ID** | Slave | 0x01 |
| 2 | **FC** | Function code | 0x06 | | **FC** | Function code | 0x06 |
| 3 | **ADDR** | Starting address | H | | **ADDR** | Starting address | H |
| 4 | | | L | | | | L |
| 5 | **NUM** | Data count （word） | 0x00(H) | | **DATA1** | Data 1 | H |
| 6 | | | 0x02(L) | | | | L |
| 7 | **CRC** | Checksum | L | | **CRC** | Checksum | L |
| 8 | | | H | | | | H |

The response frame should be identical to the request frame.
*Communication Example:*

| | |
|---|---|
| Send | 01 06 00 01 00 01 19 CA |
| Receive | 01 06 00 01 00 01 19 CA |

**Send frame:** means the master writes 0x0001 to slave ID 1 at address 0x0001. the CRC checksum for the first 6 bytes is 0xCA19.
**Receive frame:** echoes the request, confirming success.

### 9.3.3 Write Multiple Data 0x10

Function code 0x10 is to write multiple 16-bit data into servo driver. For example, from servo driver to slave as 1 and reading 2 data. (H: High 8-bit, L: Low 8-bit).

| No. | Request frame data（Master->Slave） | | | | Reply frame data（Slave->Master） | | |
|---|---|---|---|---|---|---|---|
| 1 | **ID** | Slave | 0x01 | | **ID** | Slave | 0x01 |
| 2 | **FC** | Function code | 0x03 | | **FC** | Function code | 0x03 |
| 3 | **ADDR** | Starting address | H | | **ADDR** | Address | H |
| 4 | | | L | | | | L |
| 5 | **NUM1** | Data count（word） | 0x00(H) | | **NUM** | Data count（word） | H |
| 6 | | | 0x02(L) | | | | L |
| 7 | **NUM2** | Data count（Byte） | 0x04 (2*NUM1) | | **CRC** | Checksum | L |
| | | | | | | | H |
| 8 | **DATA1** | Data 1 | H | | | | |
| 9 | | | L | | | | |
| 10 | **DATA2** | Data 2 | H | | | | |
| 11 | | | L | | | | |
| 12 | **CRC** | Checksum | L | | | | |
| 13 | | | H | | | | |

*Servo parameters are 32-bit with high 16-bit at the front and low 16-bit at the back. 2 continuous communication addresses will be distributed starting with even number (High 16-bit uses even number address, low 16-bit uses odd number address. Word byte frame word is also with high 8-bit at the front and low 8-bit at the back.*

32-bit data written from starting address 0x0000 (Servo driver with axis address 01):

| | |
|---|---|
| Send | 01 10 00 00 00 02 04 00 00 00 00 F3 AF |
| Receive | 01 10 00 00 00 02 41 C8 |

**Send Frame:** Request Frame. Master device writes a 2 Word (16 bit), 4 bytes data (0x0000 0000) into slave servo driver with ID no. 1 (Address 0x0000). 11-byte CRC value is 0xAFF3 before frame sending.

**Receive Frame:** Reply frame. Master device writes a 2 Word value into slave servo driver with ID no. 1 (Address 0x0000). 6-byte CRC value is 0xC841 before frame sending.

### 9.3.4 Reply Error

When driver receives request frame data format with error, driver will feedback error reply data frame to master device.

| No. | Error reply frame data (Slave->Master) | | |
|---|---|---|---|
| **1** | **ID** | Slave ID | 0~31 |
| **2** | **FC** | Function code | (0x03/0x06/0x10)+0x80 |
| **3** | **Error code** | Address | 0x01/0x02/0x03 |
| **4** | **CRC** | Checksum | L |
| **5** | | | H |

Error code table:

| Error code | Description |
|---|---|
| 0x01 | Function code error |
| 0x02 | Address error |
| 0x03 | Data error, i.e. written data over limit |
| 0x08 | CRC checksum error |

Communication data:

**Receive frame:** Slave servo driver's reply frame. Request frame data CRC from master device, servo driver will not respond to current request.

| | |
|---|---|
| Send | 01 11 00 04 00 02 04 01 00 00 00 F3 A0 |
| Receive | 01 91 08 4C 56 |

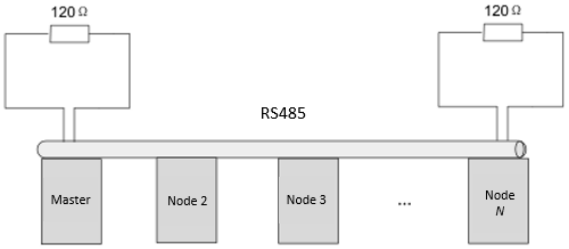
**Receive frame:** Slave servo driver's reply frame. Request frame data function from master device error or slave station does not support this function, unable to respond to current request.

| | |
|---|---|
| Send | 01 11 00 04 00 02 04 01 00 00 00 A2 65 |
| Receive | 01 91 01 8C 50 |

# 9.4 Frequently Occurred Issues and Solutions with RS485 Communication.

## 9.4.1 Frequently Occurred Issues

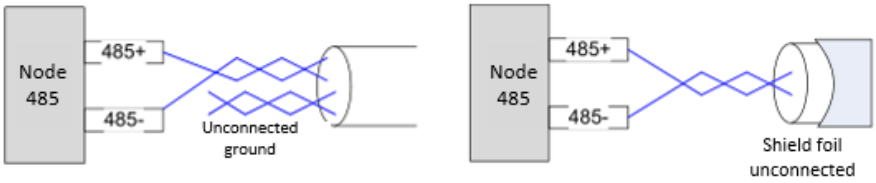
### Terminal resistor




Terminal resistor is to be connected at the start and end of the device network. Recommended resistance of the terminal resistor: 120 Ohm. Measure the resistance within the network using a multimeter and refer to the table below.

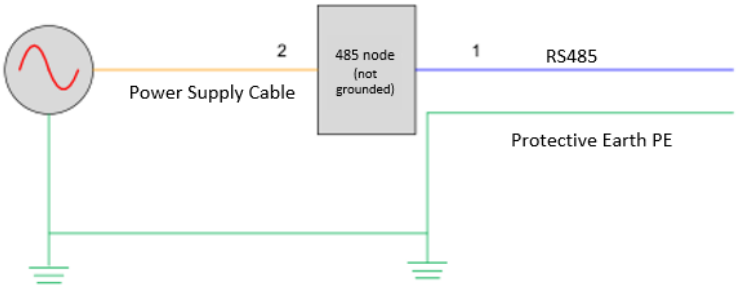
| Measured resistance (Ohm) **Normal: 60 Ohm** | Description |
|---|---|
| 0 | Short circuit |
| Much lower than 60 | Might be other resistor within the network; incorrect terminal resistor is used |
| Much higher than 60 | Might be due to damaged/faulty node communication port |

**Incorrect wiring connection**

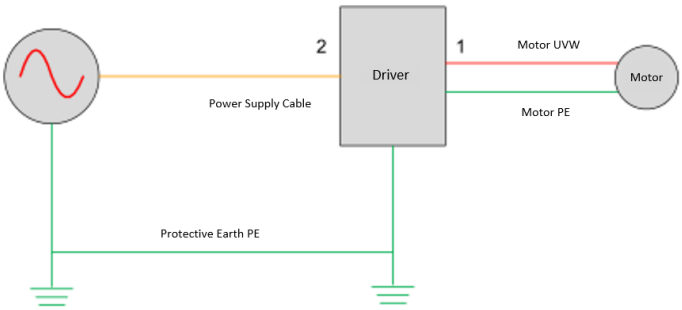



Please make sure RS485 communication connection is normal using a multimeter. Then, make sure the reference ground is corrected connected. If there is not no reference ground, please leave it unconnected. Same goes for cable shield foil.

**Signal interference**



**External interference**: Magnetic ring can be intertwined within cable 1 and 2 to prevent external interference.

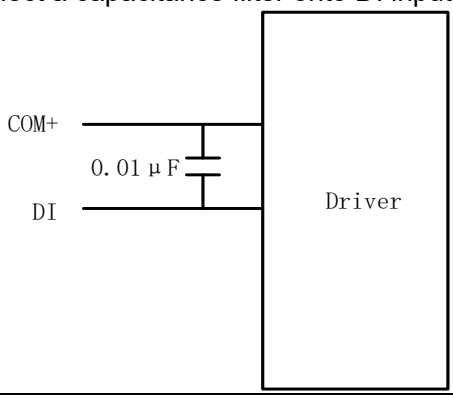



**Driver interference:** If interference occurs within the driver, please intertwine magnetic rings on cable 1 and 2. Please loop UVW cables around the magnetic ring for at least 3 rounds. Do not loop PE wire into the magnetic ring.

## 9.4.2 Step-by-Step Problem Solving

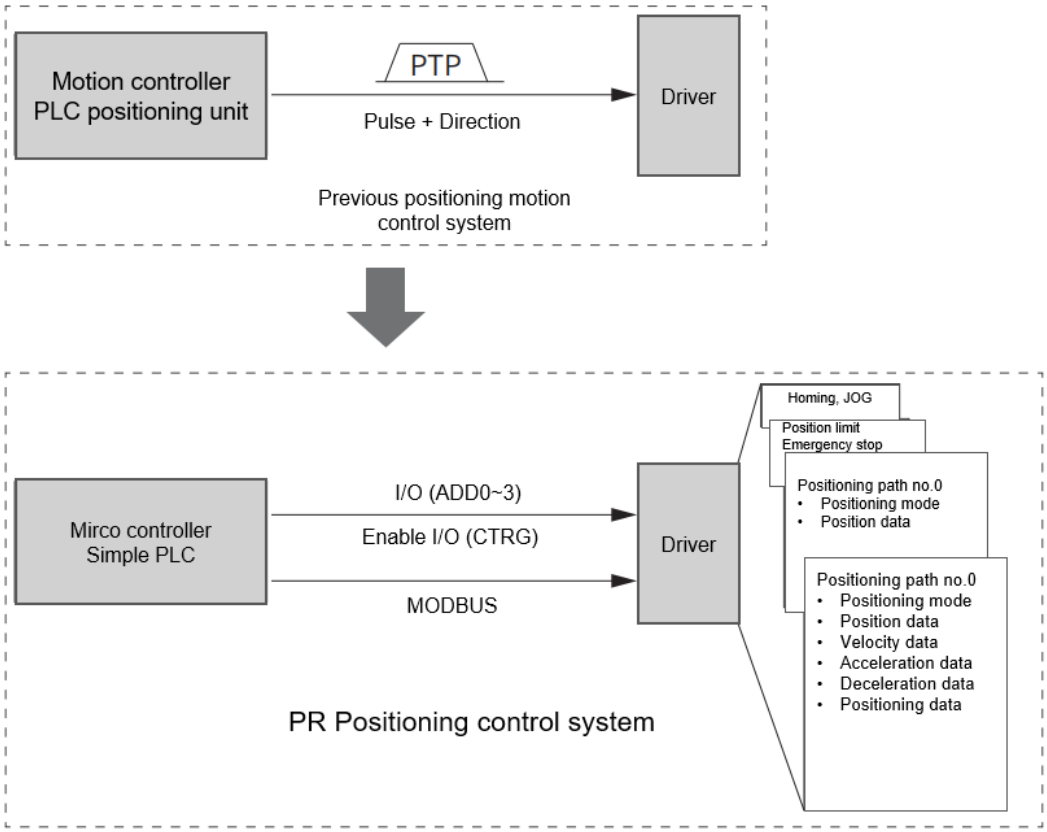
1: Verify if communication parameters setting are correct (ID not repeated, uniform Baud rate and data format);
2: If terminal resistor used is correct;
3: If wiring connection is correct;
4: Verify grounding and PE connection;
5: Communication cables should be separated from power cables.

Servo drivers are devices of good anti-interference. However, during installation, interference still might occur due to wiring and grounding issues. Please refer to the table below if such problems persist.

| Steps | Solutions |
|---|---|
| 1 | Use shielded wire cable for I/O signals, connect shield foil to PE. |
| 2 | Connect motor PE to PE terminals on drivers, connect driver PE to PE terminals of electrical network. |
| 3 | Ground master device and servo drivers together. |
| 4 | Loop UVW motor power cable around magnetic ring for 2-3 times. |
| 5 | Loop signal cable around magnetic ring for 1-2 times. |
| 6 | Use shielded cable for power cables. Connect shield foil to ground. |
| 7 | Connect a capacitance filter onto DI input. Max capacitance: 0.1 μF   |

# Chapter 10 PR Function

PR function is a control module in servo driver that controls single axis motion using Procedure program. Main single axis motion control functions included homing, path, position limit and emergency stop. Using PR functions can save resources on the main controller.




- When using PR function, set parameter P00.01 to 6. In PR control mode, all positions use 10000 pulses/rev as unit.

- When setting PR parameters via front panel, note that parameter numbers are displayed in hexadecimal.

Example: P08.15 shown on the panel means "15" is in hex, which equals decimal 21. So P08.15 on the panel corresponds to P08.21 in the software or manual.

## 10.1 PR Function Introduction

| Function | Description |
|---|---|
| Homing | Driver seeks origin signal through homing to determine zero point of the mechanical motion coordination system<br>1. Homing mode configurable. Can be chosen between position limit signal homing, origin signal homing and manually set home.<br>2. Homing direction configurable.<br>3. Specific position can be set after homing completed.<br>4. Homing velocity, acceleration and deceleration configurable.<br>5. High homing velocity to locate origin and low homing velocity to look for Z-signal. |
| JOG | Forward/Reverse JOG through I/O control. Used for tuning.<br>1. JOG direction: forward JOG, reverse JOG<br>2. JOG velocity and acceleration configurable |
| Position limit | Prevent mechanical damage by limiting the range of motion<br>1. Positive/Negative position limit input through I/O<br>2. Software position limit<br>3. Position limit deceleration configurable |
| Emergency stop | Emergency stop input signal through I/O. To stop any operating motion |
| Path motion | Select path ID through IO（ADD0-3）, then trigger path motion through enable IO（CTRG）; or directly through I/O combination mode; path motion can be controlled directly through 485 communication as well<br>1. Path motion includes positioning, velocity and homing modes.<br>2. I/O trigger includes rising edge, double edges trigger.<br>3. Supports continuous positioning.<br>4. Max. 16 paths.<br>5. Configurable position, velocity and acceleration/deceleration.<br>6. Pause time/ timer configurable. |
| 485 communication | PR parameter R/W through 485 communication. Control PR functions such as homing, JOG, path motion, emergency stop, etc. |

## 10.2 Control Parameters

All PR motion related parameters including trigger, status output, limits, emergency stop, JOG, homing, etc.

| Parameter | Label | Description | 485 Addr. |
|---|---|---|---|
| P08.00 | PR Control | PR control functions<br>Bit 0：=0，CTRG rising edge trigger<br>=1，double edges trigger<br>Bit 1：=1，software position limit valid<br>=0，software position limit not valid<br>Bit 2：=1, homing upon power on<br>=0，no homing upon power on<br>Bit 3：=1，absolute value memory<br>=0，absolute value with no memory | 0X6000 |
| P08.01 | Path count | 16 paths | 0X6001 |
| P08.02 | Control Operation | -- | 0X6002 |
| P08.06 | Software positive limit H | High 16-bit of software positive limit | 0X6006 |
| P08.07 | Software positive limit L | Software positive limit（Only able to read low 16-bit using 485 communication） | 0X6007 |
| P08.08 | Software negative limit H | High 16-bit of software negative limit | 0X6008 |
| P08.09 | Software negative limit L | Software negative limit（Only able to read low 16-bit using 485 communication） | 0X6009 |
| P08.10 | Homing mode | Homing method in PR mode<br>Bit 0：Homing direction<br>=0：Reverse<br>=1： Forward<br>Bit 1：Specific position after homing<br>=0：No<br>=1：Yes<br>Bit2~7：Homing mode<br>=0：Position limit homing<br>=1：Origin homing<br>=2：Single turn Z homing<br>=3：Torque homing<br>=8：Immediate homing<br>Bit 8： =1: Homing with Z-signal<br>= 0: Homing without Z-signal<br><br>*Single turn Z homing is homing method within 1 revolution, has nothing to do with Bit 8 Z-signal.* | 0X600A |
| P08.11 | Zero position H | High 16-bit of zero position | 0X600B |
| P08.12 | Zero position L | Zero position（Only able to read low 16-bit using 485 communication） | 0X600C |
| P08.13 | Home position offset H | High 16-bit of home position offset | 0X600D |
| P08.14 | Home position offset L | Home position offset（Only able to read low 16-bit using 485 communication） | 0X600E |
| P08.15 | High homing velocity | Set high homing velocity | 0X600F |
| P08.16 | Low homing velocity | Set low homing velocity | 0X6010 |

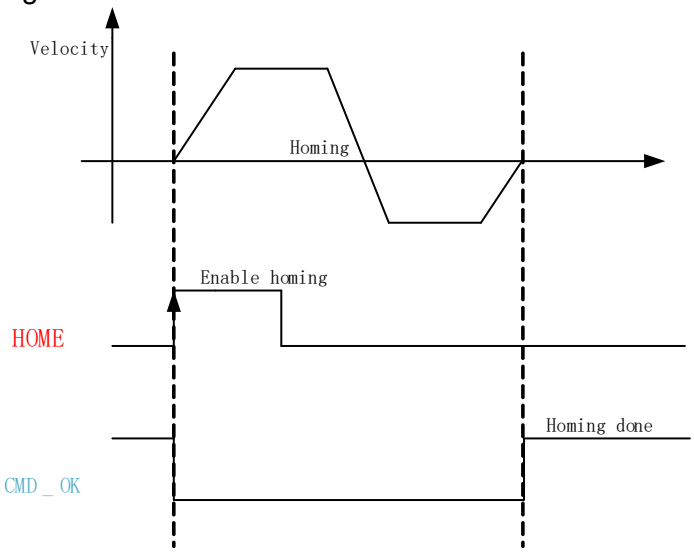
| | | | |
|---|---|---|---|
| P08.17 | Homing acceleration | Set homing acceleration | 0X6011 |
| P08.18 | Homing deceleration | Set homing deceleration | 0X6012 |
| P08.19 | Homing torque holding time | Set homing torque holding time | 0X6013 |
| P08.20 | Homing torque | Set homing torque value | 0X6014 |
| P08.21 | Homing overtravel alarm range | Set homing overtravel alarm threshold, set to 0 to deactivate the alarm | 0X6015 |
| P08.22 | Emergency stop at limit deceleration | Set position limit emergency stop deceleration | 0X6016 |
| P08.23 | STP emergency stop deceleration | Set STP emergency stop deceleration | 0X6017 |
| P08.26 | I/O combination trigger mode | 0：Disable I/O combination trigger mode. Uses I/O CTRG signal edge trigger.<br>1：Enable I/O combination trigger. Valid when HOME-OK signal is valid.<br>2：Enable I/O combination trigger. HOME-OK signal not required. | 0X601A |
| P08.27 | I/O combination filter | Set I/O combination filter time | 0X601B |
| P08.28 | S-code current output value | Display S-code output | 0X601C |
| P08.29 | PR warning | =0: Reset new command automatically<br>=0x100: Position limit error during homing<br>=0x101: Emergency stop. Homing not completed<br>=0x20x: Position limit error on Path *N* | 0X601D |
| P08.39 | JOG velocity | Set JOG velocity | 0X6027 |
| P08.40 | JOG acceleration | Set JOG acceleration | 0X6028 |
| P08.41 | JOG deceleration | Set JOG deceleration | 0X6029 |
| P08.42 | Command position H | High 16- bit of command position | 0X602A |
| P08.43 | Command position L | Command position (Only able to read low 16-bit using 485 communication) | 0X602B |
| P08.44 | Motor position H | High 16- bit of motor position | 0X602C |
| P08.45 | Motor position L | Motor position (Only able to read low 16-bit using 485 communication) | 0X602D |
| P08.46 | Input | Input status | 0X602E |
| P08.47 | Output | Output status | 0X602F |
| P08.48<br>-<br>P08.63 | S-code setting | Path *N* S-code output settings | 0x6030<br>~<br>0x603F |

## 10.3 PR Motion

### 10.3.1 Homing

Homing is divided into 5 methods according to home signal: Single turn Z-phase homing, position limit homing, origin homing, torque homing, manually set home. Position limit homing, origin homing and torque homing can be with or without Z-signal. Homing can be triggered upon power on or using I/O after servo enabled.

Homing sequence diagram




1. **HOME**: Homing trigger signal. When HOME is valid, homing will be done according to set homing method.
2. **CMD_OK**: Command completed signal. Invalid when command is being carried out, valid when command is done.
3. Please refer to P08.10 to set homing methods and other homing mode related settings. It is recommended to use EDrive to modify the control parameters in PR mode.

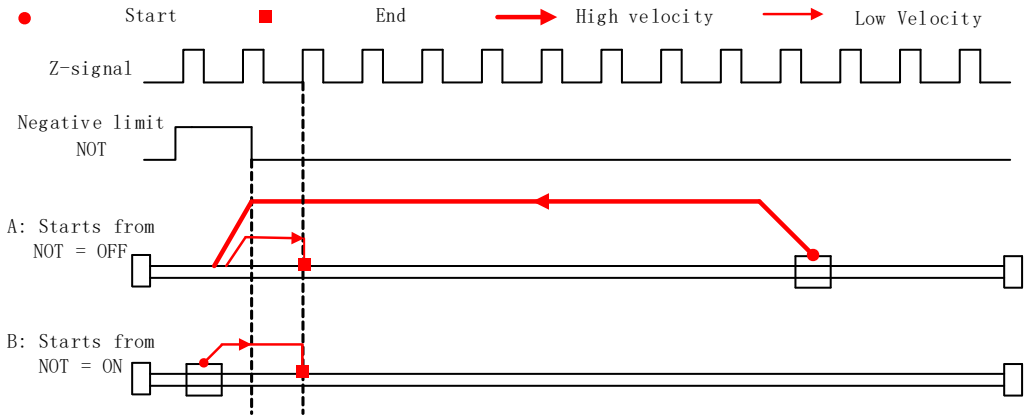
| P08.10 | Label | Homing mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0X600A |

To set homing method in PR mode. It is recommended to modify PR control parameters using EDrive.

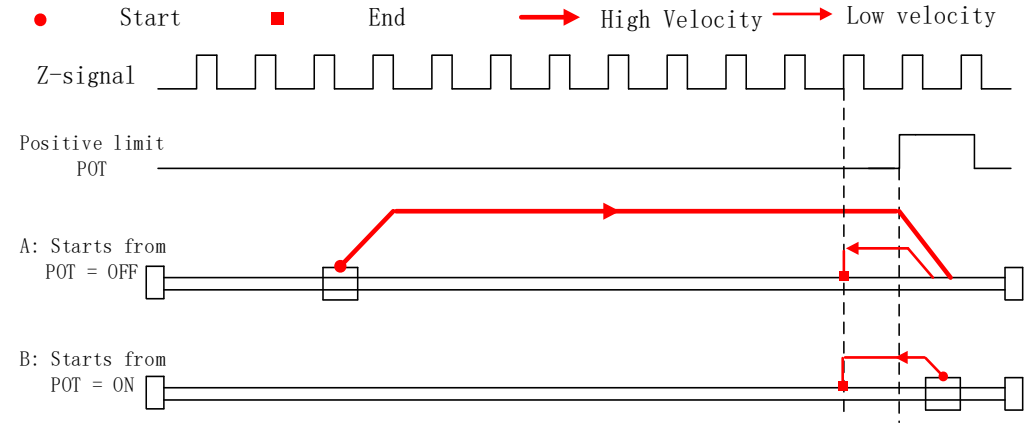
| Bit | 8（Z-signal homing） | 2-7（Homing mode） | 1（Specific position after homing） | 0（Homing direction） |
|---|---|---|---|---|
| Description | =1, homing with Z-signal<br>=0, homing without Z-signal | =0 Limit homing<br>=1 Origin homing<br>=2 Single turn Z homing<br>=3 Torque homing<br>=8 Immediate homing | =1, Yes<br>=0, No | =1, Forward<br>=0, Reverse |

## Position limit, origin and torque homing with Z-signal

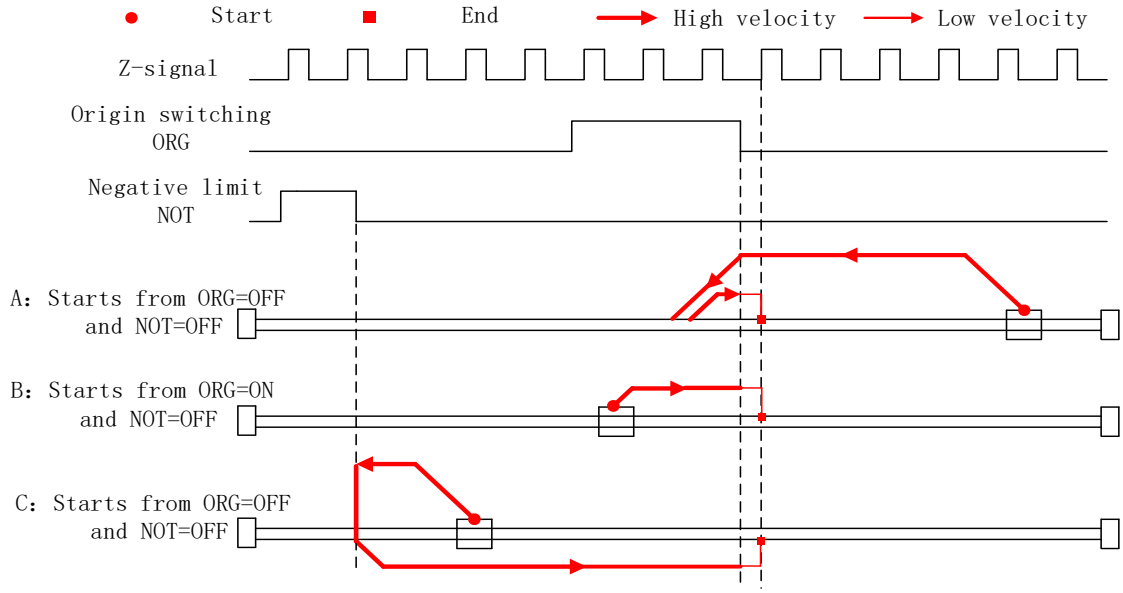
### 1. Negative limit homing



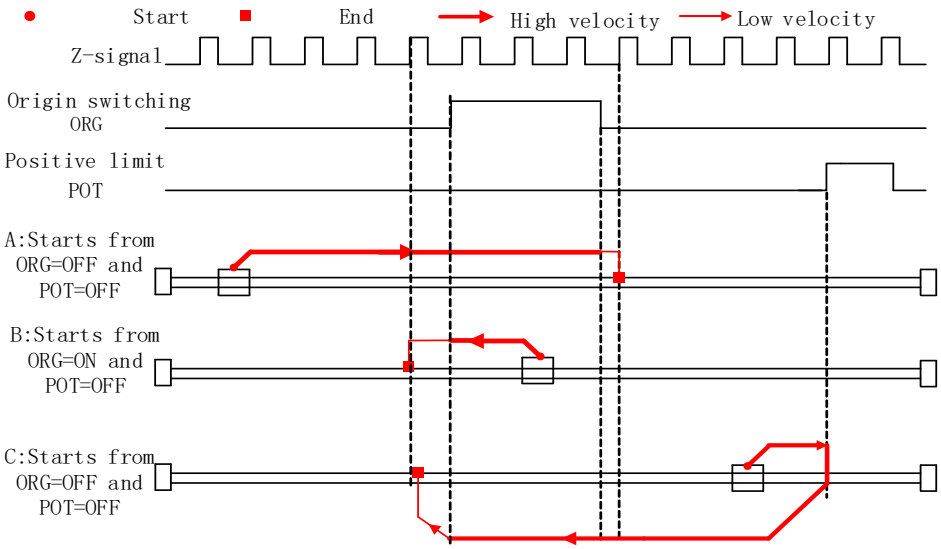

### 2. Positive limit homing



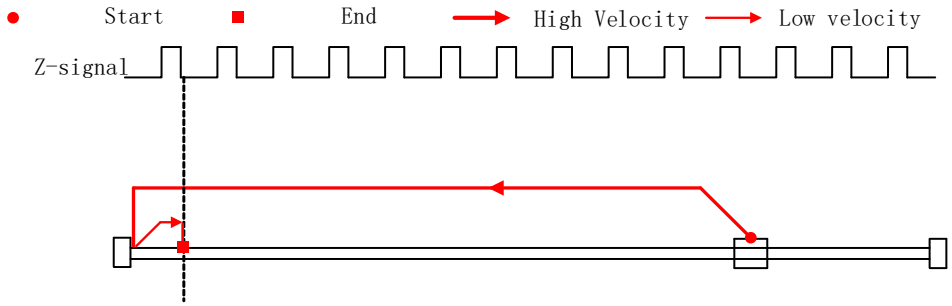

### 3. Origin homing – Negative direction



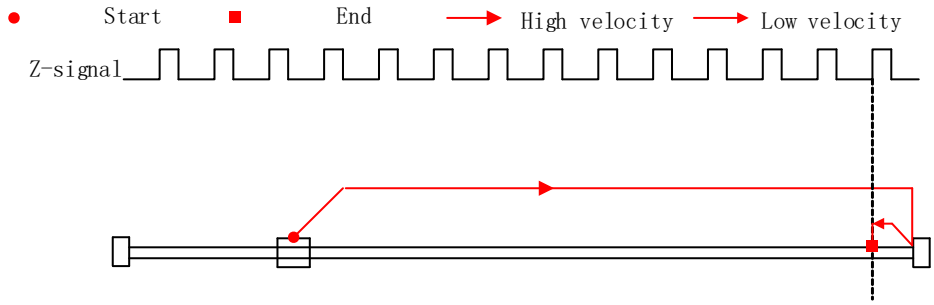

### 4. Origin homing – Positive direction




5. Torque homing – Negative direction

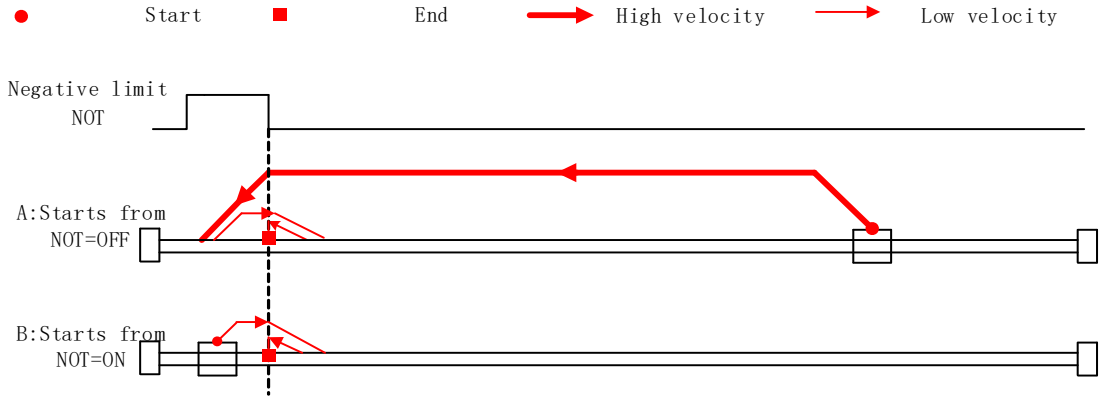



6. Torque homing – Positive direction

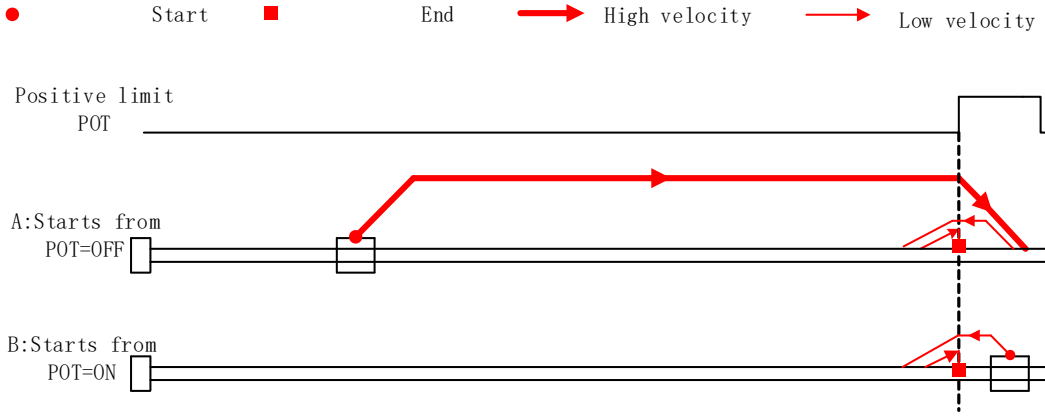


## Position limit, origin, Z-signal, torque and manual set home (Homing with single condition)

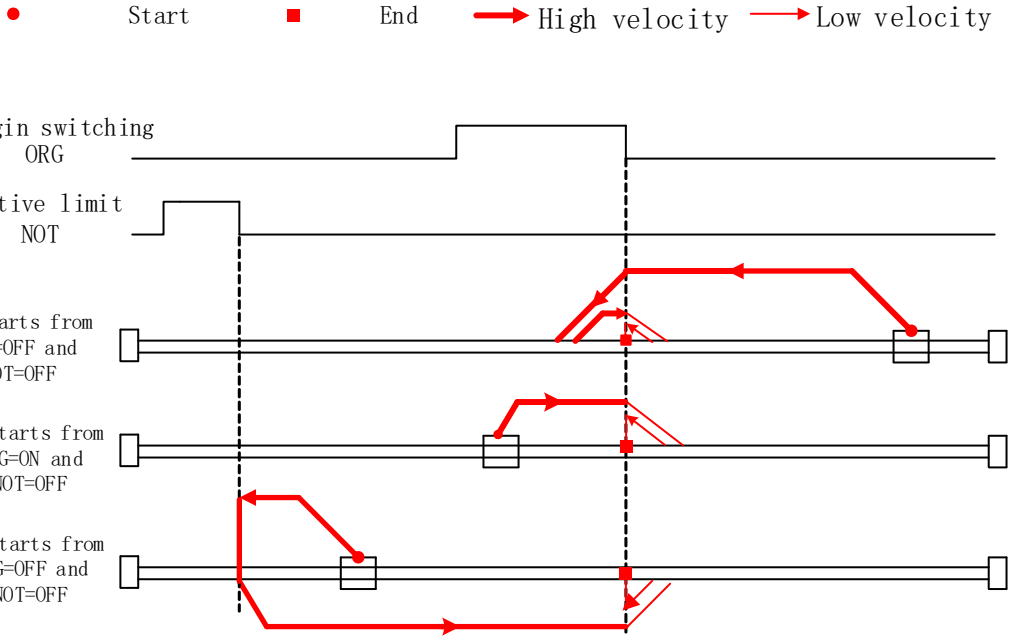
### 1. Negative limit homing



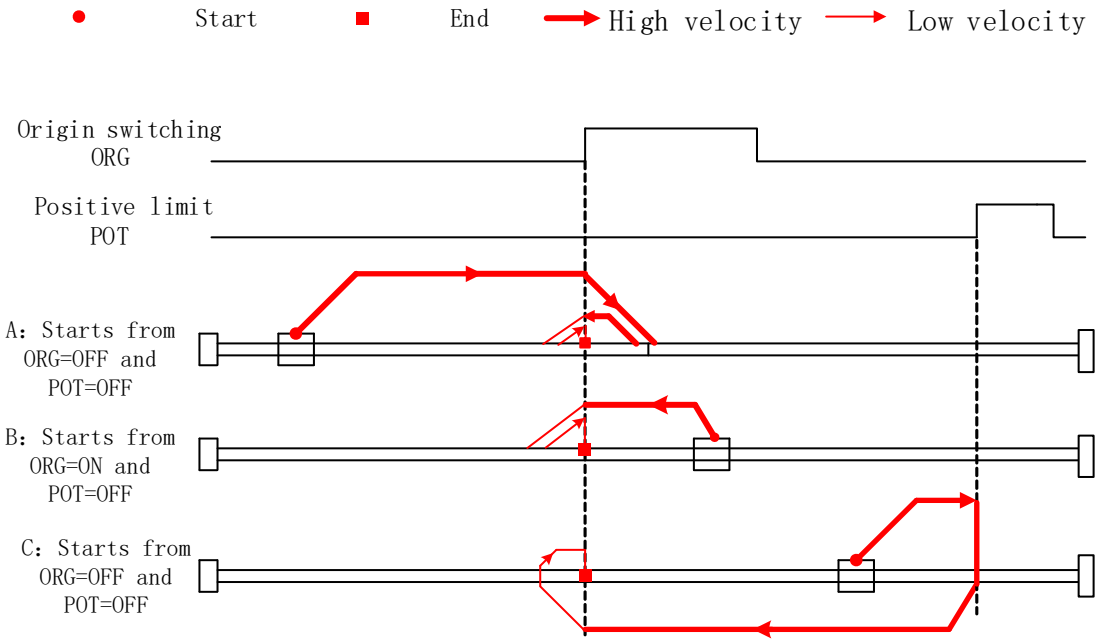

### 2. Positive limit homing



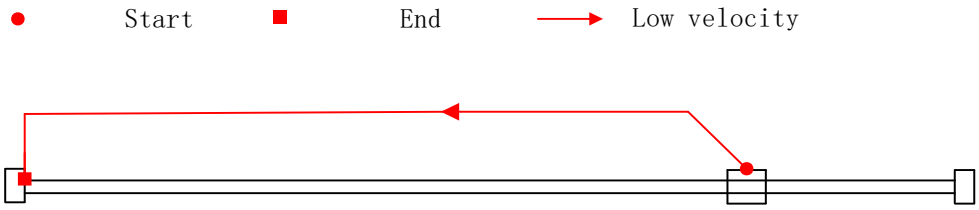

### 3. Origin homing – Negative direction



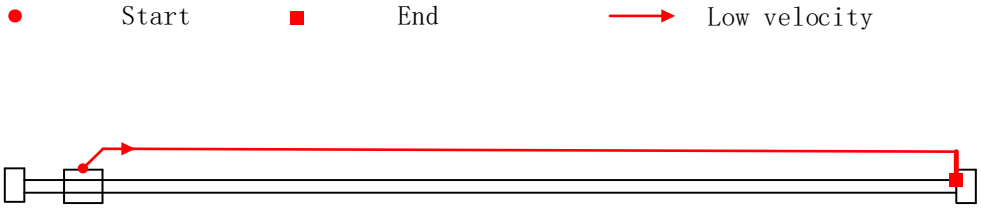
4. Origin homing – Positive direction




5. Torque homing – Negative direction

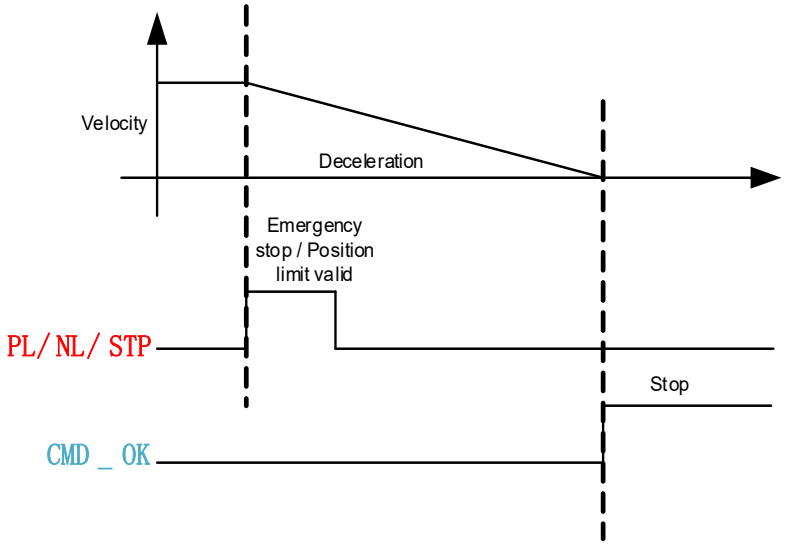



6. Torque homing – Positive direction



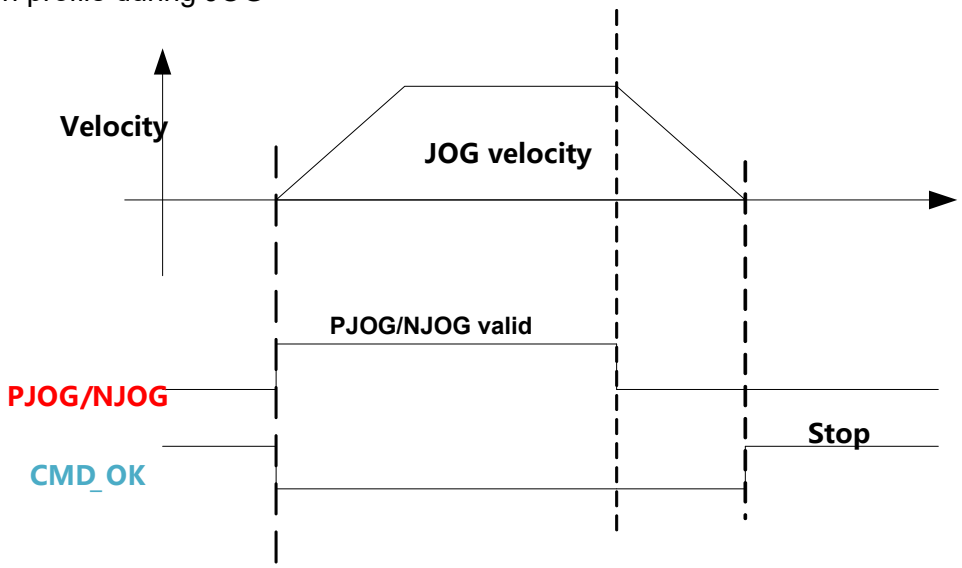
### 10.3.2 Position Limit and Emergency Stop

For safety concerns, PR mode is designed to trigger emergency stop when position limit or emergency stop signal is valid. Please refer to the sequence diagram below.




### 10.3.3 JOG

JOG is used to make tuning more convenient. Please refer to the sequence diagram below for motion profile during JOG



### 10.3.4 Path Motion

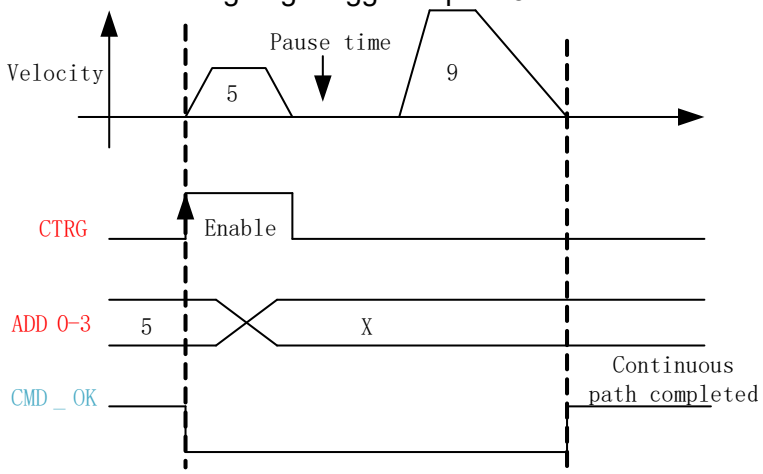
Path motion: Segmented, continuous, interrupted. Path positioning: Position, velocity, homing.
PR path is to a total of 16 paths. Every path can be set with motion type, positioning mode, velocity, acceleration, deceleration and pause time independently.

| Parameter | Label | Description | 485 addr. |
|---|---|---|---|
| P09.00 | PR mode | Attribute of PR path is determined by its mode.<br>Bit 0-3：type ： 0: null<br>1: Positioning<br>2: Velocity<br>3: Homing<br>4: Emergency stop<br>*Indicates using P/V/H/S*<br>Bit 4: 0: Can be Interrupted<br>1: Can't be Interrupted, indicates using!<br>Bit 5: OVLP: 0: No overlap, indicates with SJ<br>1: Overlap, indicated with CJ<br>Bit 6-7: 0: absolute<br>1: relative command<br>2: relative motor<br>*Corresponding to ABS/INC/REL*<br>Bit8-13： 0-15: Jump to corresponding path<br>*Indicates using SJ0x or CJ0x*<br>Bit 14： JUMP: 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0X6200 |
| P09.01 | PR position H | High 16-bit of PR path position | 0X6201 |
| P09.02 | PR position L | PR position（Only able to read low 16-bit using 485 communication） | 0X6202 |
| P09.03 | Velocity | Velocity, rpm | 0X6203 |
| P09.04 | Acceleration time | Unit ms/1000rpm | 0X6204 |
| P09.05 | Deceleration time | Unit ms/1000rpm | 0X6205 |
| P09.06 | Pause time | Pause time after command completed | 0X6206 |
| P09.07 | Special parameter | Mapped to P08.02 | 0X6207 |
| P09.08 ~ P09.127 | | 8 parameters for each path. Please refer to Class 9 parameter in Chapter 5 | |

## Path motion

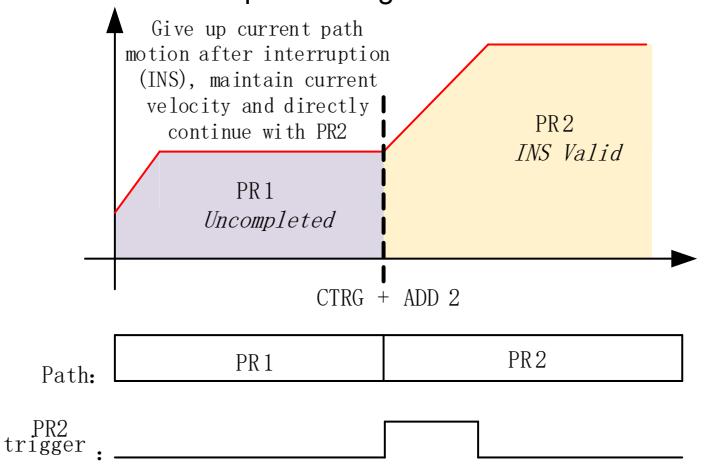
### Segmented trigger

CTRG rising edge/double edges trigger (P08.00) a segmented motion. Please refer to the sequence diagram below with rising edge trigger of path 5.



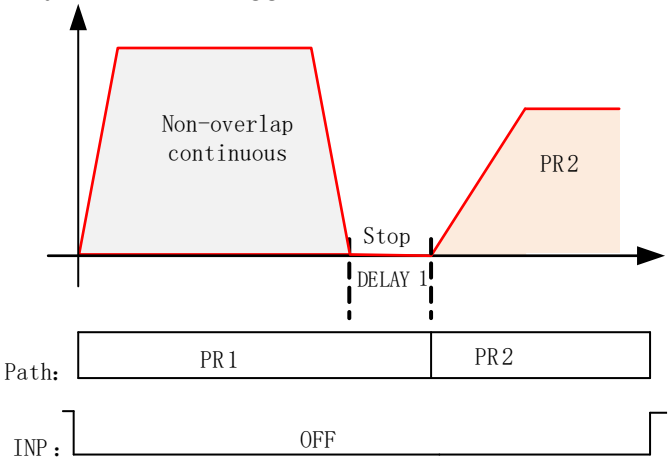

### Multi-path interrupted motion

In multi-path motion, path motion that is triggered later will interrupt path motion that has already started. Please refer to the sequence diagram below



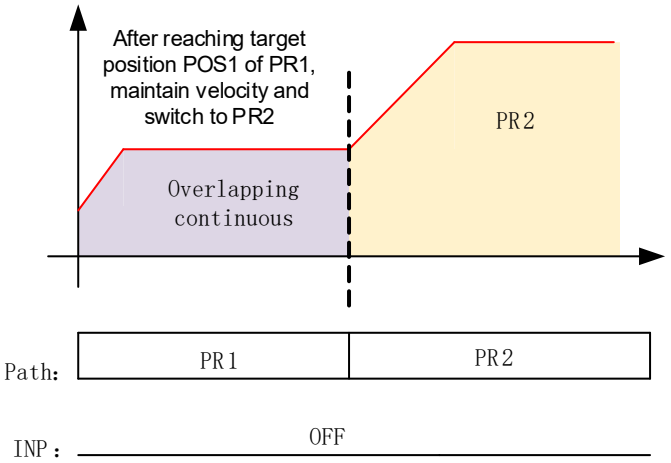
**Non-overlap continuous motion**

Path motion continues by another, no trigger needed for the next one to start.




**Overlapping continuous motion**

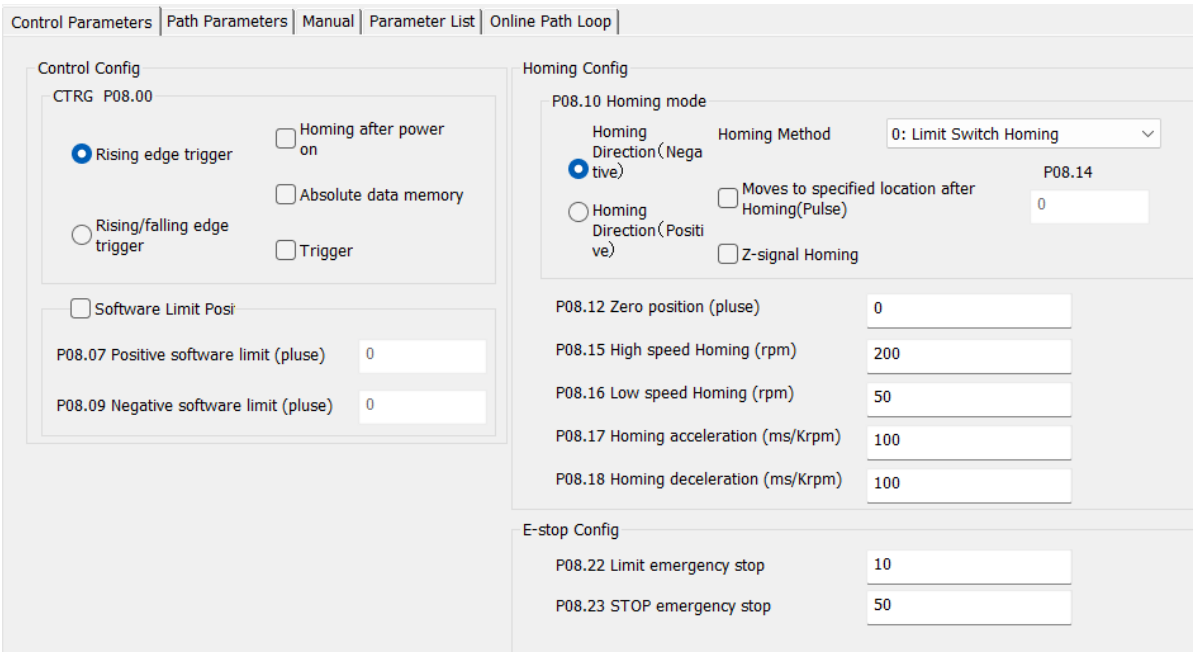
Path motion starts immediately after the previous path motion is completed without deceleration or trigger in between.



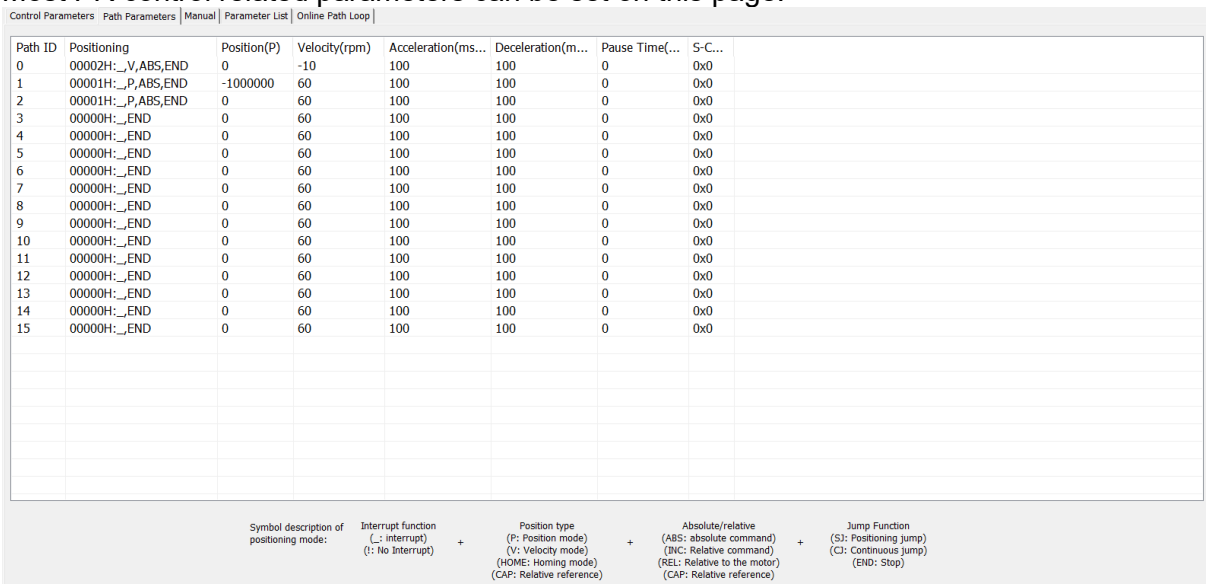
# 10.4 PR Control

## 10.4.1 PR Module in EDrive

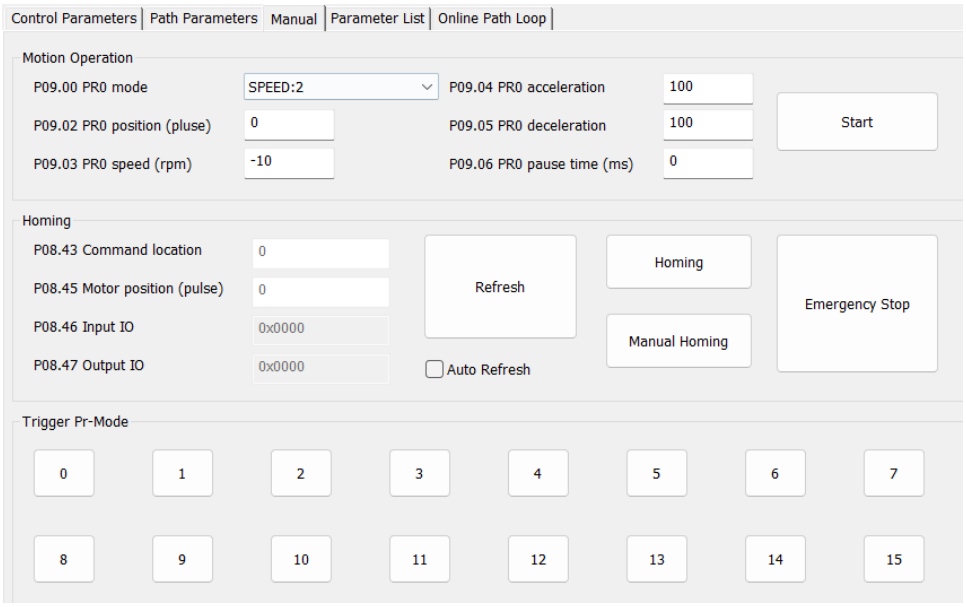
Using Pr-Motion function in EDrive 2, PR parameters can be set including trigger settings, software position limit, JOG, homing, emergency stop, etc. Manual triggering of homing, path motion or emergency stop can also be triggered on this interface.



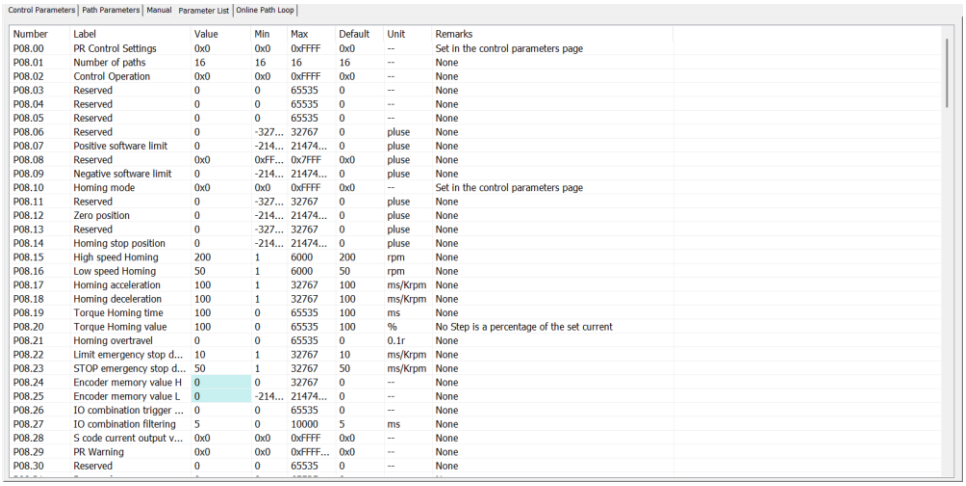

Most PR control related parameters can be set on this page.




All class 9 parameters for 0-15 paths can be found here once connected to a servo driver that supports PR mode.

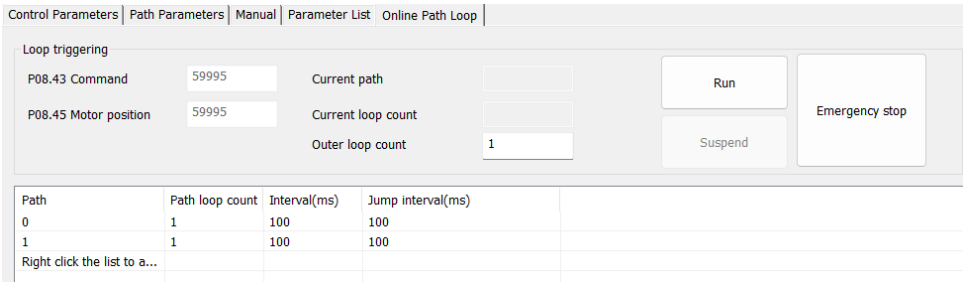



Manual control of servo driver in PR mode can be done in this page.



| Number | Label | Value | Min | Max | Default | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| P08.00 | PR Control Settings | 0x0 | 0x0 | 0xFFFF | 0x0 | -- | Set in the control parameters page |
| P08.01 | Number of paths | 16 | 16 | 16 | 16 | -- | None |
| P08.02 | Control Operation | 0x0 | 0x0 | 0xFFFF | 0x0 | -- | None |
| P08.03 | Reserved | 0 | 0 | 65535 | 0 | -- | None |
| P08.04 | Reserved | 0 | 0 | 65535 | 0 | -- | None |
| P08.05 | Reserved | 0 | 0 | 65535 | 0 | -- | None |
| P08.06 | Reserved | 0 | -327... | 32767 | 0 | pluse | None |
| P08.07 | Positive software limit | 0 | -214... | 21474... | 0 | pluse | None |
| P08.08 | Reserved | 0x0 | 0xFF... | 0x7FFF | 0x0 | pluse | None |
| P08.09 | Negative software limit | 0 | -214... | 21474... | 0 | pluse | None |
| P08.10 | Homing mode | 0x0 | 0x0 | 0xFFFF | 0x0 | -- | Set in the control parameters page |
| P08.11 | Reserved | 0 | -327... | 32767 | 0 | pluse | None |
| P08.12 | Zero position | 0 | -214... | 21474... | 0 | pluse | None |
| P08.13 | Reserved | 0 | -327... | 32767 | 0 | pluse | None |
| P08.14 | Homing stop position | 0 | -214... | 21474... | 0 | pluse | None |
| P08.15 | High speed Homing | 200 | 1 | 6000 | 200 | rpm | None |
| P08.16 | Low speed Homing | 50 | 1 | 6000 | 50 | rpm | None |
| P08.17 | Homing acceleration | 100 | 1 | 32767 | 100 | ms/Krpm | None |
| P08.18 | Homing deceleration | 100 | 1 | 32767 | 100 | ms/Krpm | None |
| P08.19 | Torque Homing time | 100 | 0 | 65535 | 100 | ms | None |
| P08.20 | Torque Homing value | 100 | 0 | 65535 | 100 | % | No Step is a percentage of the set current |
| P08.21 | Homing overtravel | 0 | 0 | 65535 | 0 | 0.1r | None |
| P08.22 | Limit emergency stop d... | 10 | 1 | 32767 | 10 | ms/Krpm | None |
| P08.23 | STOP emergency stop d... | 50 | 1 | 32767 | 50 | ms/Krpm | None |
| P08.24 | Encoder memory value H | 0 | 0 | 32767 | 0 | -- | None |
| P08.25 | Encoder memory value L | 0 | -214... | 21474... | 0 | -- | None |
| P08.26 | IO combination trigger ... | 0 | 0 | 65535 | 0 | -- | None |
| P08.27 | IO combination filtering | 5 | 0 | 10000 | 5 | ms | None |
| P08.28 | S code current output v... | 0x0 | 0x0 | 0xFFFF | 0x0 | -- | None |
| P08.29 | PR Warning | 0x0 | 0x0 | 0xFFFF... | 0x0 | -- | None |
| P08.30 | Reserved | 0 | 0 | 65535 | 0 | -- | None |

All PR mode and control parameters can be found on this list for convenience of tuning




To run PR mode in a loop

## 10.4.2 Physical I/O

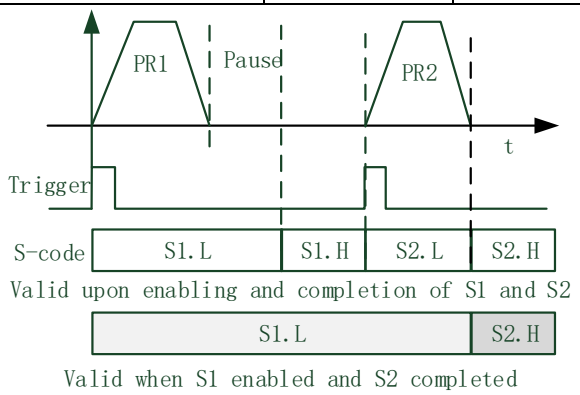
Path motion, feedback status, etc. can be triggered through I/O in PR mode. Please refer to the table below for I/O assignments in PR mode.

| Input | | | | Output | | | |
|---|---|---|---|---|---|---|---|
| Label | Signal | Value | | Label | Signal | Value | |
| | | NO | NC | | | NO | NC |
| Command trigger | CTRG | 20h | A0h | Command completed | CMD_OK | 20h | A0h |
| Homing | HOME | 21h | A1h | Path completed | PR_OK | 21h | A1h |
| Forced emergency stop | STP | 22h | A2h | Homing completed | HOME_OK | 22h | A2h |
| Positive JOG | PJOG | 23h | A3h | S-code 0 | SD0 | 23h | A3h |
| Negative JOG | NJOG | 24h | A4h | S-code 1 | SD1 | 24h | A4h |
| Positive position limit | PL | 25h | A5h | S-code 2 | SD2 | 25h | A5h |
| Negative position limit | NL | 26h | A6h | S-code 3 | SD3 | 26h | A6h |
| Origin | ORG | 27h | A7h | S-code 4 | SD4 | 27h | A7h |
| Path address 0 | ADD0 | 28h | A8h | S-code 5 | SD5 | 28h | A8h |
| Path address 1 | ADD1 | 29h | A9h | S-code 6 | SD6 | 29h | A9h |
| Path address 2 | ADD2 | 2ah | AAh | PR warning | PRWAR | 2Ah | AAh |
| Path address 3 | ADD3 | 2bh | ABh | | | | |
| Torque switching | TC-SEL | 09h | 89h | | | | |

### S-code

S-code（Status code）is the S-code of currently operating PR positioning data.
Every PR path has a S-code setting.

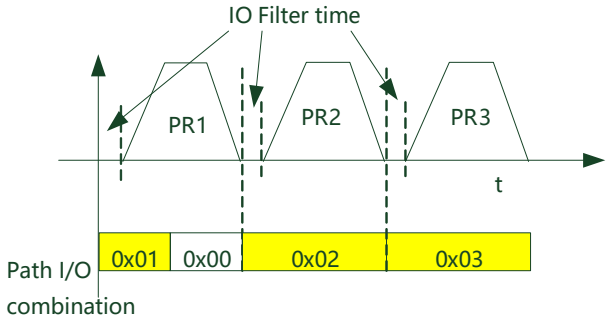
| **S-code** | Sx.H | | Sx.L | |
|---|---|---|---|---|
| **Bit** | 15 | 8-14 | 7 | 0-6 |
| **Description** | S-code valid when completed.<br>0: Invalid, retain previous value<br>1: Valid | S-code upon completion | S-code valid upon activation<br>0: Invalid<br>1: Valid | S-code upon activation |




| **S-code bit** | bit0/8 | bit1/9 | bit2/10 | bit3/11 | bit4/12 | bit5/13 | Bit6/14 |
|---|---|---|---|---|---|---|---|
| **SDx** | SD0 | SD1 | SD2 | SD3 | SD4 | SD5 | SD6 |

## I/O trigger

Path motion trigger: Edge trigger/combination trigger (P08.26). Edge trigger is triggering path combination motion using I/O. I/O combination trigger uses electrical level as trigger rather than signal edge. No valid motion for path 0 and I/O combination triggers motion once after I/O filter when converted to non-zero paths.




***Path combination 0 is invalid because I/O combination x>0->x can be triggered multiple times when using incremental position.*
**In I/O combination trigger mode 2, path motion will be triggered upon servo driver power on if I/O combination not set to 0. Please be careful.*

| P08.26 | Label | I/O combination trigger mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0X601A |

| Value | Description |
|---|---|
| 【0】 | Disable I/O combination trigger mode. Use I/O CTRG signal edge trigger. |
| 1 | Enable I/O combination trigger. Valid when HOME-OK signal is valid. |
| 2 | Enable I/O combination trigger. HOME-OK signal not required. |

IO combination trigger select path using ADD0~ADD3. Trigger mode is set in P08.26.

| ADD3 | ADD2 | ADD1 | ADD0 | Path selection |
|---|---|---|---|---|
| OFF | OFF | OFF | OFF | Path 0 (Non-action) |
| OFF | OFF | OFF | ON | Path1 |
| OFF | OFF | ON | OFF | Path2 |
| OFF | OFF | ON | ON | Path3 |
| OFF | ON | OFF | OFF | Path4 |
| OFF | ON | OFF | ON | Path5 |
| OFF | ON | ON | OFF | Path6 |
| OFF | ON | ON | ON | Path7 |
| ON | OFF | OFF | OFF | Path8 |
| ON | OFF | OFF | ON | Path9 |
| ON | OFF | ON | OFF | Path10 |
| ON | OFF | ON | ON | Path11 |
| ON | ON | OFF | OFF | Path12 |
| ON | ON | OFF | ON | Path13 |
| ON | ON | ON | OFF | Path14 |
| ON | ON | ON | ON | Path15 |

### 10.4.3 485 Communication

485 communication can be used to achieve the same functions as with I/O, modifying PR related parameters and trigger path motions. Through this communication protocol, controlling multiple axes can be realized, saving wiring works with flexibility in the system. 485 communication includes 2 kinds of mode: Fixed trigger and immediate trigger.

485 communication parameters:

<table>
<tr><th>Parameter</th><th>Label</th><th>Description</th></tr>
<tr><td>P05.29</td><td>Communication mode</td><td>485 communication mode data
<table>
<tr><th>Value</th><th>Bit</th><th>Checksum</th><th>Stop</th></tr>
<tr><td>0</td><td>8</td><td>Even</td><td>2</td></tr>
<tr><td>1</td><td>8</td><td>Odd</td><td>2</td></tr>
<tr><td>2</td><td>8</td><td>Even</td><td>1</td></tr>
<tr><td>3</td><td>8</td><td>Odd</td><td>1</td></tr>
<tr><td>4</td><td>8</td><td>Null</td><td>1</td></tr>
<tr><td>【5】</td><td>8</td><td>Null</td><td>2</td></tr>
</table></td></tr>
<tr><td>P05.30</td><td>Baud rate</td><td>To set communication speed of RS485 communication
<table>
<tr><th>Value</th><th>Baud rate</th><th>Value</th><th>Baud rate</th></tr>
<tr><td>0</td><td>2400bps</td><td>【4】</td><td>38400bps</td></tr>
<tr><td>1</td><td>4800bps</td><td>5</td><td>57600bps</td></tr>
<tr><td>2</td><td>9600bps</td><td>6</td><td>115200bps</td></tr>
<tr><td>3</td><td>19200bps</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>P05.31</td><td>ID</td><td>Modbus slave ID address</td></tr>
<tr><td>P08.02</td><td>PR trigger</td><td>
<table>
<tr><th>Attribute</th><th>Index</th><th>Description</th></tr>
<tr><td>Write</td><td>0x01P</td><td>N path positioning</td></tr>
<tr><td>Write</td><td>0x020</td><td>Reset</td></tr>
<tr><td>Write</td><td>0x021</td><td>Manually set currently position as 0 (Origin)</td></tr>
<tr><td>Write</td><td>0x040</td><td>Emergency stop</td></tr>
<tr><td>Read</td><td>0x000P</td><td>Positioning completed. Ready to receive new data</td></tr>
<tr><td>Read</td><td>0x01P,<br>0x020,<br>0x040</td><td>Yet to respond to command</td></tr>
<tr><td>Read</td><td>0x10P</td><td>Path motion undergoing</td></tr>
<tr><td>Read</td><td>0x200</td><td>Command completed. Waiting for positioning</td></tr>
</table></td></tr>
</table>

PR mode communication address:
Class 8 parameters: 0x6000+(Param-ID-800). For example, P08.06: 0x6000+(806-800) =0x6006
Class 9 parameters: 0x6200+(Param-ID-900). For example, P09.06: 0x6200+(906-900) =0x6206

### 10.4.4 Path Trigger

#### Fixed trigger

Fixed triggering method is to set all 16 paths homing and other settings, then through P08.02 (trigger register to replace CTRG and HOME) to enable path. Recommended for simple applications with fixed motions.

Steps:

1. Set homing and path attributes using EDrive. Power on driver for parameters to be valid.
2. Write corresponding command into 0x6002(P08.02) to realize required motions.

| Attribute | Index | Description |
|---|---|---|
| Write | 0x01P | *N* path positioning |
| Write | 0x020 | Reset |
| Write | 0x021 | Manually set currently position as 0 (Origin) |
| Write | 0x040 | Emergency stop |
| Read | 0x000P | Positioning completed. Ready to receive new data |
| Read | 0x01P, 0x020, 0x040 | Yet to respond to command |
| Read | 0x10P | Path motion undergoing |
| Read | 0x200 | Command completed. Waiting for positioning |

#### Immediate trigger

Immediate trigger is more flexible while fixed triggering is restricted by 16 paths position. Path motion is triggered immediately once path is written. Motions such as position, velocity or homing are realized through data frame.

This triggering method uses PR0 with 8 data from which P09.07 mapped into P08.02. When 0x10 is written into P08.02, it will trigger PR0 motion immediately.

Steps:

1. Set homing and path attributes using EDrive. (Homing parameters must be set) Power on driver for parameters to be valid.
2. Control specific path using P08.02.
3. Realize path motion by writing into P09.00 – P09.07 with P09.07 = 0x10

Master device request frame byte data

| No. | Data | Description | Value |
|---|---|---|---|
| 1 | ID | Slave ID | 1~127 |
| 2 | FC | Function code | 0x10 |
| 3 | ADDR | Address | 0x62 |
| 4 | ADDR | Address | 0x00 |
| 5~6 | NUM1 | Data count（Word） | 0x0008 |
| 7 | NUM2 | Data count（Byte） | 0x10 |
| 8-9 | P09.00 | Mode | XXXX |
| 10-11 | P09.01 | Position high bit | XXXX |
| 12-13 | P09.02 | Position low bit | XXXX |
| 14-15 | P09.03 | Velocity | XXXX |
| 16-17 | P09.04 | Acceleration | XXXX |
| 18-19 | P09.05 | Deceleration | XXXX |
| 20-21 | P09.06 | Delay time | XXXX |
| 22-23 | P09.07 | Trigger control | 0x0010 |
| 24 | CRC | Checksum Lo | |
| 25 | | Checksum Hi | |

**Slave response frame byte data**

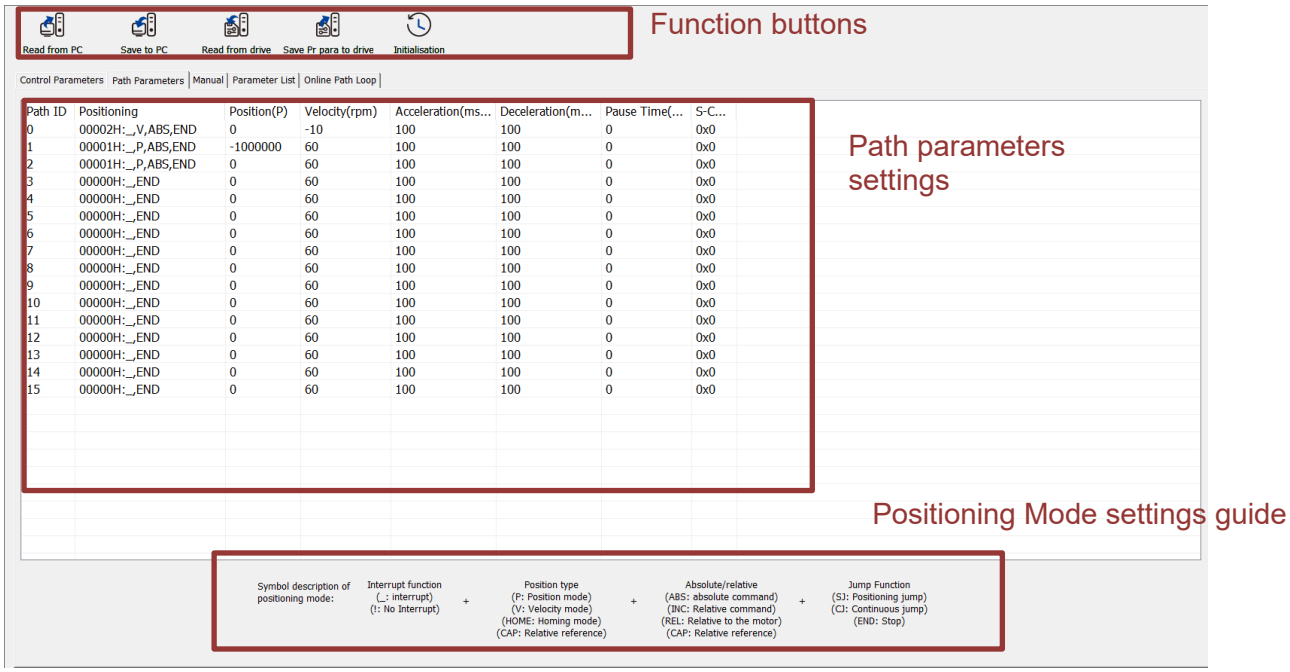
| No. | Data | Description | Value |
|---|---|---|---|
| 1 | ID | Slave ID | 1~127 |
| 2 | FC | Function code | 0x10 |
| 3 | ADDR | Address | 0x62 |
| 4 | ADDR | Address | 0x00 |
| 5 | NUM | Data count（Word） | 0x08 |
| 6 | CRC | Checksum Lo | 0xXX |
| 7 | | Checksum Hi | 0xXX |

18.

## 10.5 PR motion

### 10.5.1 Trigger Using Physical I/O

1. Set up servo driver parameters such as P00.01 = 6. Required PR I/Os are set in P04.00-P04.15
2. Set up PR control parameters such as trigger, homing, emergency stop, velocity, etc. as shown below
3. Set PR path parameters such as motion type, S-code, etc. as shown below. The interface is divided into 3 parts：



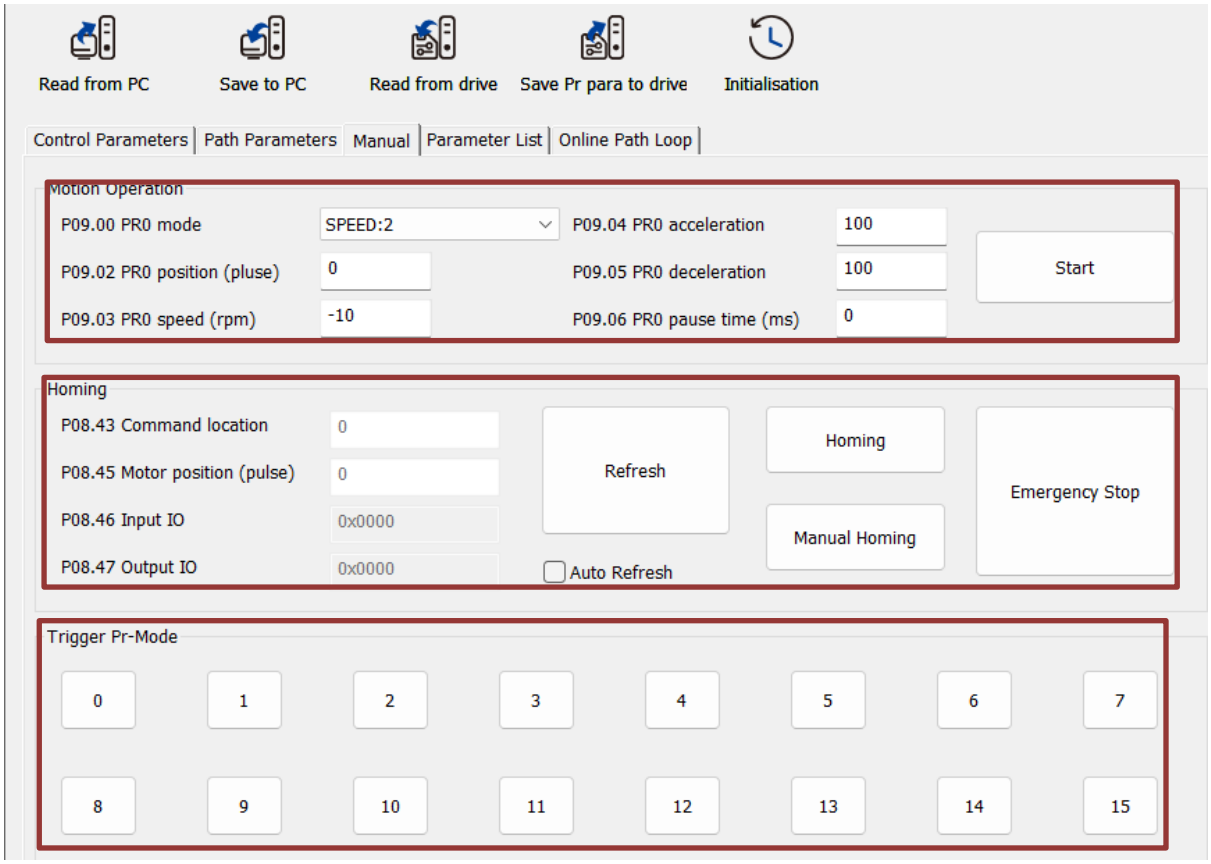

| Path ID | Positioning | Position(P) | Velocity(rpm) | Acceleration(ms... | Deceleration(m... | Pause Time(... | S-C... |
|---|---|---|---|---|---|---|---|
| 0 | 00002H:_,V,ABS,END | 0 | -10 | 100 | 100 | 0 | 0x0 |
| 1 | 00001H:_,P,ABS,END | -1000000 | 60 | 100 | 100 | 0 | 0x0 |
| 2 | 00001H:_,P,ABS,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 3 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 4 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 5 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 6 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 7 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 8 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 9 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 10 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 11 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 12 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 13 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 14 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |
| 15 | 00000H:_,END | 0 | 60 | 100 | 100 | 0 | 0x0 |

**Function buttons**: Upload, download parameters to/from drives, save parameter, backup and reset to factory default.




**Parameters**: Set PR path related parameters here
**Descriptions**: Short explanation on each PR path motion types
*Remember to upload parameters to drive and save to drive after parameters setup.*
4. Set up homing, trigger, I/O in PR mode as shown below:
***Please select required path when using edge trigger. Make sure the corresponding path is chosen in I/O path selection*

**Please set up I/O combination filter time when using I/O combination trigger. Make sure I/O signal filter time covers the change in signal level.*




This page is divided into 3 parts:
**Motion Operation:** To set up parameters for Path 0. Click on “Start” and parameters will be automatically uploaded to driver
**Homing:** I/O and position display; Homing and emergency stop button
**Trigger Pr-Mode:** To trigger operation of any of the 16 PR paths.

## 10.5.2 Control Using 485 Communication

485 communication data frame format

| **Byte(x)** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **Definition** | ID | Function code | Addr. High 8-bit | Addr. Low 8-bit | Data High 8-bit | Data Low 8-bit | CRC checksum Low 8-bit | CRC checksum High 8-bit |

Please refer to Modbus communication in Chapter 7 to use Word function code writing. The request and respond frame data format is similar.

1. Set PR0 to travel to absolute position = 200000 (10000 pulse/rev)

| No. | 485 communication data frame | Description |
|---|---|---|
| 1 | 01 06 62 00 00 01 57 B2 | Set PR0 mode as absolute position |
| 2 | 01 06 62 01 00 03 87 B3 | Set PR0 position high bit |
| 3 | 01 06 62 02 0D 40 32 D2 | Set PR0 position low bit |
| 4 | 01 06 62 03 02 58 66 E8 | Set PR0 velocity |
| 5 | 01 06 62 04 00 32 56 66 | Set PR0 acceleration |
| 6 | 01 06 62 05 00 32 07 A6 | Set PR0 deceleration |
| 7 | 01 06 60 02 00 10 37 C6 | Trigger PR0 motion |
| 8 | 01 06 60 02 00 40 37 FA | Send Emergency stop datagram when required |

2. Set PR0 to travel relative distance = 10000 (10000 pulse/rev)

| No. | 485 communication data frame | Description |
|---|---|---|
| 1 | 01 06 62 00 00 41 56 42 | Set PR0 mode as relative position |
| 2 | 01 06 62 01 00 00 C7 B2 | Set PR0 position high bit |
| 3 | 01 06 62 02 27 10 2D 8E | Set PR0 position low bit |
| 4 | 01 06 62 03 02 58 66 E8 | Set PR0 velocity |
| 5 | 01 06 62 04 00 32 56 66 | Set PR0 acceleration |
| 6 | 01 06 62 05 00 32 07 A6 | Set PR0 deceleration |
| 7 | 01 06 60 02 00 10 37 C6 | Trigger PR0 motion |
| 8 | 01 06 60 02 00 40 37 FA | Send Emergency stop datagram when required |

3. Set PR0 as velocity mode with velocity = 600rpm

| No. | 485 communication data frame | Description |
|---|---|---|
| 1 | 01 06 62 00 00 02 17 B3 | Set PR0 as velocity mode |
| 2 | 01 06 62 03 02 58 66 E8 | Set PR0 velocity |
| 3 | 01 06 62 04 00 32 56 66 | Set PR0 acceleration |
| 4 | 01 06 62 05 00 32 07 A6 | Set PR0 deceleration |
| 5 | 01 06 60 02 00 10 37 C6 | Trigger PR0 motion |
| 6 | 01 06 60 02 00 40 37 FA | Send Emergency stop datagram when required |

4. Set PR1 to travel to absolute position = 200000 (10000 pulse/rev)

| No. | 485 communication data frame | Description |
|---|---|---|
| 1 | 01 06 62 08 00 01 D6 70 | Set PR1 mode |
| 2 | 01 06 62 09 FF FC 07 C1 | Set PR1 position high bit |
| 3 | 01 06 62 0A F2 C0 F3 40 | Set PR1 position low bit |
| 4 | 01 06 62 0B 02 58 E7 2A | Set PR1 velocity |
| 5 | 01 06 62 0C 00 32 D7 A4 | Set PR1 acceleration |
| 6 | 01 06 62 0D 00 32 86 64 | Set PR1 deceleration |
| 7 | 01 06 60 02 00 11 F6 06 | Trigger PR1 motion |
| 8 | 01 06 60 02 00 40 37 FA | Send Emergency stop datagram when required |

5. Set PR1 as velocity mode with velocity = 300rpm

| No. | 485 communication data frame | Description |
|---|---|---|
| 1 | 01 06 62 08 00 02 96 71 | Set PR1 as velocity mode |
| 2 | 01 06 62 0B 01 2C E7 FD | Set PR1 velocity |
| 3 | 01 06 60 02 00 11 F6 06 | Set PR1 acceleration |
| 4 | 01 06 62 0C 00 32 D7 A4 | Set PR1 deceleration |
| 5 | 01 06 62 0D 00 32 86 64 | Trigger PR1 motion |
| 6 | 01 06 60 02 00 40 37 FA | Send Emergency stop datagram when required |

6. Homing

| No. | 485 communication data frame | Description |
|---|---|---|
| 1 | 01 06 60 0A 00 00 B7 C8 | Set homing method |
| 2 | 01 06 60 0F 00 64 A6 22 | Set high homing velocity |
| 3 | 01 06 60 10 00 1E 16 07 | Set low homing velocity |
| 4 | 01 06 60 02 00 20 37 D2 | Trigger homing |
| 5 | 01 06 60 02 00 40 37 FA | Send Emergency stop datagram when required |

# Chapter 11 Special Functions

## 11.1 Multi-turn Absolute Encoder

Multiturn absolute encoder records the position, and the revolution counts of the motor. When driver is powered-off, multiturn absolute encoder will back 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.
If it is the first time using the encoder, please home the mechanical axis and initialize the absolute position of the encoder to zero. Set up a homing point and only home when there is an alarm. Please stop the axis before reading any position data to prevent inaccuracy.

### 11.1.1 Parameters Setting

| P00.15 | Label | Absolute encoder settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~15 | Unit | - | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x001F | | |
| | Valid | After restart | | | | | | |

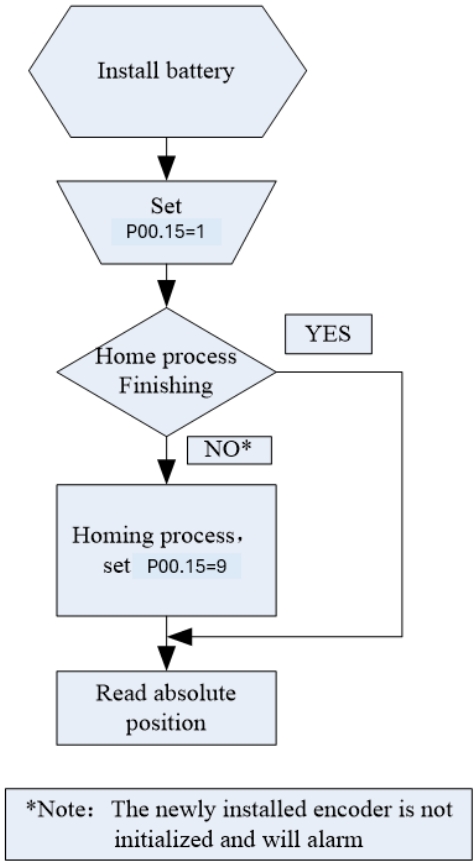
| Value | Mode | Description |
|---|---|---|
| 【0】 | Incremental | Doesn't retain position data on power off. Unlimited travel distance. |
| 1 | Multiturn absolute linear | Retrain position data on power off. For applications with fixed travel distance and no multiturn data overflow. |
| 2 | Multiturn absolute rotary | Retrain position data on power off. Actual data feedback in between 0-(P06.63+1). Unlimited travel distance. |
| 3 | Single turn absolute | Used when travel distance is within 1 revolution of the encoder. Data overflow will trigger alarm. |
| 5 | Multi turn absolute | Clear multiturn alarm and activate multiturn absolute function. Will switch to multiturn mode once alarm cleared, if remains at 5 after 3s, please solve according to Er153. |
| 9 | | Clear multiturn position, reset multiturn alarm and activate multiturn absolute function. Will switch to multiturn mode once alarm cleared, if remains at 9 after 3s, please solve according to Er153. Please disable axis before setting to 9 and home the axis before using. |
| Others | | Do not use! |

| P06.63 * | Label | Absolute Multi-turn Data Upper Limit | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~32766 | Unit | Turn | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x067F | | |
| | Valid | Power Cycle | | | | | | |

Sets the upper limit for absolute multi-turn data.
Applicable when P00.15 = 2 (multi-turn mode). In this case, feedback position cycles between 0 and (P06.63 + 1) × encoder resolution.
If the multi-turn data exceeds this limit, the value resets to 0.

## Read Absolute Position

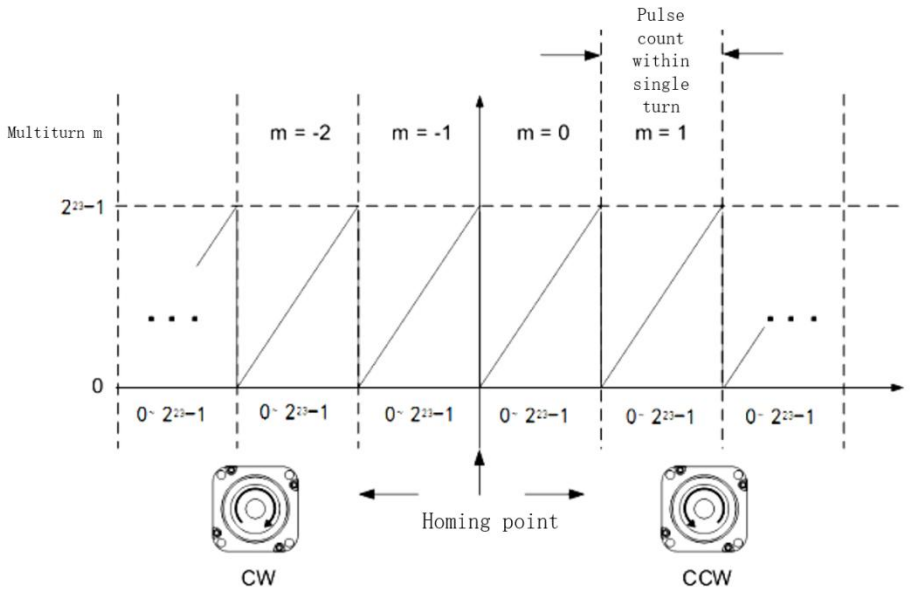
1. Steps：
   1) First, select a motor with multiturn absolute encoder, install battery and confirm whether the driver version supports the specific motor;
   2) Set P00.15 = 1. If it is the first time installation, Err153 will occur because battery is newly installed and position data is invalid. Please 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

When the rotor turns in clockwise direction, the revolution count will be negative; turns in counterclockwise direction, the count will be positive. No. of revolutions will be from -32767 to +32767. If the count number reaches +32767 in counterclockwise direction, the count will revert back to -32768, -32767 and vice versa for clockwise direction.

As for position data, it depends on the precision of the encoder. For 17 bit = 0-131071, 23 bit = 0-8388607



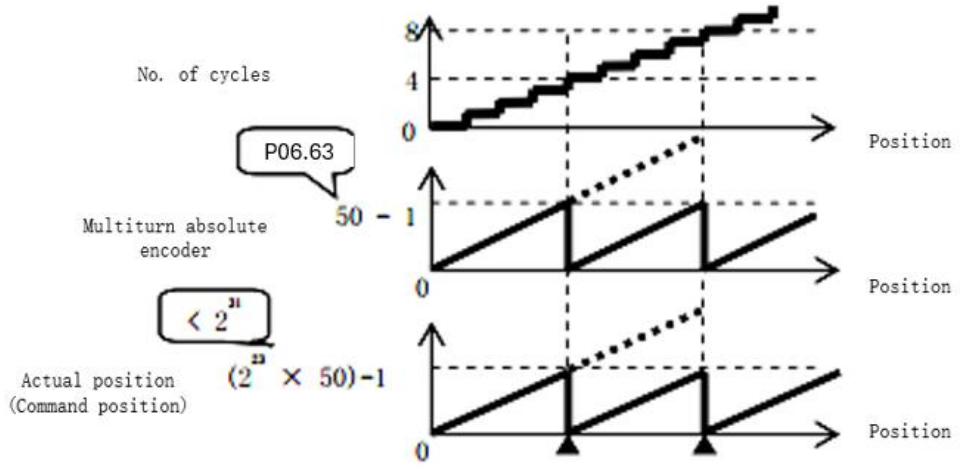

Read data from 485 address object dictionary
*Please read data only when the motor is fully stopped or it might cause calculation errors. Please repeat this step at least twice to make sure the result is uniform.*

## Multiturn linear mode(P00.15 = 1)

Multiturn absolute with memory of position at power off. Use this mode when travel distance is constant, encoder multiturn data would not overflow.
In this mode, encoder data ranges from -32768~32767. If the value either of the limits, Er157 might occur. Set 9 in P00.15 to clear multiturn data and home the axis.

## Multiturn rotational mode

For absolute encoder, multiturn rotational mode (P00.15 = 2, P06.63 set to multiturn upper limit) is added on top of incremental mode and multiturn linear mode. Actual feedback multiturn data is always between 0 – [P06.63 + 1], regardless of the direction of rotation. There is no limit to no. of rotation and no data overflow.



## Single turn absolute mode

Use this mode when the travel distance of the axis is within a single turn of the rotor.

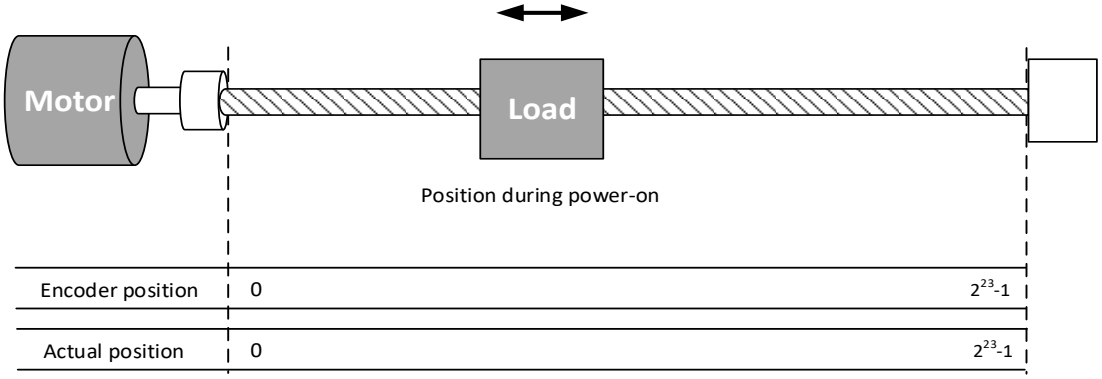
1. Target position input range – EtherCAT

When using 23-bit absolute encoder, under single turn absolute mode, electronic gear ratio =1:1

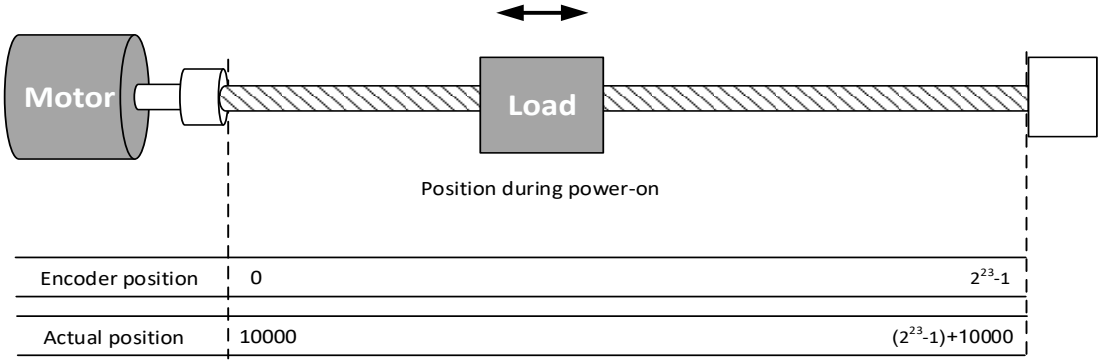
Homing point offset 607Ch = 0, target position range = 0 – [$2^{23}$-1]

Axis is homed, target position range = 607Ch – [$2^{23}$-1+607Ch]

When electronic gear ratio = 1:1, 607Ch = 0:




When electronic gear ratio = 1:1, 607Ch = 10000:




2. Clear multiturn position

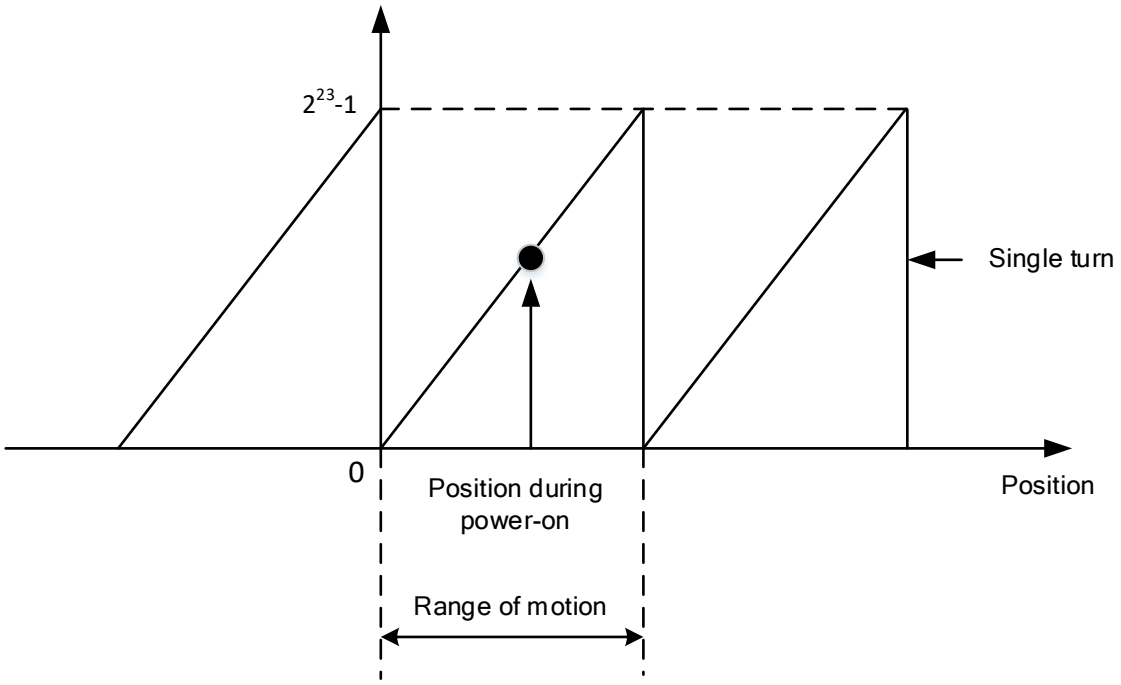
Before clearing multiturn position, axis needs to be homed. After clearing multiturn position, revolution count = 0 but absolute position remains unchanged and Err153 alarm will be cleared.

Please make sure the homing point is within the range of 1 revolution of the rotor. Installation and setup of the homing point can be set with the use of auxiliary function D21 on the front panel.

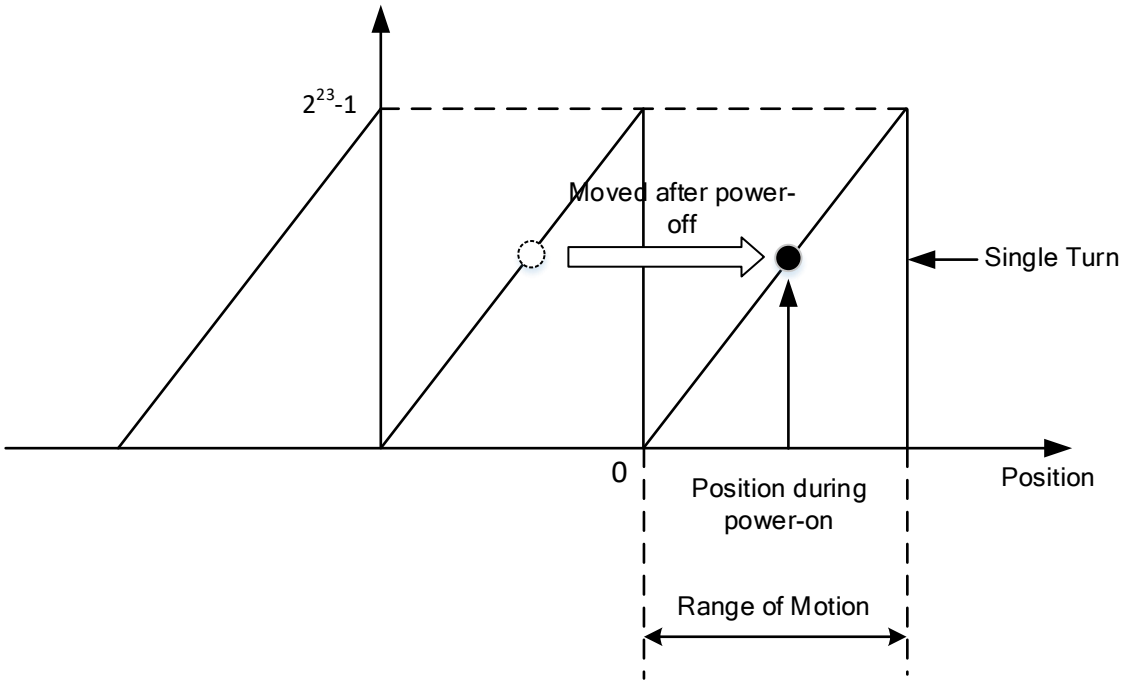
By setting P00.15 to 9, multiturn position will be cleared.

Please take notice of motor position during power on. Range of motion of a motor depends on the position of the motor during power on (23-bit absolute encoder as example).

If the motor position is as shown below during power on. The range of motion of the motor is within the range of a single turn of the motor from motor position during power on.




If power is turned off at position as shown below and power on when motor reaches the position below. Motor range of motion changes as shown below.



### 11.1.2 Absolute Encoder Related Alarm

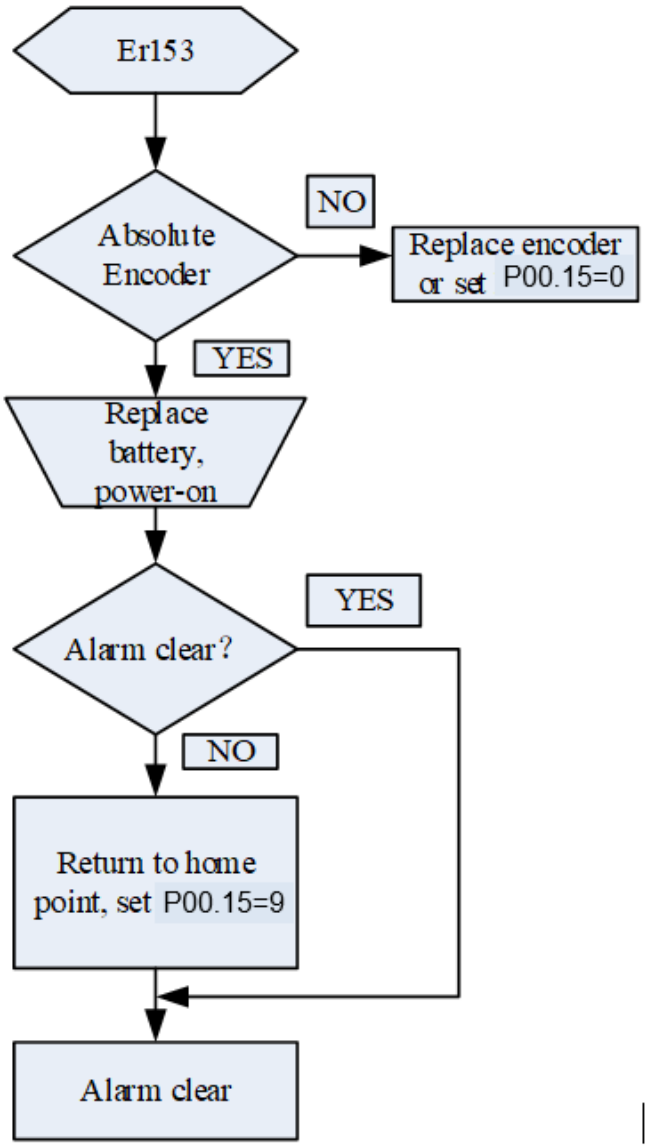
The alarm can determine if absolute value encoder is valid. If battery power is low, not a motor with absolute encoder, encoder error etc. occurs, user can find out about the error from alarm output or on the front panel. Controller will stop any operation until alarm is cleared.

Alarm output:
Err153 will be shown on front panel or by I/O ALM signal and from controller.

Err153 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) If battery voltage is lower than 3.2v. Replace battery and restart the motor.
3) If battery voltage is lower than 2.5v or battery power was cut off. Replacing the battery won't clear the alarm. Axis needs to be homed, and multiturn data needs to be cleared.

Alarm processing flow chart




### 11.1.3 Battery kit

In multiturn absolute mode, Er153 might occur upon first time installation. P00.15 needs to be set to 0 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 driver will reset warning automatically.

## 11.2 Safety Feature

### 11.2.1 Max. Motor Rotational Speed Limitation

Motor rotational speed limits can be set on P03.24. If command speed is 1500r/min, but P03.24 is set to 1000r/min, motor rotational speed will only go up to 1000r/min.
Motor overspeed threshold value can be set in P05.13, if the rotational speed is exceeded during operation, Er1A0 might occur.

| P03.24 | Label | Maximum motor rotational speed | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0331 | | |
| | Valid | Immediate | | | | | | |
| | To set maximum motor rotational speed but not higher than motor rated speed<br>If P03.24 = 0, maximum motor rotational speed = max. speed in motor parameter. | | | | | | | |

| P05.13 | Label | Overspeed level settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x051B | | |
| | Valid | Immediate | | | | | | |
| | If motor speed exceeds P05.13, Er1A0 might occur.<br>When P05.13 = 0, overspeed level = max. motor speed x 1.2 | | | | | | | |

## 11.2.2 Emergency Stop Function

Emergency stop is used when an alarm occurs or a servo prohibition signal is received when servo driver is enabled.

Method 1: Set up P04.43 to enable the function

| P04.43 | Label | Emergency stop function | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0457 | | |
| | Valid | Immediate | | | | | | |

| Value | Description. |
|---|---|
| 【0】 | Emergency stop is valid, servo driver will be forced to STOP and Err570 occurs. |
| 1 | Emergency stop is invalid, servo driver will not be forced to STOP. Servo can be enabled once E-STOP signal is cleared. |

| P05.04 | Label | Driver prohibition input settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0/1/2 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0509 | | |
| | Valid | Immediate | | | | | | |

To set driver prohibition input (POT/NOT)

| Value | Description |
|---|---|
| 0 | POT → Positive direction drive prohibited<br>NOT → Negative direction drive prohibited |
| 1 | POT and NOT invalid |
| 2 | Any single sided input from POT or NOT might cause Er260 |

Method 2: Using 605Ah object dictionary through master device to activate this function.

| P05.11 | Label | Servo braking torque setting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0517 | | |
| | Valid | Immediate | | | | | | |

To set torque limit for servo braking mode.
If P05.11 = 0, use torque limit as under normal situation.
Please note that if P05.11 set value is too low, emergency stop will take longer.

### 11.2.3 Servo Stopping Mode

| P05.06 | Label | Servo-off mode | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x050D | | |
| | Valid | Immediate | | | | | | |

To set servo driver disable mode and status.

| Value | Description | |
|---|---|---|
| | *Mode* | *Status* |
| 0 | Servo braking | Dynamic braking |
| 1 | Free stopping | Dynamic braking |
| 2 | Dynamic braking | Dynamic braking |
| 3 | Servo braking | Free-run |
| 4 | Free stopping | Free-run |
| 5 | Dynamic braking | Free-run |

*Servo braking: Stop servo axis quickly using braking torque*
*P05.06 only effective for stopping under normal circumstances. For stopping on alarm occurrence but refer to P05.10*

| P05.10 | Label | Servo-off due to alarm mode | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0515 | | |
| | Valid | After restart | | | | | | |

To set servo driver disable mode and status if alarm is triggered.
Alarm type 2:

| Value | Explanation | |
|---|---|---|
| | *Mode* | *Status* |
| 0 | Servo braking | Dynamic braking |
| 1 | Free stopping | Dynamic braking |
| 2 | Dynamic braking | Dynamic braking |
| 3 | Servo braking | Free-run |
| 4 | Free stopping | Free-run |
| 5 | Dynamic braking | Free-run |

Alarm type 1:

| Value | Explanation | |
|---|---|---|
| | *Mode* | *Status* |
| 0 | Dynamic braking | Dynamic braking |
| 1 | | |
| 2 | | |
| 3 | Servo braking | Free-run |
| 4 | Free stopping | Free-run |
| 5 | Dynamic braking | Free-run |

### 11.2.4 Max. Duration for Motor to Stop After Disabling

Set max time duration for motor to stop after disabling. If the time taken for motor to stop exceeds the duration set in P06.14 and motor speed is still higher than P04.39, holding brake will be activated. If motor doesn't have holding brake, dynamic braking will be activated to force stop the motor.

| P06.14 | Label | Max. time to stop after disabling | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | ms | Default | 500 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x061D | | |
| | Valid | Immediate | | | | | | |

To set the max. time allowed for the axis to stop at the emergency stop or normal axis disabling.
After disabling axis, if motor speed is still higher than P04.39 but the time set in P06.14 is reached, BRK_ON given and holding brake activated.
BRK_ON given time is determined by P06.14 or when motor speed goes below P04.39, whichever comes first.

Applications:
1. After disabling axis, if motor speed is still higher than P04.39 but the time set in P06.14 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 P06.14 is not yet reached, BRK_ON given and holding brake activated.

Dynamic brake will be providing the braking function if the function is activated for motors without holding brake.

### 11.2.5 External Brake Deactivation Output Signal BRK-OFF

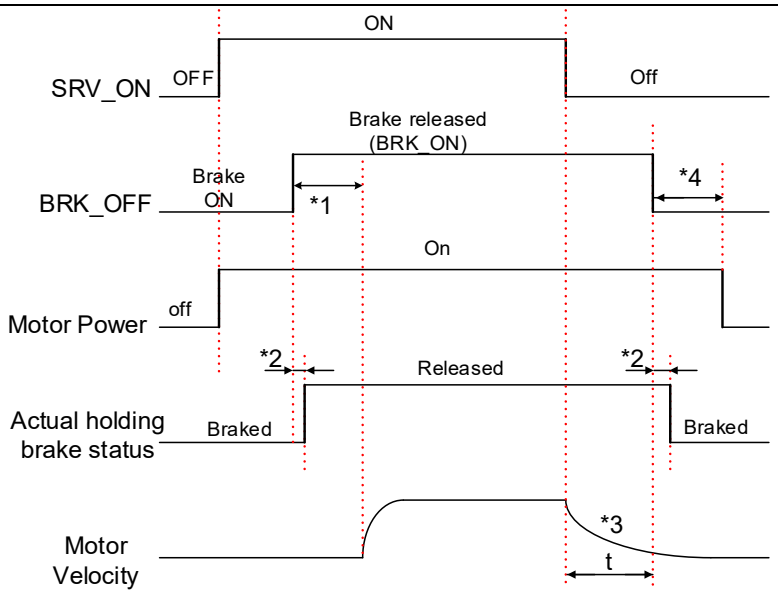
Please refer to P04.11 to set up the I/O output function parameters. When enabled and timing conditions are fulfilled, the set I/O output will deliver ON signal.

| P04.37 | Label | Motor power-off delay time | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3000 | Unit | 1ms | Default | 150 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x044B | | |
| | Valid | Immediate | | | | | | |

To set delay time for holding brake to be activated after motor power off to prevent axis from sliding.
When P05.06 = 0, SRV-ON signal is off, holding brake is activated (delay time is determined by P04.39 or P06.14). Motor powered-off once delay time set in P04.37 is due.

| P04.38 | Label | Holding brake release time | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3000 | Unit | 1ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x044D | | |
| | Valid | Immediate | | | | | | |

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 P04.38
*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 P06.14 or if motor speed goes below P04.39, whichever comes first. BRK_OFF given after deceleration time.
*4: P04.37 set time value.

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

| P04.39 | **Label** | Holding brake activation speed | | | **Valid mode(s)** | **P** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 30~3000 | **Unit** | r/min | **Default** | 30 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x044F | | |
| | **Valid** | Immediate | | | | | | |

To set the activation speed for which holding brake will be activated.

When SRV-OFF signal is given, motor decelerates, after it reaches below P04.39 and P06.14 is not yet reached, BRK_OFF is given.
BRK_OFF signal is determined by P06.14 or if motor speed goes below P04.39, whichever comes first.

Application:
1. After disabling axis, P06.14 has been reached but motor speed is still above P04.39, BRK_OFF signal given.
2. After disabling axis, P06.14 has not been reached but motor speed is below P04.39, BRK_OFF signal given.

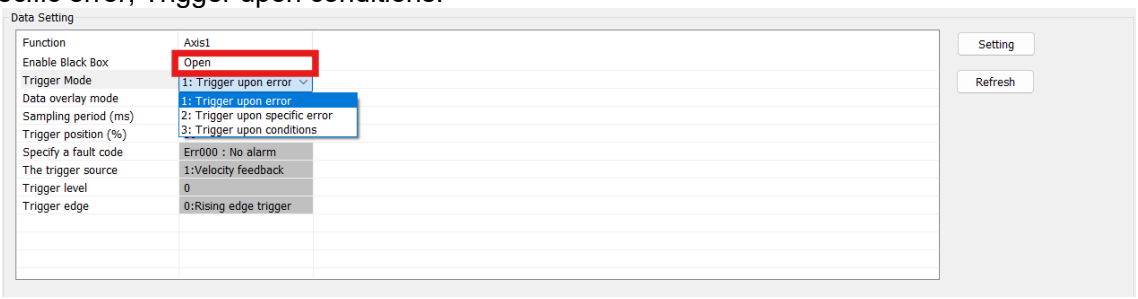
Deceleration max duration: 2s. Servo disabled after 2s.

## 11.3 Black Box

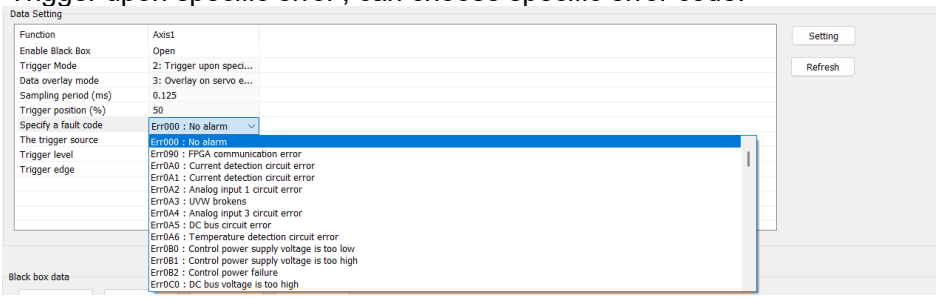
Black box is a function which allows users to set conditions or data to be captured whenever error occurs. The data will be recorded by black box at the moment of error occurrence and automatically saved. Thus, through Misumi EDrive, user can analyze cause of the problem with the aid of black box data.
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.

### Black Box Trigger Settings

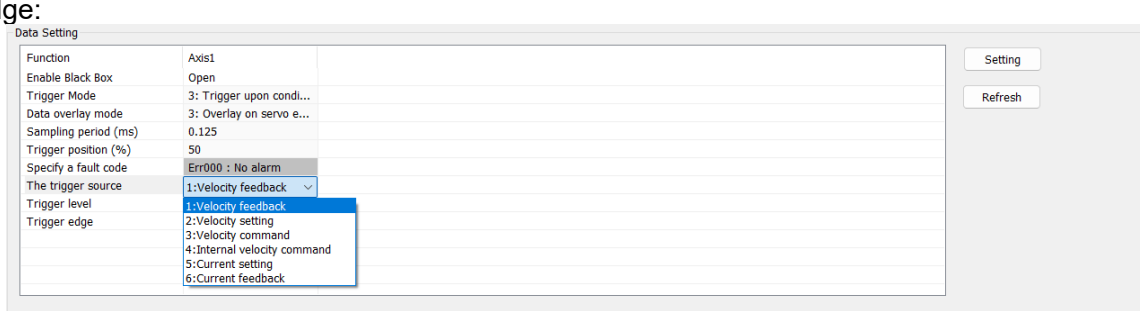
1. After Enable Black Box, there are three trigger modes: Trigger upon error, Trigger upon specific error, Trigger upon conditions.




2. If select ‘Trigger upon specific error’, can choose specific error code:




3. If select ‘Trigger upon conditions’, can choose the trigger source, Trigger level and Trigger edge:




4. Choose whether black box data can be overwritten and when. If choose ‘No overlay’, the black box will only save data from the first fault trigger.



5. Sampling Period: Determines total sampling time and waveform resolution. Smaller values result in finer waveforms but shorter total sampling time.

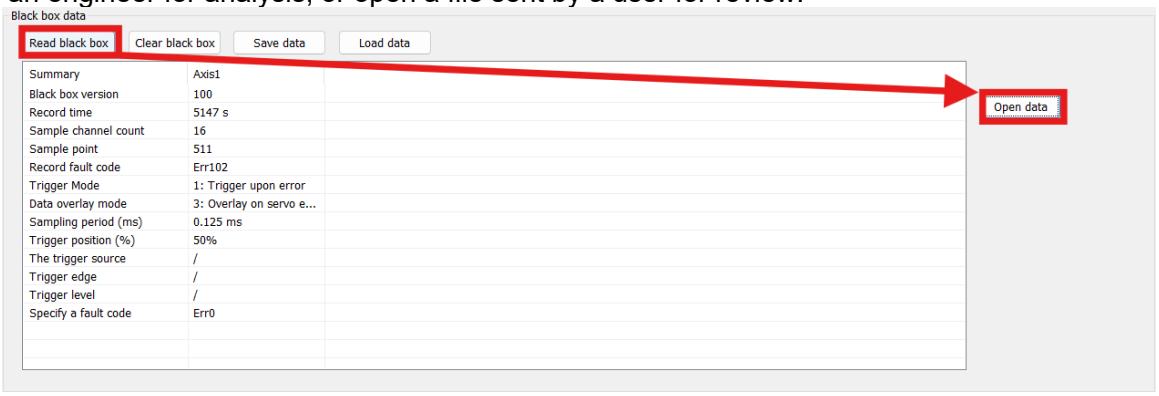
6. Trigger Position: Can set the trigger point within the total sampling time. This is user-configurable.

7. After selecting black box properties, click “Setting” to download the configuration parameters to the driver.

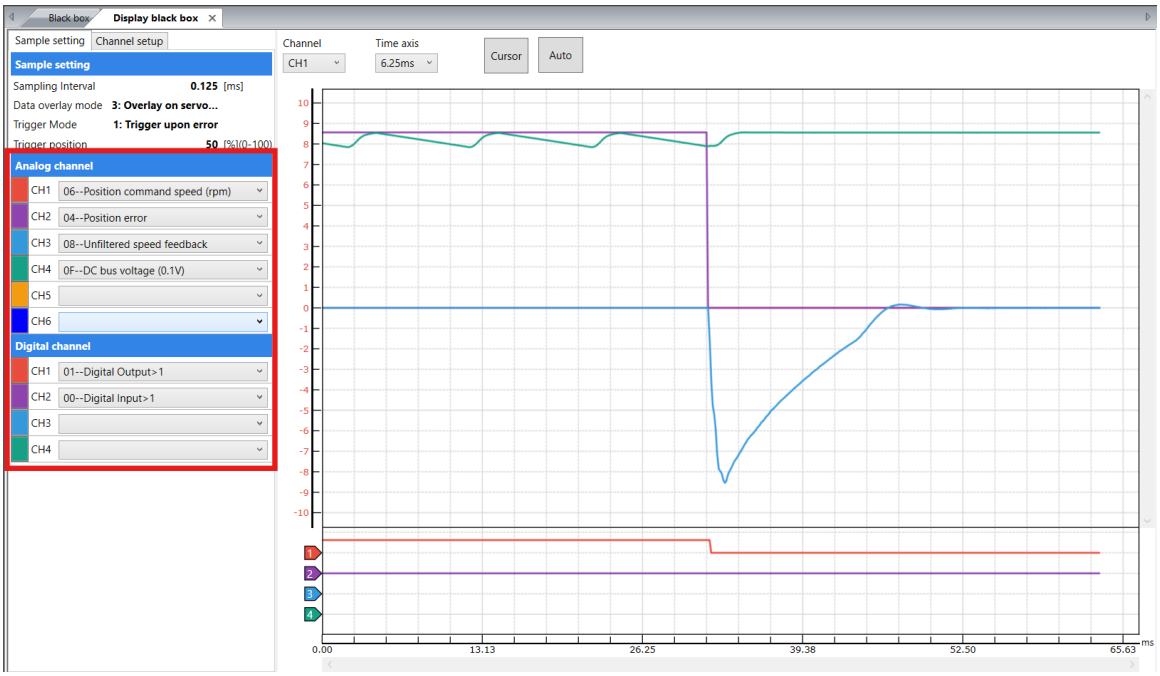
## Black Box Data Reading

When the black box contains fault waveform data, you can use the MISUMI EDrive Black Box Function to read or clear the data.

1. Click “Read Black Box”. This retrieves the current stored data. Click “Open Data” to enter the waveform display interface. You can also save or load data, export the black box data file to send to an engineer for analysis, or open a file sent by a user for review.




2. Black Box Waveform Display Interface: In this interface, you can configure which channels you want to view.



## 11.4 Full Closed Loop Control

Full closed loop control utilizes external position sensor (i.e. grading ruler) to get actual position feedback to implement position control. This control can compensate for lead screw tolerance and any changes due to temperature.
Parameters setting needs to make sure a smooth axis motion profile. No overtravel or abnormal noise at stopping.

1. Set external encoder
   External encoder type can be set accordingly in P00.31. At the moment, only ABZ incremental encoder is supported.

| Parameter | Label | Range | Description |
|---|---|---|---|
| P00.31 | External encoder type | 0~3 | =0：ABZ incremental encoder<br>=1：Communication incremental encoder<br>=2：Communication absolute incremental encoder (Tamagawa protocol)<br>=3：BISS-C |

2. Set direction of external encoder
   Please make sure the direction of the external encoder is the same as the motor encoder to prevent motor runaway.
   a) Enter position JOG mode. Jog the motor in the same direction at low velocity. Monitor if the feedback value of d21 absolute encoder single turn position and d21_1 external encoder are changing in the same trend. If they are not the same, inverse the setting of P00.32.
   b) The feedback value of d21 and d21_1 can be verified by pushing the axis and monitoring the trend of the changes. Please make sure the servo axis is disabled.
   c) Use trial run to set up a reciprocating motion. Max velocity > 200rpm. If d49 = 1 after several cycles of motion, set P00.32 to 1; d48 External encoder feedback pulse count per revolution.
3. Set external encoder feedback pulse count
   When P00.37 = 0, set external encoder feedback pulse count per revolution in P00.36. If the lead size of lead screw and encoder accuracy are known, please calculate using the formula below and enter the result into P00.36.

$$\text{P00.36} = \frac{\text{Lead size of lead screw (mm)}}{\text{Encoder accuracy } (\frac{\mu\text{m}}{\text{pulse}})}$$

   23-bit encoder resolution = 8388608 pulses
   Please make sure the parameters are set correctly to avoid excessive position deviation especially after long range motion. This may trigger excessive hybrid control deviation error alarm.

| Parameter | Label | Range | Description |
|---|---|---|---|
| P00.35 | External encoder frequency divider numerator | 0~$2^{23}$ | To set external encoder frequency divider numerator<br>When P00.35 = 0, numerator = resolution of encoder |
| P00.36 | External encoder frequency divider denominator | 1~$2^{23}$ | To set external encoder frequency divider denominator |
| P00.37 | External encoder feedback pulse count per revolution | 0~2147483648 | When P00.37 = 0, P00.36 set value = external encoder feedback pulse count per revolution. |

4. Set alarm threshold
   - Excessive hybrid deviation (P00.33)

   To set alarm threshold value for the position deviation between motor actual position and external encoder actual position. Er191 might occur if position deviation exceeds alarm threshold value.
   - Clear hybrid control deviation (P00.34)

   Use to set the condition to clear hybrid control deviation (Only in full closed loop control mode)

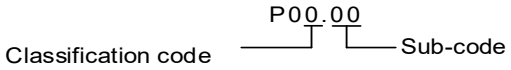
| Set value | Description |
|---|---|
| 【0】 | OFF |
| 1~100 | Revolution count to clear hybrid control deviation |

5. Set encoder feedback mode
   Set P00.30 = 1 to enable external encoder feedback, this is to activate full closed loop control. P00.01 needs to be set to 1 to enable this function. Please restart driver after modifying this parameter.

| Parameter | Label | Range | Description |
|---|---|---|---|
| P00.30 | Encoder feedback mode | 0~2 | =0：Motor encoder<br>=1：External encoder (Full closed loop control)<br>=2：Reserved |

# Appendix I Parameter

## Parameters List




*Valid mode:*
**P**: Valid in position control mode
**S**: Valid in velocity control mode
**T**: Valid in torque control mode
**PR**: Valid in PR control mode

**Initial Value:**
Factory default value

◆ **Activation Method:**
"**O**" indicates the parameter takes effect after power cycle
"**—**" indicates the parameter takes effect immediately
"△" indicates the parameter takes effect after stopping
"●" indicates the parameter takes effect after re-enabling

◆ **Effective Mode:**
"**O**" in the Effective Mode column means the parameter is valid in this mode
"**—**" means the parameter is not valid in this mode

◆ **Additional Notes:**
32-bit data, with high byte first and low byte last
The attribute of mapped parameters (including R/W permissions and data length) is determined by the parameter to which the pointer refers

**Note:**
For software versions **105 and above**, parameter numbers **PAx** have been changed to **P0x**. To check the software version, refer to the panel "Run Data Monitor Mode" display code **d28no**.

**[Class 0] Basic settings**

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P00.00 | Model-following bandwidth (MFC) | / | / | O | — | — | 16bit | R/W | 0x0001 |
| P00.01 | Control Mode Settings | / | / | O | O | O | 16bit | R/W | 0x0003 |
| P00.02 | Real time Auto Gain Adjusting | / | / | O | O | O | 16bit | R/W | 0x0005 |
| P00.03 | Real time auto stiffness adjusting | / | / | O | O | O | 16bit | R/W | 0x0007 |
| P00.04 | Inertia ratio | / | / | O | O | O | 16bit | R/W | 0x0009 |
| P00.05 | Command pulse input selection | / | / | O | — | — | 16bit | R/W | 0x000B |
| P00.06 | Command pulse polarity inversion | / | / | O | — | — | 16bit | R/W | 0x000D |
| P00.07 | Command pulse input mode | / | / | O | — | — | 16bit | R/W | 0x000F |
| P00.08 | 1st command pulse count per revolution | / | / | O | — | — | 32bit | R/W | 0x0010 0x0011 |
| P00.09 | 1st command frequency divider/multiplier numerator | / | / | O | — | — | 32bit | R/W | 0x0012 0x0013 |

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P00.10 | 1st command frequency divider/multiplier denominator | / | / | O | — | — | 32bit | R/W | 0x0014 0x0015 |
| P00.11 | Encoder output pulse count per revolution | / | / | O | O | O | 16bit | R/W | 0x0017 |
| P00.12 | Pulse output logic inversion | / | / | O | O | O | 16bit | R/W | 0x0019 |
| P00.13 | 1st Torque Limit | / | / | O | O | O | 16bit | R/W | 0x001B |
| P00.14 | Excessive position deviation | / | / | O | — | — | 16bit | R/W | 0x001D |
| P00.15 | Absolute Encoder settings | / | / | O | O | O | 16bit | R/W | 0x001F |
| P00.16 | Regenerative resistance | / | / | O | O | O | 16bit | R/W | 0x0021 |
| P00.17 | Regenerative resistor power rating | / | / | O | O | O | 16bit | R/W | 0x0023 |
| P00.22 | PR and P/S/T switching | / | / | O | O | O | 16bit | R/W | 0x002D |
| P00.25 | Auxiliary function | / | / | O | O | O | 16bit | R/W | 0x0033 |
| P00.26 | Simulated I/O | / | / | O | O | O | 16bit | R/W | 0x0035 |
| P00.39 | Pulses per revolution (PR dedicated) | / | / | - | - | - | 32bit | R/W | 0x004E 0x004F |
| P00.40 | Mapping parameter 1 | / | / | O | O | O | 32bit | R/W * | 0x0050 0x0051 |
| P00.41 | Mapping parameter 2 | / | / | O | O | O | 32bit | R/W * | 0x0052 0x0053 |
| P00.42 | Mapping parameter 3 | / | / | O | O | O | 32bit | R/W * | 0x0054 0x0055 |
| P00.43 | Mapping parameter 4 | / | / | O | O | O | 32bit | R/W * | 0x0056 0x0057 |
| P00.44 | Mapping parameter 5 | / | / | O | O | O | 32bit | R/W * | 0x0058 0x0059 |
| P00.45 | Mapping parameter 6 | / | / | O | O | O | 32bit | R/W * | 0x005A 0x005b |
| P00.46 | Mapping parameter 7 | / | / | O | O | O | 32bit | R/W * | 0x005C 0x005d |
| P00.47 | Mapping parameter 8 | / | / | O | O | O | 32bit | R/W * | 0x005E 0x005F |
| P00.50 | Mapping parameter 1 indicator | / | / | O | O | O | 32bit | R/W | 0x0064 0x0065 |
| P00.51 | Mapping parameter 2 indicator | / | / | O | O | O | 32bit | R/W | 0x0066 0x0067 |
| P00.52 | Mapping parameter 3 indicator | / | / | O | O | O | 32bit | R/W | 0x0068 0x0069 |
| P00.53 | Mapping parameter 4 indicator | / | / | O | O | O | 32bit | R/W | 0x006A 0x006B |
| P00.54 | Mapping parameter 5 indicator | / | / | O | O | O | 32bit | R/W | 0x006C 0x006D |
| P00.55 | Mapping parameter 6 indicator | / | / | O | O | O | 32bit | R/W | 0x006E 0x007F |
| P00.56 | Mapping parameter 7 indicator | / | / | O | O | O | 32bit | R/W | 0x0070 0x0071 |

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P00.57 | Mapping parameter 8 indicator | / | / | O | O | O | 32bit | R/W | 0x0072<br>0x0073 |

## [Class 1] Gain adjustment

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P01.00 | 1st position loop gain | / | / | O | — | — | 16bit | R/W | 0x0101 |
| P01.01 | 1st velocity loop gain | / | / | O | O | O | 16bit | R/W | 0x0103 |
| P01.02 | 1st Integral Time Constant of Velocity Loop | / | / | O | O | O | 16bit | R/W | 0x0105 |
| P01.03 | 1st velocity detection filter | / | / | O | O | O | 16bit | R/W | 0x0107 |
| P01.04 | 1st Torque Filter Time Constant | / | / | O | O | O | 16bit | R/W | 0x0109 |
| P01.05 | 2nd Position Loop Gain | / | / | O | — | — | 16bit | R/W | 0x010B |
| P01.06 | 2nd velocity loop gain | / | / | O | O | O | 16bit | R/W | 0x010D |
| P01.07 | 2nd Integral Time Constant of Velocity Loop | / | / | O | O | O | 16bit | R/W | 0x010F |
| P01.08 | 2nd velocity detection filter | / | / | O | O | O | 16bit | R/W | 0x0111 |
| P01.09 | 2nd Torque Filter Time Constant | / | / | O | O | O | 16bit | R/W | 0x0113 |
| P01.10 | Velocity feed forward gain | / | / | O | — | — | 16bit | R/W | 0x0115 |
| P01.11 | Velocity feed forward filter time constant | / | / | O | — | — | 16bit | R/W | 0x0117 |
| P01.12 | Torque feed forward gain | / | / | O | O | — | 16bit | R/W | 0x0119 |
| P01.13 | Torque feed forward filter time constant | / | / | O | O | — | 16bit | R/W | 0x011B |
| P01.15 | Position control gain switching mode | / | / | O | — | — | 16bit | R/W | 0x011F |
| P01.17 | Position control gain switching level | / | / | O | — | — | 16bit | R/W | 0x0123 |
| P01.18 | Hysteresis at position control switching | / | / | O | — | — | 16bit | R/W | 0x0125 |
| P01.19 | Position control switching time | / | / | O | — | — | 16bit | R/W | 0x0127 |
| P01.35 | Position command pulse filter time | / | / | O | — | — | 16bit | R/W | 0x0147 |
| P01.39 | Special function register 1 | / | / | O | O | O | 16bit | R/W | 0x014E<br>0x014F |

## [Class 2] Vibration suppression

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P02.00 | Adaptive filtering mode settings | / | / | O | O | — | 16bit | R/W | 0x0201 |
| P02.01 | 1st notch frequency | / | / | O | O | O | 16bit | R/W | 0x0203 |
| P02.02 | 1st notch width | / | / | O | O | O | 16bit | R/W | 0x0205 |
| P02.03 | 1st notch depth | / | / | O | O | O | 16bit | R/W | 0x0207 |
| P02.04 | 2nd notch frequency | / | / | O | O | O | 16bit | R/W | 0x0209 |
| P02.05 | 2nd notch width | / | / | O | O | O | 16bit | R/W | 0x020B |
| P02.06 | 2nd notch depth | / | / | O | O | O | 16bit | R/W | 0x020D |
| P02.07 | 3rd notch frequency | / | / | O | O | O | 16bit | R/W | 0x020F |
| P02.08 | 3rd notch width | / | / | O | O | O | 16bit | R/W | 0x0211 |
| P02.09 | 3rd notch depth | / | / | O | O | O | 16bit | R/W | 0x0213 |
| P02.14 | 1st damping frequency | / | / | O | — | — | 16bit | R/W | 0x021D |
| P02.16 | 2nd damping frequency | / | / | O | — | — | 16bit | R/W | 0x0221 |
| P02.22 | Position command smoothing filter | / | / | O | — | — | 16bit | R/W | 0x022D |
| P02.23 | Position command FIR filter | / | / | O | — | — | 16bit | R/W | 0x022F |
| P02.48 | Adjustment mode | / | / | O | O | O | 16bit | R/W | 0x0261 |

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P02.50 | MFC type | / | / | O | — | — | 16bit | R/W | 0x0265 |
| P02.51 | Velocity feedforward compensation coefficient | / | / | O | — | — | 16bit | R/W | 0x0267 |
| P02.52 | Torque feedforward compensation coefficient | / | / | O | O | — | 16bit | R/W | 0x0269 |
| P02.53 | Dynamic friction compensation coefficient | / | / | O | O | O | 16bit | R/W | 0x026B |
| P02.54 | Overshoot time coefficient | / | / | O | O | O | 16bit | R/W | 0x026D |
| P02.55 | Overshoot supP0Ession gain | / | / | O | O | O | 16bit | R/W | 0x026F |

## [Class 3] Velocity / Torque Control

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P03.00 | Velocity internal/external switching | / | / | — | O | — | 16bit | R/W | 0x0301 |
| P03.01 | Velocity command rotational direction selection | / | / | — | O | — | 16bit | R/W | 0x0303 |
| P03.02 | Velocity command input gain | / | / | — | O | O | 16bit | R/W | 0x0305 |
| P03.03 | Velocity command input inversion | / | / | — | O | — | 16bit | R/W | 0x0307 |
| P03.04 | 1st speed of velocity setting | / | / | — | O | — | 16bit | R/W | 0x0309 |
| P03.05 | 2nd speed of velocity setting | / | / | — | O | — | 16bit | R/W | 0x030B |
| P03.06 | 3rd speed of velocity setting | / | / | — | O | — | 16bit | R/W | 0x030D |
| P03.07 | 4th speed of velocity setting | / | / | — | O | — | 16bit | R/W | 0x030F |
| P03.08 | 5th speed of velocity setting | / | / | — | O | — | 16bit | R/W | 0x0311 |
| P03.09 | 6th speed of velocity setting | / | / | — | O | — | 16bit | R/W | 0x0313 |
| P03.10 | 7th speed of velocity setting | / | / | — | O | — | 16bit | R/W | 0x0315 |
| P03.11 | 8th speed of velocity setting | / | / | — | O | — | 16bit | R/W | 0x0317 |
| P03.12 | Acceleration time settings | / | / | — | O | — | 16bit | R/W | 0x0319 |
| P03.13 | Deceleration time settings | / | / | — | O | — | 16bit | R/W | 0x031B |
| P03.14 | Sigmoid acceleration/deceleration settings | / | / | — | O | — | 16bit | R/W | 0x031D |
| P03.15 | Zero speed clamp function selection | / | / | — | O | — | 16bit | R/W | 0x031F |
| P03.16 | Zero speed clamp level | / | / | — | O | — | 16bit | R/W | 0x0321 |
| P03.17 | Torque internal/external switching | / | / | — | — | O | 16bit | R/W | 0x0323 |
| P03.18 | Torque command direction selection | / | / | — | — | O | 16bit | R/W | 0x0325 |
| P03.19 | Torque command input gain | / | / | — | — | O | 16bit | R/W | 0x0327 |
| P03.20 | Torque command input inversion | / | / | — | — | O | 16bit | R/W | 0x0329 |
| P03.21 | Velocity limit in torque mode | / | / | — | — | O | 16bit | R/W | 0x032B |
| P03.22 | Torque command | / | / | O | O | O | 16bit | R/W | 0x032D |
| P03.23 | Zero speed delay time in velocity mode | / | / | — | O | — | 16bit | R/W | 0x032F |
| P03.24 | Maximum motor rotational speed | / | / | O | O | O | 16bit | R/W | 0x0331 |
| P03.58 | Speed Regulation Ratio 1 | / | / | O | | O | 16bit | R/W | 0x0374 0x0375 |
| P03.59 | Speed Regulation Ratio 2 | / | / | O | | O | 16bit | R/W | 0x0376 0x0377 |
| P03.60 | Speed Regulation Ratio 3 | / | / | O | | O | 16bit | R/W | 0x0378 0x0379 |
| P03.61 | Speed Regulation Ratio 4 | / | / | O | | O | 16bit | R/W | 0x037A 0x037B |

## [Class 4] I/O Monitoring Settings

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P04.00 | Input selection DI1 | / | / | O | O | O | 16bit | R/W | 0x0401 |
| P04.01 | Input selection DI2 | / | / | O | O | O | 16bit | R/W | 0x0403 |
| P04.02 | Input selection DI3 | / | / | O | O | O | 16bit | R/W | 0x0405 |
| P04.03 | Input selection DI4 | / | / | O | O | O | 16bit | R/W | 0x0407 |
| P04.04 | Input selection DI5 | / | / | O | O | O | 16bit | R/W | 0x0409 |
| P04.05 | Input selection DI6 | / | / | O | O | O | 16bit | R/W | 0x040B |
| P04.06 | Input selection DI7 | / | / | O | O | O | 16bit | R/W | 0x040D |
| P04.07 | Input selection DI8 | / | / | O | O | O | 16bit | R/W | 0x040F |
| P04.10 | Output selection DO1 | / | / | O | O | O | 16bit | R/W | 0x0415 |
| P04.11 | Output selection DO2 | / | / | O | O | O | 16bit | R/W | 0x0417 |
| P04.12 | Output selection DO3 | / | / | O | O | O | 16bit | R/W | 0x0419 |
| P04.13 | Output selection DO4 | / | / | O | O | O | 16bit | R/W | 0x041B |
| P04.14 | Output selection DO5 | / | / | O | O | O | 16bit | R/W | 0x041D |
| P04.31 | Positioning complete range | / | / | O | O | O | 16bit | R/W | 0x043F |
| P04.32 | Positioning complete output setting | / | / | — | O | — | 16bit | R/W | 0x0441 |
| P04.33 | INP positioning delay time | / | / | — | O | — | 16bit | R/W | 0x0443 |
| P04.34 | Zero speed | / | / | O | O | O | 16bit | R/W | 0x0445 |
| P04.35 | Velocity coincidence range | / | / | O | O | O | 16bit | R/W | 0x0447 |
| P04.36 | Arrival velocity | / | / | O | O | O | 16bit | R/W | 0x0449 |
| P04.37 | Motor power-off delay time | / | / | O | O | O | 16bit | R/W | 0x044B |
| P04.38 | Holding braker release time | / | / | O | O | O | 16bit | R/W | 0x044D |
| P04.39 | Holding brake activation speed | / | / | O | O | O | 16bit | R/W | 0x044F |
| P04.43 | Emergency stop function | / | / | O | O | O | 16bit | R/W | 0x0457 |
| P04.62 | Position/Speed/Torque Feedback Polarity Setting | / | / | O | O | O | 16bit | R/W | 0x047D |

## [Class 5] Extension settings

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P05.00 | 2nd pulse count per revolution | / | / | O | — | — | 32bit | R/W | 0x0500 0x0501 |
| P05.01 | 2nd Command frequency divider/multiplier numerator | / | / | O | — | — | 32bit | R/W | 0x0502 0x0503 |
| P05.02 | 2nd Command frequency divider/multiplier denominator | / | / | O | — | — | 32bit | R/W | 0x0504 0x0505 |
| P05.04 | Driver prohibition input settings | / | / | O | O | O | 16bit | R/W | 0x0509 |
| P05.06 | Servo-off mode | / | / | O | O | O | 16bit | R/W | 0x050D |
| P05.08 | DC bus voltage undervoltage | / | / | O | O | O | 16bit | R/W | 0x0513 |
| P05.09 | Main power-off detection time | / | / | O | O | O | 16bit | R/W | 0x0515 |
| P05.10 | Servo-off due to alarm mode | / | / | O | O | O | 16bit | R/W | 0x0517 |
| P05.11 | Servo braking torque setting | / | / | O | O | O | 16bit | R/W | 0x0519 |
| P05.12 | Overload level setting | / | / | O | O | O | 16bit | R/W | 0x051B |
| P05.15 | I/O digital filter | / | / | O | O | O | 16bit | R/W | 0x051F |
| P05.17 | Counter clearing input mode | / | / | O | — | — | 16bit | R/W | 0x0523 |
| P05.20 | Position unit settings | / | / | O | — | — | 16bit | R/W | 0x0529 |
| P05.21 | Torque limit selection | / | / | O | O | O | 16bit | R/W | 0x052B |
| P05.22 | 2nd torque limit | / | / | O | O | O | 16bit | R/W | 0x052D |
| P05.23 | Positive torque warning threshold | / | / | O | O | O | 16bit | R/W | 0x052F |
| P05.24 | Negative torque warning threshold | / | / | O | O | O | 16bit | R/W | 0x0531 |
| P05.28 | LED initial status | / | / | O | O | O | 16bit | R/W | 0x0539 |

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P05.29 | RS485 communication mode | / | / | O | O | O | 16bit | R/W | 0x053B |
| P05.30 | RS485 communication Baud rate | / | / | O | O | O | 16bit | R/W | 0x053D |
| P05.31 | RS485 axis address | / | / | O | O | O | 16bit | R/W | 0x053F |
| P05.32 | Max. command pulse input frequency | / | / | O | — | — | 16bit | R/W | 0x0541 |
| P05.35 | Front panel lock setting | / | / | O | O | O | 16bit | R/W | 0x0547 |
| P05.37 | Torque saturation alarm detection time | / | / | O | O | O | 16bit | R/W | 0x0549 |
| P05.42 | Frequency divider output – Z-signal polarity | / | / | O | — | — | 16bit | R/W | 0x0555 |
| P05.43 | Frequency divider output – Z-signal width | / | / | O | — | — | 16bit | R/W | 0x0557 |

## [Class 6] Other Settings

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P06.01 | Encoder zero position compensation | / | / | O | O | O | 16bit | R/W | 0x0603 |
| P06.03 | JOG trial run torque command | / | / | — | — | O | 16bit | R/W | 0x0607 |
| P06.04 | JOG trial run velocity command | / | / | O | O | O | 16bit | R/W | 0x0609 |
| P06.05 | Position 3rd gain valid time | / | / | O | — | — | 16bit | R/W | 0x060B |
| P06.06 | Position 3rd gain scale factor | / | / | O | — | — | 16bit | R/W | 0x060D |
| P06.07 | Torque command additional value | / | / | O | O | O | 16bit | R/W | 0x060F |
| P06.08 | Positive direction torque compensation value | / | / | O | O | O | 16bit | R/W | 0x0611 |
| P06.09 | Negative direction torque compensation value | / | / | O | O | O | 16bit | R/W | 0x0613 |
| P06.11 | Current response settings | / | / | O | O | O | 16bit | R/W | 0x0617 |
| P06.14 | Max. time to stop after disabling | / | / | O | O | O | 16bit | R/W | 0x061D |
| P06.20 | Trial run distance | / | / | O | — | — | 16bit | R/W | 0x0629 |
| P06.21 | Trial run waiting time | / | / | O | — | — | 16bit | R/W | 0x062B |
| P06.22 | No. of trial run cycles | / | / | O | — | — | 16bit | R/W | 0x062D |
| P06.25 | Trial run acceleration | / | / | O | O | — | 16bit | R/W | 0x0633 |
| P06.28 | Observer gain | / | / | O | O | O | 16bit | R/W | 0x0639 |
| P06.29 | Observer filter | / | / | O | O | O | 16bit | R/W | 0x063B |
| P06.56 | Blocked rotor alarm torque threshold | / | / | O | O | O | 16bit | R/W | 0x0671 |
| P06.57 | Blocked rotor alarm delay time | / | / | O | O | O | 16bit | R/W | 0x0673 |
| P06.63 | Absolute multiturn data upper limit | / | / | O | O | O | 16bit | R/W | 0x067F |

## [Class B] Status Parameters

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| P0B.00 | Software version 1（DSP） | / | / | O | O | O | 16bit | R | 0x0B00 |
| P0B.01 | Software version 2（CPLD） | / | / | O | O | O | 16bit | R | 0x0B01 |
| P0B.02 | Software version 3（Others） | / | / | O | O | O | 16bit | R | 0x0B02 |
| P0B.03 | Current alarm | / | / | O | O | O | 16bit | R | 0x0B03 |
| P0B.04 | Motor not rotating cause | / | / | O | O | O | 16bit | R | 0x0B04 |
| P0B.05 | Driver operation status | / | / | O | O | O | 16bit | R | 0x0B05 |
| P0B.06 | Motor speed（Before filter） | / | / | O | O | O | 16bit | R | 0x0B06 |
| P0B.07 | Motor torque | / | / | O | O | O | 16bit | R | 0x0B07 |
| P0B.08 | Motor current | / | / | O | O | O | 16bit | R | 0x0B08 |
| P0B.09 | Motor speed（After filter） | / | / | O | O | O | 16bit | R | 0x0B09 |
| P0B.10 | DC bus voltage | / | / | O | O | O | 16bit | R | 0x0B0A |
| P0B.11 | Driver temperature | / | / | O | O | O | 16bit | R | 0x0B0B |
| P0B.15 | Motor overload rate | / | / | O | O | O | 16bit | R | 0x0B0F |
| P0B.16 | Vent overload rate | / | / | O | O | O | 16bit | R | 0x0B10 |
| P0B.17 | Physical I/O input status | / | / | O | O | O | 16bit | R | 0x0B11 |
| P0B.18 | Physical I/O output status | / | / | O | O | O | 16bit | R | 0x0B12 |
| P0B.20 | Command position (Command unit) | / | / | O | O | O | 32bit | R | 0x0B14 0x0B15 |
| P0B.21 | Motor position (Command unit) | / | / | O | - | - | 32bit | R | 0x0B16 |

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | S | T | Byte | Op. | 485 Addr. |
| | | | | | | | | | 0x0B17 |
| P0B.22 | Position deviation (Command unit) | / | / | O | O | O | 32bit | R | 0x0B18 0x0B19 |
| P0B.23 | Command position (Encoder unit) | / | / | O | O | O | 32bit | R | 0x0B1A 0x0B1B |
| P0B.24 | Motor position (Encoder unit) | / | / | O | - | - | 32bit | R | 0x0B1C 0x0B1D |
| P0B.25 | Position deviation (Encoder unit) | / | / | O | O | O | 32bit | R | 0x0B1E 0x0B1F |
| P0B.26 | Rotational encoder position feedback | / | / | O | - | - | 32bit | R | 0x0B20 0x0B21 |

## [Class 8] PR-Control Parameters

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | PR | S | T | Byte | Op. | 485 Addr. |
| P08.00 | PR Control | / | / | O | — | — | 16bit | R/W | 0x6000 |
| P08.01 | Path count | / | / | O | — | — | 16bit | R/W | 0x6001 |
| P08.02 | Control Operation | / | / | O | — | — | 16bit | R/W | 0x6002 |
| P08.06 | Software positive limit H | / | / | O | | | 16bit | R/W | 0x6006 |
| P08.07 | Software positive limit (L) | / | / | O | — | — | 16bit | R/W | 0x6007 |
| P08.08 | Software negative limit H | / | / | O | — | — | 16bit | R/W | 0x6008 |
| P08.09 | Software negative limit (L) | / | / | O | — | — | 16bit | R/W | 0x6009 |
| P08.10 | Homing mode | / | / | O | — | — | 16bit | R/W | 0x600A |
| P08.11 | Zero position H | / | / | O | — | — | 16bit | R/W | 0x600B |
| P08.12 | Zero position (L) | / | / | O | — | — | 16bit | R/W | 0x600C |
| P08.13 | Home position off set H | / | / | O | — | — | 16bit | R/W | 0x600D |
| P08.14 | Home position off set (L) | / | / | O | — | — | 16bit | R/W | 0x600E |
| P08.15 | High homing velocity | / | / | O | — | — | 16bit | R/W | 0x600F |
| P08.16 | Low homing velocity | / | / | O | — | — | 16bit | R/W | 0x6010 |
| P08.17 | Homing acceleration | / | / | O | — | — | 16bit | R/W | 0x6011 |
| P08.18 | Homing deceleration | / | / | O | — | — | 16bit | R/W | 0x6012 |
| P08.19 | Homing torque holding time | / | / | O | — | — | 16bit | R/W | 0x6013 |
| P08.20 | Homing torque | / | / | O | — | — | 16bit | R/W | 0x6014 |
| P08.21 | Homing overtravel alarm range | / | / | O | — | — | 16bit | R/W | 0x6015 |
| P08.22 | Emergency stop at limit deceleration | / | / | O | — | — | 16bit | R/W | 0x6016 |
| P08.23 | STP emergency stop deceleration | / | / | O | — | — | 16bit | R/W | 0x6017 |
| P08.24 | I/O combination trigger mode | / | / | O | — | — | 16bit | R/W | 0x601A |
| P08.25 | I/O commbination filter | / | / | O | — | — | 16bit | R/W | 0x601B |
| P08.26 | S-code current output value | / | / | O | — | — | 16bit | R/W | 0x601C |
| P08.27 | PR warning | / | / | O | — | — | 16bit | R/W | 0x601D |
| P08.39 | JOG velocity | / | / | O | — | — | 16bit | R/W | 0x6027 |
| P08.40 | JOG acceleration | / | / | O | — | — | 16bit | R/W | 0x6028 |
| P08.41 | JOG deceleration | / | / | O | — | — | 16bit | R/W | 0x6029 |
| P08.42 | Command position H | / | / | O | — | — | 16bit | R/W | 0x602A |
| P08.43 | Command position（L） | / | / | O | — | — | 16bit | R/W | 0x602B |
| P08.44 | Motor position H | / | / | O | — | — | 16bit | R/W | 0x602C |
| P08.45 | Motor position（L） | / | / | O | — | — | 16bit | R/W | 0x602D |
| P08.46 | Input I/O status | / | / | O | — | — | 16bit | R/W | 0x602E |
| P08.47 | Output I/O status | / | / | O | — | — | 16bit | R/W | 0x602F |
| P08.48 | Path 0 S-code | / | / | O | — | — | 16bit | R/W | 0x6030 |
| P08.49 | Path 1 S-code | / | / | O | — | — | 16bit | R/W | 0x6031 |
| P08.50 | Path 2 S-code | / | / | O | — | — | 16bit | R/W | 0x6032 |
| P08.51 | Path 3 S-code | / | / | O | — | — | 16bit | R/W | 0x6033 |
| P08.52 | Path 4 S-code | / | / | O | — | — | 16bit | R/W | 0x6034 |
| P08.53 | Path 5 S-code | / | / | O | — | — | 16bit | R/W | 0x6035 |

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | PR | S | T | Byte | Op. | 485 Addr. |
| P08.54 | Path 6 S-code | / | / | O | — | — | 16bit | R/W | 0x6036 |
| P08.55 | Path 7 S-code | / | / | O | — | — | 16bit | R/W | 0x6037 |
| P08.56 | Path 8 S-code | / | / | O | — | — | 16bit | R/W | 0x6038 |
| P08.57 | Path 9 S-code | / | / | O | — | — | 16bit | R/W | 0x6039 |
| P08.58 | Path 10 S-code | / | / | O | — | — | 16bit | R/W | 0x603A |
| P08.59 | Path 11 S-code | / | / | O | — | — | 16bit | R/W | 0x603B |
| P08.60 | Path 12 S-code | / | / | O | — | — | 16bit | R/W | 0x603C |
| P08.61 | Path 13 S-code | / | / | O | — | — | 16bit | R/W | 0x603D |
| P08.62 | Path 14 S-code | / | / | O | — | — | 16bit | R/W | 0x603E |
| P08.63 | Path 15 S-code | / | / | O | — | — | 16bit | R/W | 0x603F |

## [Class 9] Pr-Control Path Parameters

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | PR | S | T | Byte | Op. | 485 Addr. |
| P09.00 | PR0 mode | / | / | O | — | — | 16bit | R/W | 0x6200 |
| P09.01 | PR0 position H | / | / | O | — | — | 16bit | R/W | 0x6201 |
| P09.02 | PR0 position(L) | / | / | O | — | — | 16bit | R/W | 0x6202 |
| P09.03 | PR0 velocity | / | / | O | — | — | 16bit | R/W | 0x6203 |
| P09.04 | PR0 acceleration time | / | / | O | — | — | 16bit | R/W | 0x6204 |
| P09.05 | PR0 deceleration time | / | / | O | — | — | 16bit | R/W | 0x6205 |
| P09.06 | PR0 pause time | / | / | O | — | — | 16bit | R/W | 0x6206 |
| P09.07 | PR0 special parameter | / | / | O | — | — | 16bit | R/W | 0x6207 |
| P09.08 | PR1 mode | / | / | O | — | — | 16bit | R/W | 0x6208 |
| P09.09 | PR1 position H | / | / | O | — | — | 16bit | R/W | 0x6209 |
| P09.10 | PR1 position(L) | / | / | O | — | — | 16bit | R/W | 0x620A |
| P09.11 | PR1 velocity | / | / | O | — | — | 16bit | R/W | 0x620B |
| P09.12 | PR1 acceleration time | / | / | O | — | — | 16bit | R/W | 0x620C |
| P09.13 | PR1 deceleration time | / | / | O | — | — | 16bit | R/W | 0x620D |
| P09.14 | PR1 pause time | / | / | O | — | — | 16bit | R/W | 0x620E |
| P09.15 | PR1 special parameter | / | / | O | — | — | 16bit | R/W | 0x620F |
| P09.16 | PR2 mode | / | / | O | — | — | 16bit | R/W | 0x6210 |
| P09.17 | PR2 position H | / | / | O | — | — | 16bit | R/W | 0x6211 |
| P09.18 | PR2 position(L) | / | / | O | — | — | 16bit | R/W | 0x6212 |
| P09.19 | PR2 velocity | / | / | O | — | — | 16bit | R/W | 0x6213 |
| P09.20 | PR2 acceleration time | / | / | O | — | — | 16bit | R/W | 0x6214 |
| P09.21 | PR2 deceleration time | / | / | O | — | — | 16bit | R/W | 0x6215 |
| P09.22 | PR2 pause time | / | / | O | — | — | 16bit | R/W | 0x6216 |
| P09.23 | PR2 special parameter | / | / | O | — | — | 16bit | R/W | 0x6217 |
| P09.24 | PR3 mode | / | / | O | — | — | 16bit | R/W | 0x6218 |
| P09.25 | PR3 position H | / | / | O | — | — | 16bit | R/W | 0x6219 |
| P09.26 | PR3 position(L) | / | / | O | — | — | 16bit | R/W | 0x621A |
| P09.27 | PR3 velocity | / | / | O | — | — | 16bit | R/W | 0x621B |
| P09.28 | PR3 acceleration time | / | / | O | — | — | 16bit | R/W | 0x621C |
| P09.29 | PR3 deceleration time | / | / | O | — | — | 16bit | R/W | 0x621D |
| P09.30 | PR3 pause time | / | / | O | — | — | 16bit | R/W | 0x621E |
| P09.31 | PR3 special parameter | / | / | O | — | — | 16bit | R/W | 0x621F |
| P09.32 | PR4 mode | / | / | O | — | — | 16bit | R/W | 0x6220 |
| P09.33 | PR4 position H | / | / | O | — | — | 16bit | R/W | 0x6221 |
| P09.34 | PR4 position(L) | / | / | O | — | — | 16bit | R/W | 0x6222 |
| P09.35 | PR4 velocity | / | / | O | — | — | 16bit | R/W | 0x6223 |
| P09.36 | PR4 acceleration time | / | / | O | — | — | 16bit | R/W | 0x6224 |
| P09.37 | PR4 deceleration time | / | / | O | — | — | 16bit | R/W | 0x6225 |
| P09.38 | PR4 pause time | / | / | O | — | — | 16bit | R/W | 0x6226 |
| P09.39 | PR4 special parameter | / | / | O | — | — | 16bit | R/W | 0x6227 |

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | PR | S | T | Byte | Op. | 485 Addr. |
| P09.40 | PR5 mode | / | / | O | — | — | 16bit | R/W | 0x6228 |
| P09.41 | PR5 position H | / | / | O | — | — | 16bit | R/W | 0x6229 |
| P09.42 | PR5 position(L) | / | / | O | — | — | 16bit | R/W | 0x622A |
| P09.43 | PR5 velocity | / | / | O | — | — | 16bit | R/W | 0x622B |
| P09.44 | PR5 acceleration time | / | / | O | — | — | 16bit | R/W | 0x622C |
| P09.45 | PR5 deceleration time | / | / | O | — | — | 16bit | R/W | 0x622D |
| P09.46 | PR5 pause time | / | / | O | — | — | 16bit | R/W | 0x622E |
| P09.47 | PR5 special parameter | / | / | O | — | — | 16bit | R | 0x622F |
| P09.48 | PR6 mode | / | / | O | — | — | 16bit | R/W | 0x6230 |
| P09.49 | PR6 position H | / | / | O | — | — | 16bit | R/W | 0x6231 |
| P09.50 | PR6 position(L) | / | / | O | — | — | 16bit | R/W | 0x6232 |
| P09.51 | PR6 velocity | / | / | O | — | — | 16bit | R/W | 0x6233 |
| P09.52 | PR6 acceleration time | / | / | O | — | — | 16bit | R/W | 0x6234 |
| P09.53 | PR6 deceleration time | / | / | O | — | — | 16bit | R/W | 0x6235 |
| P09.54 | PR6 pause time | / | / | O | — | — | 16bit | R/W | 0x6236 |
| P09.55 | PR6 special parameter | / | / | O | — | — | 16bit | R/W | 0x6237 |
| P09.56 | PR7 mode | / | / | O | — | — | 16bit | R/W | 0x6238 |
| P09.57 | PR7 position H | / | / | O | — | — | 16bit | R/W | 0x6239 |
| P09.58 | PR7 position(L) | / | / | O | — | — | 16bit | R/W | 0x623A |
| P09.59 | PR7 velocity | / | / | O | — | — | 16bit | R/W | 0x623B |
| P09.60 | PR7 acceleration time | / | / | O | — | — | 16bit | R/W | 0x623C |
| P09.61 | PR7 deceleration time | / | / | O | — | — | 16bit | R/W | 0x623D |
| P09.62 | PR7 pause time | / | / | O | — | — | 16bit | R/W | 0x623E |
| P09.63 | PR7 special parameter | / | / | O | — | — | 16bit | R/W | 0x623F |
| P09.64 | PR8 mode | / | / | O | — | — | 16bit | R/W | 0x6240 |
| P09.65 | PR8 position H | / | / | O | — | — | 16bit | R/W | 0x6241 |
| P09.66 | PR8 position(L) | / | / | O | — | — | 16bit | R/W | 0x6242 |
| P09.67 | PR8 velocity | / | / | O | — | — | 16bit | R/W | 0x6243 |
| P09.68 | PR8 acceleration time | / | / | O | — | — | 16bit | R/W | 0x6244 |
| P09.69 | PR8 deceleration time | / | / | O | — | — | 16bit | R/W | 0x6245 |
| P09.70 | PR8 pause time | / | / | O | — | — | 16bit | R/W | 0x6246 |
| P09.71 | PR8 special parameter | / | / | O | — | — | 16bit | R/W | 0x6247 |
| P09.72 | PR9 mode | / | / | O | — | — | 16bit | R/W | 0x6248 |
| P09.73 | PR9 position H | / | / | O | — | — | 16bit | R/W | 0x6249 |
| P09.74 | PR9 position(L) | / | / | O | — | — | 16bit | R/W | 0x624A |
| P09.75 | PR9 velocity | / | / | O | — | — | 16bit | R/W | 0x624B |
| P09.76 | PR9 acceleration time | / | / | O | — | — | 16bit | R/W | 0x624C |
| P09.77 | PR9 deceleration time | / | / | O | — | — | 16bit | R/W | 0x624D |
| P09.78 | PR9 pause time | / | / | O | — | — | 16bit | R/W | 0x624E |
| P09.79 | PR9 special parameter | / | / | O | — | — | 16bit | R/W | 0x624F |
| P09.80 | PR10 mode | / | / | O | — | — | 16bit | R/W | 0x6250 |
| P09.81 | PR10 position H | / | / | O | — | — | 16bit | R/W | 0x6251 |
| P09.82 | PR10 position(L) | / | / | O | — | — | 16bit | R/W | 0x6252 |
| P09.83 | PR10 velocity | / | / | O | — | — | 16bit | R/W | 0x6253 |
| P09.84 | PR10 acceleration time | / | / | O | — | — | 16bit | R/W | 0x6254 |
| P09.85 | PR10 deceleration time | / | / | O | — | — | 16bit | R/W | 0x6255 |
| P09.86 | PR10 pause time | / | / | O | — | — | 16bit | R/W | 0x6256 |
| P09.87 | PR10 special parameter | / | / | O | — | — | 16bit | R/W | 0x6257 |
| P09.88 | PR11 mode | / | / | O | — | — | 16bit | R/W | 0x6258 |
| P09.89 | PR11 position H | / | / | O | — | — | 16bit | R/W | 0x6259 |
| P09.90 | PR11 position(L) | / | / | O | — | — | 16bit | R/W | 0x625A |
| P09.91 | PR11 velocity | / | / | O | — | — | 16bit | R/W | 0x625B |
| P09.92 | PR11 acceleration time | / | / | O | — | — | 16bit | R/W | 0x625C |
| P09.93 | PR11 deceleration time | / | / | O | — | — | 16bit | R/W | 0x625D |
| P09.94 | PR11 pause time | / | / | O | — | — | 16bit | R/W | 0x625E |

| Code | Label | Default | Activation | Valid mode | | | Communication mode | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | PR | S | T | Byte | Op. | 485 Addr. |
| P09.95 | PR11 special parameter | / | / | O | — | — | 16bit | R/W | 0x625F |
| P09.96 | PR12 mode | / | / | O | — | — | 16bit | R/W | 0x6260 |
| P09.97 | PR12 position H | / | / | O | — | — | 16bit | R/W | 0x6261 |
| P09.98 | PR12 position(L) | / | / | O | — | — | 16bit | R/W | 0x6262 |
| P09.99 | PR12 velocity | / | / | O | — | — | 16bit | R/W | 0x6263 |
| P09.100 | PR12 acceleration time | / | / | O | — | — | 16bit | R/W | 0x6264 |
| P09.101 | PR12 deceleration time | / | / | O | — | — | 16bit | R/W | 0x6265 |
| P09.102 | PR12 pause time | / | / | O | — | — | 16bit | R/W | 0x6266 |
| P09.103 | PR12 special parameter | / | / | O | — | — | 16bit | R/W | 0x6267 |
| P09.104 | PR13 mode | / | / | O | — | — | 16bit | R/W | 0x6268 |
| P09.105 | PR13 position H | / | / | O | — | — | 16bit | R/W | 0x6269 |
| P09.106 | PR13 position(L) | / | / | O | — | — | 16bit | R/W | 0x626A |
| P09.107 | PR13 velocity | / | / | O | — | — | 16bit | R/W | 0x626B |
| P09.108 | PR13 acceleration time | / | / | O | — | — | 16bit | R/W | 0x626C |
| P09.109 | PR13 deceleration time | / | / | O | — | — | 16bit | R/W | 0x626D |
| P09.110 | PR13 pause time | / | / | O | — | — | 16bit | R/W | 0x626E |
| P09.111 | PR13 special parameter | / | / | O | — | — | 16bit | R/W | 0x626F |
| P09.112 | PR14 mode | / | / | O | — | — | 16bit | R/W | 0x6270 |
| P09.113 | PR14 position H | / | / | O | — | — | 16bit | R/W | 0x6271 |
| P09.114 | PR14 position(L) | / | / | O | — | — | 16bit | R/W | 0x6272 |
| P09.115 | PR14 velocity | / | / | O | — | — | 16bit | R/W | 0x6273 |
| P09.116 | PR14 acceleration time | / | / | O | — | — | 16bit | R/W | 0x6274 |
| P09.117 | PR14 deceleration time | / | / | O | — | — | 16bit | R/W | 0x6275 |
| P09.118 | PR14 pause time | / | / | O | — | — | 16bit | R/W | 0x6276 |
| P09.119 | PR14 special parameter | / | / | O | — | — | 16bit | R/W | 0x6277 |
| P09.120 | PR15 mode | / | / | O | — | — | 16bit | R/W | 0x6278 |
| P09.121 | PR15 position H | / | / | O | — | — | 16bit | R/W | 0x6279 |
| P09.122 | PR15 position(L) | / | / | O | — | — | 16bit | R/W | 0x627A |
| P09.123 | PR15 velocity | / | / | O | — | — | 16bit | R/W | 0x627B |
| P09.124 | PR15 acceleration time | / | / | O | — | — | 16bit | R/W | 0x627C |
| P09.125 | PR15 deceleration time | / | / | O | — | — | 16bit | R/W | 0x627D |
| P09.126 | PR15 pause time | / | / | O | — | — | 16bit | R/W | 0x627E |
| P09.127 | PR15 special parameter | / | / | O | — | — | 16bit | R/W | 0x627F |

# Parameters Description

## [Class 0] Basic Settings

| P00.00 | Label | Model-following/Zero tracking control | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0-5000 | Unit | 0.1Hz | Default | 1 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0001 | | |
| | Valid | At stop | | | | | | |

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 to tune MFC or ZTC bandwidth.

| Value | Description |
|---|---|
| 0 | Disable model following/zero tracking control |
| 1 | Set bandwidth automatically |
| 2~9 | Reserved |
| 10~5000 | Manually set control bandwidth. 30~100 recommended for belt application |

| P00.01 | Label | Control Mode Settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0003 | | |
| | Valid | After restart | | | | | | |

| Value | Description | |
|---|---|---|
| | 1st mode | 2nd mode |
| 【0】 | Position | — |
| 1 | Velocity | — |
| 2 | Torque | — |
| 3 | Position | Velocity |
| 4 | Position | Torque |
| 5 | Velocity | Torque |
| 6 | PR internal command control | Position P00.22=0 |
| | | Velocity P00.22=1 |
| | | Torque P00.22=2 |
| 7~10 | Reserved | |

◆When 3, 4, 5, 6 combination hybrid mode, 1st and 2nd mode can be chosen accordingly with control mode switching input (C-MODE).
C-MODE: Invalid, select 1st mode.
C-MODE: Valid, select 2st mode.
Please allow some time in between mode switching commands.
◆Please set P00.01 = 6 to switch to other modes from PR mod, then set 2nd mode using P00.22.

*C-MODE is defaulted to Normally Open*

| P00.02 | Label | Real time Auto Gain Adjusting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFF | Unit | — | Default | 0x1 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0005 | | |
| | Valid | Immediate | | | | | | |

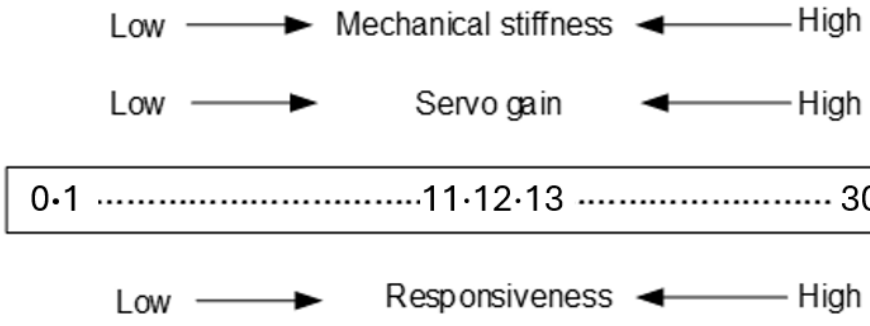
| Data bits | Category | Settings | Application |
|---|---|---|---|
| 0x00_ | Motion setting mode | Used to set motion setting mode, which can be selected according to the motion characteristics or setting requirements. Generally, it is recommended to select mode 1 with good generality when there is 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 | P00.03 invalid. Gain value must be adjusted manually and accordingly. |
| | | 1: Standard | P00.03 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 | P00.03 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 vertically to ground, or please compensate for the load using P06.07 |
| 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-P0Ecision 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 |

| P00.03 | Label | Real time auto stiffness adjusting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~ 31 | Unit | — | Default | 68 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0007 | | |

| | | | | | |
|---|---|---|---|---|---|
| | **Valid** | Immediate | | | |




Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Recommend to set to around 68 with motor with high inertia.

| **P00.04** | **Label** | Inertia ratio | | | **Valid mode(s)** | **P** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 0~20000 | **Unit** | % | **Default** | 250 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0009 | | |
| | **Valid** | Immediate | | | | | | |

**P00.04=(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 motors with high inertia, P00.04 can be left unfilled but optimal setting of P00.04 could improve system performance

| **P00.05** | **Label** | Command pulse input selection | | | **Valid mode(s)** | **P** | | |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 0~1 | **Unit** | — | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x000B | | |
| | **Valid** | After restart | | | | | | |

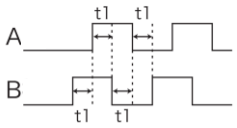
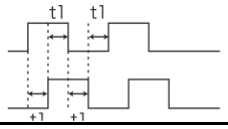
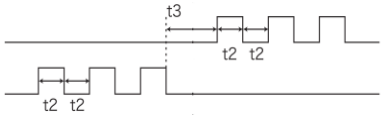
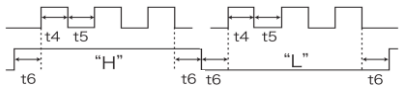
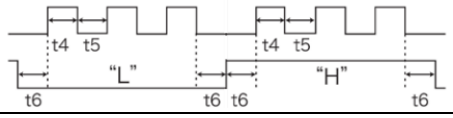
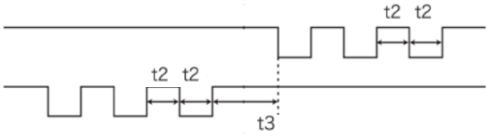
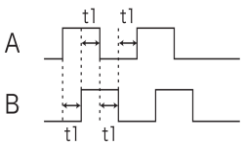
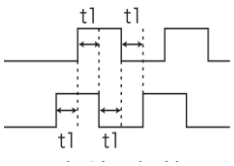
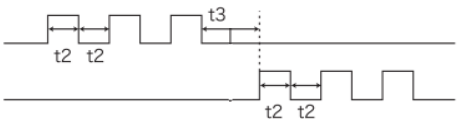
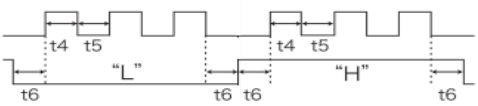
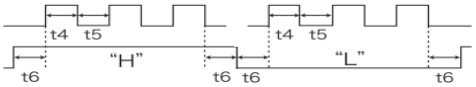
| Value | Description |
|---|---|
| 【0】 | Pulse input low speed channel (200/500kHz pulse input) |
| 1 | Pulse input high speed channel (4MHz pulse input) |

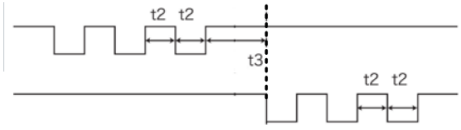
*Both channels cannot be used at the same time*.

| P00.06 | Label | Command pulse polarity inversion | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x000D | | |
| | Valid | After restart | | | | | | |
| P00.06 and P00.07 set command pulse input inversion and mode correspondingly. | | | | | | | | |

| P00.07 | Label | Command pulse input mode | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~6 | Unit | — | Default | 3 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x000F | | |
| | Valid | After restart | | | | | | |

**Command pulse input**

| (P00.06) Command Polarity inversion | (P00.07) Command pulse input mode settings | Command Pulse Mode | Positive signal | Negative signal |
|---|---|---|---|---|
| 【0】 | 0 *or* 2 | 90°phase difference 2 phase pulse （Phase A+ Phase B） |  |  |
| | 1 | CW pulse sequence ＋ CCW pulse sequence |  | |
| | 【3】 | Pulse sequence + direction sign positive logic |  | |
| | 5 | Pulse sequence + direction sign negative logic |  | |
| | 6 | Positive direction pulse + negative direction pulse (CW CCW) negative logic |  | |
| 1 | 0 *or* 2 | 90°phase difference 2 phase pulse （Phase A＋Phase B） |  |  |
| | 1 | CW pulse sequence ＋ CCW pulse sequence |  | |
| | 3 | Pulse sequence + direction sign positive logic |  | |
| | 5 | Pulse sequence + direction sign negative logic |  | |

| | | | |
|---|---|---|---|
| | 6 | Positive direction pulse + negative direction pulse (CW CCW) negative logic |   |

**Command pulse input signal max. frequency and min. duration needed**

| Command pulse input interface | | Max. Frequency | Min. duration needed（μs） | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | t1 | t2 | t3 | t4 | t5 | t6 |
| Pulse sequence interface | Differential drive | 500 kHz | 2 | 1 | 1 | 1 | 1 | 1 |
| | Open collector | 200 kHz | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| | High speed differential drive | 4Mhz | 0.25 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 |

Please set >0.1μs for the duration between rising and falling edge of command pulse input signal.
1 revolution with 2500 pulses 2-phase pulse input when P00.07=0 or 2, P00.08 = 10000;
1 revolution with 10000 pulses 1-phase pulse input when P00.07=1 or 3, P00.08 = 10000

| **P00.08** | **Label** | 1st command pulse count per revolution | | | **Valid mode(s)** | **P** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 0-8388608 | **Unit** | PULSE | **Default** | 10000 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0010<br>L: 0x0011 | | |
| | **Valid** | After restart | | | | | | |

Control will be affected if value set is too low. Err1b1 might occur if value < 500.
(1) P00.08 valid when ≠ 0: Motor revolution = input pulse count / [P00.08 value]
(2) P00.08 invalid when = 0: P00.09 and P00.10 valid.

| **P00.09** | **Label** | 1st command frequency divider/multiplier numerator | | | **Valid mode(s)** | **P** | | |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 1~2147483647 | **Unit** | — | **Default** | 1 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0012<br>L: 0x0013 | | |
| | **Valid** | After restart | | | | | | |

Valid when P00.08 = 0, please refer to description in P00.10.

| **P00.10** | **Label** | 1st command frequency divider/multiplier denominator | | | **Valid mode(s)** | **P** | | |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 1~2147483647 | **Unit** | — | **Default** | 1 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0014<br>L: 0x0015 | | |
| | **Valid** | After restart | | | | | | |

1. Settings：
(1) Driver command pulse input count: X
(2) Encoder pulse count after frequency divider/multiplier: Y
(3) Encoder pulse count per revolution: Z
(4) Motor revolution: W
2. Calculation：
（1）X, Y
Y = X * P00.09 / P00.10
Please keep the value of P00.09 and P00.10 to be smaller than $2^{24}$ (16777216).
（2）Z
Motor with 23-bit motor： Z= $2^{23}$ = 8388608
（3）Y, Z, W
W = Y / Z
*Performance cannot be guaranteed if frequency divider/multiplier ratio is set to extreme values. Err1b1 might occur if W < 500.*

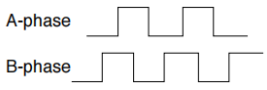
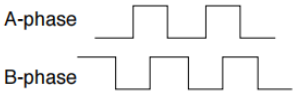
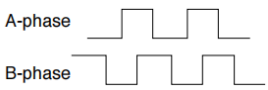
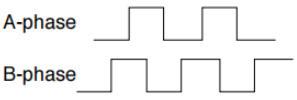
| P00.11 | Label | Encoder output pulse count per revolution | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~32767 | Unit | P/r | Default | 2500 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0017 | | |
| | Valid | After restart | | | | | | |

Sets the number of divided output pulses.
Set the number of output pulses of phase A and phase B of the frequency division output terminal for one rotation of the motor as position feedback in the upper device.
Motor rotation 1 turn terminal output pulse resolution = P00.11 × 4.
When setting this parameter, it must meet: motor speed (revolution/second) x P00.11 (encoder output pulse number per revolution) ≤ 1MHz. Otherwise alarm Er280

| P00.12 | Label | Pulse output logic inversion | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0019 | | |
| | Valid | After restart | | | | | | |

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

**Pulse output logic inversion**

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

| P00.13 | Label | 1st torque limit | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 350 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x001B | | |
| | Valid | Immediate | | | | | | |

1st torque limit is set according to ratio percentage of motor rated current. Do not exceed max driver output current.

Please refer to P05.21 on how to set torque limit.

| P00.14 | Label | Excessive position deviation | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~310 | Unit | 0.1rev | Default | 30 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x001D |
| | **Valid** | Immediate | | | | |
| | 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.<br>P00.14 If the setting is too small, the fault Er180 will easily occur (abnormal detection of excessive position deviation) | | | | | |

| **P00.15** | **Label** | Absolute encoder settings | | | **Valid mode(s)** | **P** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 0~15 | **Unit** | - | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x001F | | |
| | **Valid** | After restart | | | | | | |

| Value | Mode | Description |
|---|---|---|
| 【0】 | Incremental | Doesn't retain position data on power off. Unlimited travel distance. |
| 1 | Multiturn absolute linear | Retrain position data on power off. For applications with fixed travel distance and no multiturn data overflow. |
| 2 | Multiturn absolute rotary | Retrain position data on power off. Actual data feedback in between 0-(P06.63+1). Unlimited travel distance. |
| 3 | Single turn absolute | Used when travel distance is within 1 revolution of the encoder. Data overflow will trigger alarm. |
| 5 | Multi turn absolute | Clear multiturn alarm and activate multiturn absolute function. Will switch to multiturn mode once alarm cleared, if remains at 5 after 3s, please solve according to Er153. |
| 9 | | Clear multiturn position, reset multiturn alarm and activate multiturn absolute function. Will switch to multiturn mode once alarm cleared, if remains at 9 after 3s, please solve according to Er153. Please disable axis before setting to 9 and home the axis before using. |
| Others | | Do not use! |

| **P00.16** | **Label** | Regenerative resistance | | | **Valid mode(s)** | **P** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 25~500 | **Unit** | Ohm | **Default** | 100 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0021 | | |
| | **Valid** | Immediate | | | | | | |
| | To set resistance value of regenerative resistor<br>P00.16 and P00.17set value determine alarm threshold of Er120.<br>If set value > actual regenerative resistance, Er120 occurrence might be delayed. | | | | | | | |

| **P00.17** | **Label** | Regenerative resistor power rating | | | **Valid mode(s)** | **P** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 20~5000 | **Unit** | W | **Default** | 50 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0023 | | |
| | **Valid** | Immediate | | | | | | |

To set power rating of regenerative resistor. Please refer to table below

| Model | Internal resistance(Ω) | Internal resistor power rating(W) |
|---|---|---|
| E-DFAS01P | - | - |
| E-DFAS04P | - | - |
| E-DFAS08P | 50 | 75 |
| E-DFAS10P | 50 | 75 |

P00.16 and P00.17 determines the threshold value of Er120. 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.*

| **P00.22** | **Label** | PR and P/S/T switching | | | **Valid mode(s)** | **P** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|
| | **Range** | 0~2 | **Unit** | - | **Default** | 0 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x002D |
| | **Valid** | Immediate | | | | |

When P00.01 = 6(PR Mode), 2nd mode can be set on P00.22

| P00.01 | P00.22 | Control mode |
|---|---|---|
| 6 | 【0】 | PR / Position |
| | 1 | PR / Velocity |
| | 2 | PR / Torque |

| **P00.25** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Label** | Auxiliary function | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFF | **Unit** | - | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0033 | | |
| | **Valid** | Immediate | | | | | | |

| Parameter | Auxiliary function |
|---|---|
| 0x1111 | Reset current alarm |
| 0x1122 | Reset record alarm |
| 0x2211 | Save parameter to EEPROM (not including PR) |
| 0x2212 | Save PR parameters |
| 0x2222 | Initialize parameter (not including motor parameters) |
| 0x2233 | All parameters restore to default |
| 0x4001 | JOG_P（once every 50ms） |
| 0x4002 | JOG_N（once every 50ms） |
| 0x4411 | Encoder auto correction to zero |
| 0x6666 | Software reset |

Only for RS485 communication, please write corresponding parameters into P00.25
Do not use JOG_P and JOG_N in PR mode

| **P00.26** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Label** | Simulated I/O | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFF | **Unit** | - | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0035 | | |
| | **Valid** | Immediate | | | | | | |

| Bit | Input |
|---|---|
| 0 | DI1 |
| 1 | DI2 |
| 2 | DI3 |
| 3 | DI4 |
| 4 | DI5 |
| 5 | DI6 |
| 6 | DI7 |
| 7 | DI8 |

Only for RS485 communication. Simulated I/O is different from physical I/O which means inversion of current I/O status

| **P00.39** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Label** | Number of pulses per revolution (PR only) | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 10~390000 | **Unit** | PULSE | **Default** | 10000 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x004E | | |
| | **Valid** | | | | | L: 0x004F | | |

*Sets the number of command pulses per motor revolution in PR mode. This parameter is valid when P01.37 = 0x 20000[bit17 = 1], and the number of motor turns in PR mode = the number of input pulses/ [P00.39 setting value]*

| P00.40 (Only for RS485) | Label | Mapping parameter 1 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Byte length | 32bit | Attribute | | 485 address | H: 0x0050 | | |
| | Valid | | | | | L: 0x0051 | | |
| For users to set parameters unrelated by RS485 address quickly. Mapping parameter ID to be written is set on P00.50 by RS485. Data saved in P00.40 is parameter designated by P00.50.<br>Please refer to P00.57 for parameter settings.<br>*Note: Range, unit and attribute of P00.40 is determined by P00.50 designated parameter.* | | | | | | | | |

| P00.41 (Only for RS485) | Label | Mapping parameter 2 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Byte length | 32bit | Attribute | | 485 address | H: 0x0052 | | |
| | Valid | | | | | L: 0x0053 | | |
| Please refer to P00.40 for parameter description and P00.57 for parameter settings.<br>*Note: Range, unit and attribute of P00.41 is determined by P00.51 designated parameter.* | | | | | | | | |

| P00.42 (Only for RS485) | Label | Mapping parameter 3 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Byte length | 32bit | Attribute | | 485 address | H: 0x0054 | | |
| | Valid | | | | | L: 0x0055 | | |
| Please refer to P00.40 for parameter description and P00.57 for parameter settings.<br>*Note: Range, unit and attribute of P00.42 is determined by P00.52 designated parameter.* | | | | | | | | |

| P00.43 (Only for RS485) | Label | Mapping parameter 4 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Byte length | 32bit | Attribute | | 485 address | H: 0x0056 | | |
| | Valid | | | | | L: 0x0057 | | |
| Please refer to P00.40 for parameter description and P00.57 for parameter settings.<br>*Note: Range, unit and attribute of P00.43 is determined by P00.53 designated parameter.* | | | | | | | | |

| P00.44 (Only for RS485) | Label | Mapping parameter 5 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Byte length | 32bit | Attribute | | 485 address | H: 0x0058 | | |
| | Valid | | | | | L: 0x0059 | | |
| Please refer to P00.40 for parameter description and P00.57 for parameter settings.<br>*Note: Range, unit and attribute of P00.44 is determined by P00.54 designated parameter.* | | | | | | | | |

| P00.45 (Only for RS485) | Label | Mapping parameter 6 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Byte length | 32bit | Attribute | | 485 address | H: 0x005A | | |
| | Valid | | | | | L: 0x005B | | |
| Please refer to P00.40 for parameter description and P00.57 for parameter settings.<br>*Note: Range, unit and attribute of P00.45 is determined by P00.55 designated parameter.* | | | | | | | | |

| P00.46 (Only for RS485) | Label | Mapping parameter 7 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Byte length | 32bit | Attribute | | 485 address | H: 0x005C | | |
| | Valid | | | | | L: 0x005D | | |
| Please refer to P00.40 for parameter description and P00.57 for parameter settings.<br>*Note: Range, unit and attribute of P00.46 is determined by P00.56 designated parameter.* | | | | | | | | |

| P00.47 (Only for RS485) | Label | Mapping parameter 8 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Byte length | 32bit | Attribute | | 485 address | H: 0x005E | | |
| | Valid | | | | | L: 0x005F | | |
| Please refer to P00.40 for parameter description and P00.57 for parameter settings.<br>*Note: Range, unit and attribute of P00.47 is determined by P00.57 designated parameter.* | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P00.50 (Only for RS485)** | **Label** | Mapping parameter 1 indicator | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFFFFFF | **Unit** | | **Default** | 0x00490049 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0064 | | |
| | **Valid** | Immediate | | | | L: 0x0065 | | |
| **P00.51 (Only for RS485)** | **Label** | Mapping parameter 2 indicator | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFFFFFF | **Unit** | | **Default** | 0x00490049 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0066 | | |
| | **Valid** | Immediate | | | | L: 0x0067 | | |
| **P00.52 (Only for RS485)** | **Label** | Mapping parameter 3 indicator | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFFFFFF | **Unit** | | **Default** | 0x00490049 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0068 | | |
| | **Valid** | Immediate | | | | L: 0x0069 | | |
| **P00.53 (Only for RS485)** | **Label** | Mapping parameter 4 indicator | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFFFFFF | **Unit** | | **Default** | 0x00490049 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x006A | | |
| | **Valid** | Immediate | | | | L: 0x006B | | |
| **P00.54 (Only for RS485)** | **Label** | Mapping parameter 5 indicator | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFFFFFF | **Unit** | | **Default** | 0x00490049 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x006C | | |
| | **Valid** | Immediate | | | | L: 0x006D | | |
| **P00.55 (Only for RS485)** | **Label** | Mapping parameter 6 indicator | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFFFFFF | **Unit** | | **Default** | 0x00490049 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x006E | | |
| | **Valid** | Immediate | | | | L: 0x006F | | |
| **P00.56 (Only for RS485)** | **Label** | Mapping parameter 7 indicator | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFFFFFF | **Unit** | | **Default** | 0x00490049 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0070 | | |
| | **Valid** | Immediate | | | | L: 0x0071 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P00.57 (Only for RS485)** | **Label** | Mapping parameter 8 indicator | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~0xFFFFFFFF | **Unit** | | **Default** | 0x00490049 | | |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | H: 0x0072 | | |
| | **Valid** | Immediate | | | | L: 0x0073 | | |

Set parameter to 0xABCDWXYZ

High bit parameter position (PH) and low bit parameter position (PL)settings format：

0xABCD & 0xWXYZ

| 4-bit value | Definition | 4-bit value | Definition |
|---|---|---|---|
| CD | Parameter bias decimal | YZ | Parameter bias decimal |
| B | Parameter type hexadecimal | X | Parameter type hexadecimal |
| A | Unused | W | Unused |

Description of corresponding parameter using Mapping Parameter 1 as example:

Mapping content is 32-bit wide, able to map 2 16-bit or 1 32-bit parameters：

P00.50 content as below：

(Mapping parameter 1 indicator：P00.50；Mapping parameter 1: P00.40)

P00.40 high bit corresponds to P00.50 high bit indicator (PH) value;

P00.40 low bit corresponds to P00.50 low bit indicator (PL) value;

1. When P00.50 PH≠PL, indicates that P00.40 contains 2 16-bit mapped values.
If P00.50=0x06200101; PH=0x0620, PL=0x0101; write 0x0005 0064 into P00.40; write 0x0005 into P06.20, write 0x0064 into P01.01;

2. When P00.50 PH=PL, indicates that P00.40 contains 1 32-bit mapped value.
If P00.50=0x01150115; PH=0x0115, PL=0x0115; write 0x00000001into P00.40; write 0x00000001 into P01.15;

*Note: When a 32-bit address parameter is mapped, please write same address into high and low bit as shown above.*

## [Class 1] Gain Adjustments

| P01.00 | Label | 1st position loop gain | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0～30000 | Unit | 0.1/s | Default | 320 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0101 | | |
| | Valid | Immediate | | | | | | |
| Higher position loop gain value improves the responsiveness of the servo driver and lessens the positioning time.<br>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.<br>As velocity loop gain is based on position loop gain, please set both values accordingly.<br>Recommended range: 1.2≤P01.00/P01.01≤1.8 | | | | | | | | |

| P01.01 | Label | 1st velocity loop gain | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 1～32767 | Unit | 0.1Hz | Default | 180 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0103 | | |
| | Valid | Immediate | | | | | | |
| To determine the responsiveness of the velocity loop. If inertia ratio of P00.04 is uniform with actual inertia ratio, velocity loop responsiveness = P01.01.<br>To increase position loop gain and improve responsiveness of the whole system, velocity loop gain must be set at higher value. Please note that if the velocity loop gain is too high, it might cause vibration. | | | | | | | | |
| P01.02 | Label | 1st Integral Time Constant of Velocity Loop | | | Valid mode(s) | P | S | T |
| | Range | 1～10000 | Unit | 0.1ms | Default | 310 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0105 | | |
| | Valid | Immediate | | | | | | |
| 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.<br>Set 10000 to deactivate P01.02. | | | | | | | | |
| P01.03 | Label | 1st velocity detection filter | | | Valid mode(s) | P | S | T |
| | Range | 0～31 | Unit | — | Default | 15 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0107 | | |
| | Valid | Immediate | | | | | | |

This filter is a low pass filter. It blocks high frequencies which cause system instability from velocity feedback data. The higher the set value, lower frequencies will be blocked and velocity responsiveness will also be lowered. P01.03 needs to match velocity loop gain. Please refer to the following table.

| Value | Velocity Detection Filter Cut-off Frequency(Hz) | Value | Velocity Detection Filter Cut-off Frequency(Hz) |
|---|---|---|---|
| 0 | 2500 | 16 | 750 |
| 1 | 2250 | 17 | 700 |
| 2 | 2100 | 18 | 650 |
| 3 | 2000 | 19 | 600 |
| 4 | 1800 | 20 | 550 |
| 5 | 1600 | 21 | 500 |
| 6 | 1500 | 22 | 450 |
| 7 | 1400 | 23 | 400 |
| 8 | 1300 | 24 | 350 |
| 9 | 1200 | 25 | 300 |
| 10 | 1100 | 26 | 250 |
| 11 | 1000 | 27 | 200 |
| 12 | 950 | 28 | 175 |
| 13 | 900 | 29 | 150 |
| 14 | 850 | 30 | 125 |
| 【15】 | 800 | 31 | 100 |

| P01.04 | Label | 1st Torque Filter Time Constant | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0～2500 | Unit | 0.01ms | Default | 126 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0109 | | |
| | Valid | Immediate | | | | | | |

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. The smaller the value, the better the responsiveness but also subject to machine conditions. If the value is too large, it might lower the responsiveness of current loop.
With higher P01.01 value settings and no resonance, reduce P01.04 value;
With lower P01.01 value settings, increase P01.04 value to lower motor noise.

| P01.05 | Label | 2nd Position Loop Gain | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0～30000 | Unit | 0.1/s | Default | 380 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x010B | | |
| | Valid | Immediate | | | | | | |
| P01.06 | Label | 2nd velocity loop gain | | | Valid mode(s) | P | S | T |
| | Range | 1～32767 | Unit | 0.1Hz | Default | 180 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x010D | | |
| | Valid | Immediate | | | | | | |
| P01.07 | Label | 2nd Integral Time Constant of Velocity Loop | | | Valid mode(s) | P | S | T |
| | Range | 1～10000 | Unit | 0.1ms | Default | 10000 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x010F | | |
| | Valid | Immediate | | | | | | |

| P01.08 | Label | 2nd velocity detection filter | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0～31 | Unit | — | Default | 15 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0111 | | |
| | Valid | Immediate | | | | | | |
| P01.09 | Label | 2nd Torque Filter Time Constant | | | Valid mode(s) | P | S | T |
| | Range | 0~2500 | Unit | 0.01ms | Default | 126 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0113 | | |
| | Valid | Immediate | | | | | | |
| | Position loop, velocity loop, velocity detection filter, torque command filter each have 2 pairs of gain or time constant (1st and 2nd). | | | | | | | |
| P01.10 | Label | Velocity feed forward gain | | | Valid mode(s) | P | | |
| | Range | 0~1000 | Unit | 0.10% | Default | 300 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0115 | | |
| | Valid | Immediate | | | | | | |
| | Used for decreasing following error caused by low responsiveness of velocity loop. Might cause overshoot or increase in noise if set value is too high. | | | | | | | |

| P01.11 | Label | Velocity feed forward filter time constant | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~6400 | Unit | 0.01ms | Default | 50 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0117 | | |
| | Valid | Immediate | | | | | | |
| | 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.<br>Position deviation under constant velocity can be lowered with higher velocity feed forward gain. Please refer to the equation below.<br>Reduce P01.11 value to supP0Ess velocity overshoot during deceleration; Increase P01.11 value to supP0Ess noise or vibration due to long driver control cycle or position command uneven pulse frequency.<br><br>**<Application>**<br>Set P01.11 = 50（0.5ms）, improve feedforward effect by gradually increasing P01.10.<br>The equation below can be used to determine the position deviation due to velocity feedforward gain under constant velocity.<br>Position deviation[Unit]= $\frac{Set\ velocity[\frac{Uint}{s}]}{Position\ loop\ gain[Hz]} \times \frac{100 - Velocity\ feed\ foward\ gain[\%]}{100}$ | | | | | | | |
| P01.12 | Label | Torque feed forward gain | | | Valid mode(s) | P | S | |
| | Range | 0~1000 | Unit | 0.1% | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0119 | | |
| | Valid | Immediate | | | | | | |
| | Before using torque feed forward, please set correct inertia ratio P00.04. 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. | | | | | | | |
| P01.13 | Label | Torque feed forward filter time constant | | | Valid mode(s) | P | S | |
| | Range | 0~6400 | Unit | 0.01ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x011B | | |
| | Valid | Immediate | | | | | | |
| | Low pass filter to eliminate abnormal or high frequencies in torque feed forward command. Usually used when encoder has lower resolution or P0Ecision.<br>Noise reduces if torque feed forward filter time constant is set higher but position deviation will increase at acceleration varied points.<br>**<Application>** | | | | | | | |

- Set P01.13 = 0.5ms, please increase torque forward gain gradually to enable torque feedforward.
- By increasing P01.13, noise will reduce but position deviation will become larger.

| P01.15 | Label | Position control gain switching mode | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0～10 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x011F | | |
| | Valid | Immediate | | | | | | |

In position control, set the conditions for gain switching to be valid.

| Value | Condition | Gain switching condition |
|---|---|---|
| 【0】 | 1st gain fixed | Fixed on using 1st gain(P01.00-P01.04) |
| 1 | 2nd gain fixed | Fixed on using 2nd gain (P01.05-P01.09) |
| 2 | Gain switching input valid | · Gain switching input （GAIN）invalid: 1st gain.<br>· Gain switching input （GAIN）valid: 2nd gain.<br>**Default: 1st gain* |
| 3 | High command torque | Switch to 2nd gain when set torque command absolute value larger than (level + hysteresis)[%]<br>Currently at the second gain, if the absolute value of the torque command is less than (level-hysteresis)[%] and the state duration reaches the delay time, return to the first gain |
| 4-9 | Reserved | Reserved |
| 10 | Pending position command +actual velocity | Valid for position control.<br>Switch to 2nd gain if position command ≠ 0<br>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) |

*** Above 'level' and 'hysteresis' are in correspondence to P01.17 Position control gain switching level and P01.18 Hysteresis at position control switching.*

| P01.17 | Label | Position control gain switching level | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | Mode dependent | Default | 50 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0123 | | |
| | Valid | Immediate | | | | | | |

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

| Switching condition | Unit |
|---|---|
| Position | Encoder pulse count |
| Velocity | RPM |
| Torque | % |

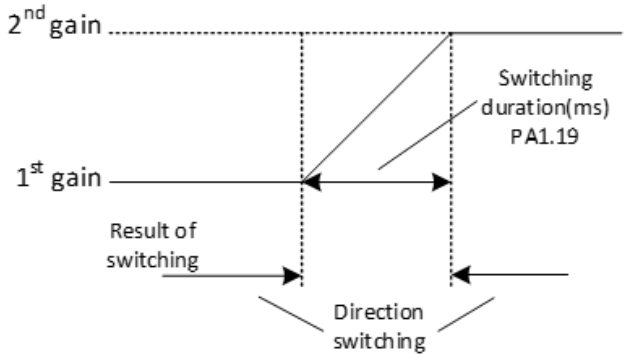
*Please set level ≥ hysteresis*

| P01.18 | Label | Hysteresis at position control switching | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | Mode dependent | Default | 33 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0125 | | |
| | Valid | Immediate | | | | | | |

To eliminate the instability of gain switching. Used in combination with P01.17 using the same unit.
If level< hysteresis, driver will set internally hysteresis = level.

| P01.19 | Label | Position control switching time | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 33 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0127 | | |
| | Valid | Immediate | | | | | | |

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 (P01.00) <-> 2nd (P01.05)




| P01.35 | Label | Position command pulse filter time | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~200 | Unit | 0.02us / 0.1us | Default | 8 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0147 | | |
| | Valid | After restart | | | | | | |

The position given pulse is filtered to eliminate the interfering narrow pulse. Low-speed pulse input unit is 0.1us, high-speed pulse input unit is 0.02us, high-speed pulse input coefficient is 0.6, low-speed 0.75.
If set value is overly large, it will affect the receiving of high frequency command pulse and with high delay time.
P01.35 formula：

$$\text{Filter frequency} = \frac{1}{2 \times \text{P01.35} \times 0.1\text{us}} \times 1000000\text{Hz} \times \text{coefficient}$$

Example：P00.05=1,P01.35=200, pulse frequency > 200KHz will be filtered;

| P01.35 | Filter frequency | P01.35 | Filter frequency |
|---|---|---|---|
| 0 | *Null* | 50 | 75kHz(300kHz) |
| 3 | 1.25MHz(5MHz) | 80 | 50kHz(190kHz) |
| 6 | 625kHz(2.5MHz) | 100 | 37.5kHz(150kHz) |
| 8 | 470kHz(1.9MHz) | 125 | 30kHz(120kHz) |
| 10 | 375kHz(1.5MHz) | 160 | 20kHz(100kHz) |
| 20 | 200kHz(750KHz) | 200 | 15kHz(75kHz) |

| P01.39 | Label | Special Function Register 1 | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0x0~0x7F FFFFFF | Unit | - | Default | 0x0 | | |
| | Byte length | 32bit | Attribute | R/W | 485 address | H: 0x014E L: 0x014F | | |
| | Valid | Immediate | | | | | | |

| BIT | value | Description |
|---|---|---|
| Bit 18 | 0x40000 | When Bit18 = 0, the positioning is completed using the relative position error. When Bit18 = 1, the positioning is completed using the absolute position error. |

## [Class 2] Vibration Suppression

| P02.00 | Label | Adaptive filtering mode settings | | | Valid mode(s) | P | S | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0201 | | |
| | Valid | Immediate | | | | | | |

| Value | Description | |
|---|---|---|
| 0 | Adaptive filter: invalid | Parameters related to 3rd notch filter remain unchanged |
| 1 | Adaptive filter: 1 filter valid for once. | 1 adaptive filter becomes valid. 3rd notch filter related parameters updated accordingly. P02.00 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. |
| 3-4 | Reserved | - |

| P02.01 | Label | 1st notch frequency | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50~4000 | Unit | Hz | Default | 4000 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0203 | | |
| | Valid | Immediate | | | | | | |

Set center frequency of 1st torque command notch filter.
Set P02.01 to 4000 to deactivate notch filter

| P02.02 | Label | 1st notch width | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | — | Default | 4 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0205 | | |
| | Valid | Immediate | | | | | | |

Set notch bandwidth for 1st resonant notch filter.
The larger the value of this parameter, the wider the notch width and the stronger the effect of suppressing mechanical vibration. However, under the premise of effectively suppressing resonance, the smaller the parameter setting, the better.
Use this parameter with P02.01 and P02.03

| P02.03 | Label | 1st notch depth | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0207 | | |
| | Valid | Immediate | | | | | | |

A notch depth of the first resonance control notch filter is set.
The smaller the value of this parameter, the deeper the notch depth, the stronger the suppression effect on mechanical vibration. However, under the premise of effectively suppressing resonance, the larger the parameter setting, the better. Use this parameter with P02.01 and P02.02

| P02.04 | Label | 2nd notch frequency | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50~4000 | Unit | Hz | Default | 4000 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0209 | | |
| | Valid | Immediate | | | | | | |

Set center frequency of 2nd torque command notch filter.
Set P02.04 to 4000 to deactivate notch filter

| P02.05 | Label | 2nd notch width | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | — | Default | 4 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x020B | | |
| | Valid | Immediate | | | | | | |

Set notch bandwidth for 2nd resonant notch filter.
The larger the value of this parameter, the wider the notch width and the stronger the effect of suppressing mechanical vibration. However, under the premise of effectively suppressing resonance, the smaller the parameter setting, the better.
Use this parameter with P02.04 and P02.06

| P02.06 | Label | 2nd notch depth | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x020D | | |
| | Valid | Immediate | | | | | | |

Set notch depth for 1st resonant notch filter.
A notch depth of the first resonance control notch filter is set.
The smaller the value of this parameter, the deeper the notch depth, the stronger the suppression effect on mechanical vibration. However, under the premise of effectively suppressing resonance, the larger the parameter setting, the better. Use this parameter with P02.04 and P02.05

| P02.07 | Label | 3rd notch frequency | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50~4000 | Unit | Hz | Default | 4000 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x020F | | |
| | Valid | Immediate | | | | | | |

Set center frequency of 3rd torque command notch filter.
Set P02.07 to 4000 to deactivate notch filter

| P02.08 | Label | 3rd notch width | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | — | Default | 4 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0211 | | |
| | Valid | Immediate | | | | | | |

The notch frequency width of the third resonance control notch filter is set.
The larger the value of this parameter, the wider the notch width and the stronger the effect of suppressing mechanical vibration. However, under the premise of effectively suppressing resonance, the smaller the parameter setting, the better.
Use this parameter with P02.07 and P02.09.

| P02.09 | Label | 3rd notch depth | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0213 | | |
| | Valid | Immediate | | | | | | |

The notch depth of the third resonance control notch filter is set.
The smaller the value of this parameter, the deeper the notch depth, the stronger the suppression effect on mechanical vibration. However, under the premise of effectively suppressing resonance, the larger the parameter setting, the better.
Use this parameter with P02.07 and P02.08.

| P02.14 | Label | 1st damping frequency | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0/10~2000 | Unit | 0.1Hz | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x021D | | |
| | Valid | Immediate | | | | | | |

Set the first damping frequency to suppress the shaking at the end of the vibration. Please measure the vibration frequency at the end of the load and set it in 0.1[Hz].

| Value | Description |
|---|---|
| 0 | Turn off the low frequency suppression function |
| 10~2000 | Set the damping frequency (0.1Hz in unit) |

Note: Suppresses sloshing at the end of the load. It is generally used to suppress the shaking of the elastic end of the load caused by the high deceleration impact when the motor is stopped. For the frequency within 100Hz shaking suppression effect is obvious. When in use, set this parameter to the frequency of shaking

| P02.16 | | | | | | |
|---|---|---|---|---|---|---|
| | **Label** | 2nd damping frequency | | | **Valid mode(s)** | **P** |
| | **Range** | 0/10~2000 | **Unit** | 0.1Hz | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0221 |
| | **Valid** | Immediate | | | | |

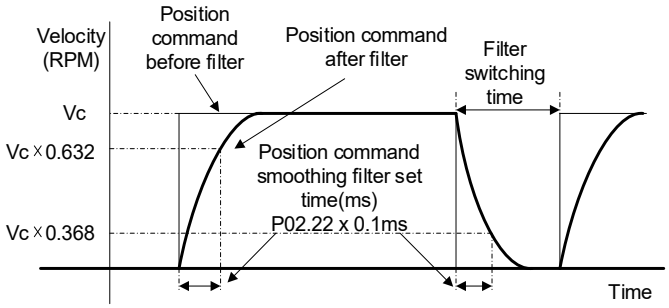
Set the second damping frequency to suppress the shaking at the end of the vibration. Please measure the vibration frequency at the end of the load and set it in 0.1[Hz].

| Value | Description |
|---|---|
| 0 | Turn off the low frequency suppression function |
| 10~2000 | Set the damping frequency (0.1Hz in unit) |

Note: Suppresses sloshing at the end of the load. It is generally used to suppress the shaking of the elastic end of the load caused by the high deceleration impact when the motor is stopped. For the frequency within 100Hz shaking suppression effect is obvious. When in use, set this parameter to the frequency of shaking

| P02.22 | | | | | | |
|---|---|---|---|---|---|---|
| | **Label** | Position command smoothing filter | | | **Valid mode(s)** | **P** |
| | **Range** | 0~32767 | **Unit** | 0.1ms | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x022D |
| | **Valid** | At stop | | | | |

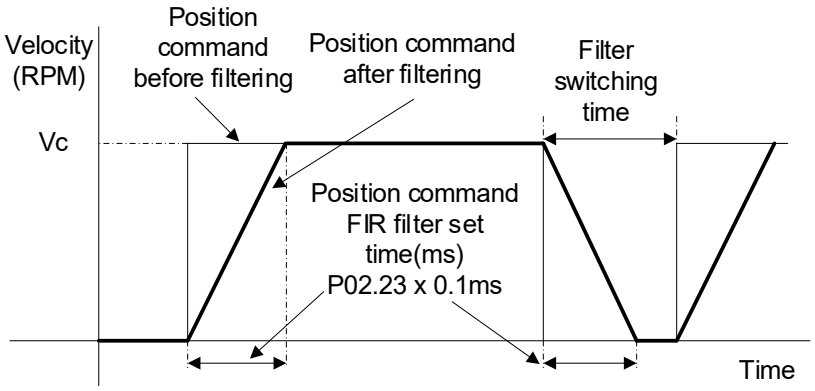
To set time constant of 1 time delay filter of position command.
To set time constant of 1 time delay filter, according to target velocity Vc square wave command as show below.



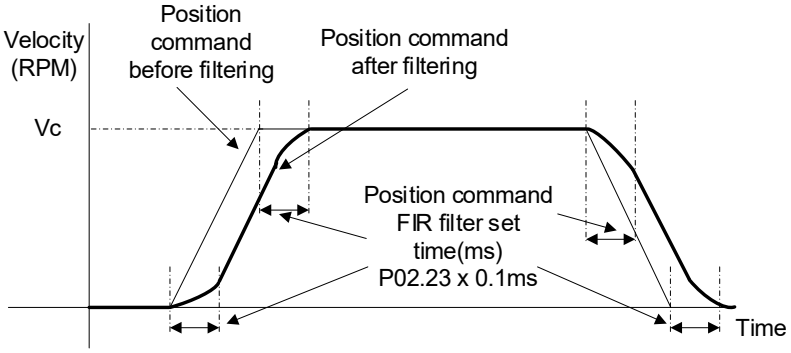

Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If P02.22 is set too high, overall time will be lengthened.

| P02.23 | Label | Position command FIR filter | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2500 | Unit | 0.1ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x022F | | |
| | Valid | At stop | | | | | | |

As shown below, when target velocity Vc square wave command reaches Vc, it becomes trapezoidal wave after filtering.




As shown below, when target velocity Vc trapezoidal command reaches Vc, it becomes S wave after filtering.




Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If P02.23 is set too high, overall time will be lengthened.

*Note: Please wait for command to stop and after filter idle time to modify P02.23.*
*Filter switching time = (P02.23 set value x 0.1ms + 0.25ms)*

| P02.48 | Label | Adjustment mode | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0261 | | |
| | Valid | Immediate | | | | | | |

| Value | Description |
|---|---|
| 【0】 | Turn off automatic adjustments |
| 1 | Turn on the automatic adjustment function, turn on the inertia real-time identification and vibration suppression, and turn off the function after the effective number of inertia identification reaches 4 within 5min, and the rigidity change is the trigger start condition. |

| P02.50 | Label | MFC type | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0265 | | |
| | Valid | Re-enable | | | | | | |

| Value | Description |
|---|---|
| 【0】 | Model following control |
| 1 | Zero tracking control |
| 2 | *3 inertia (future upgrade)* |
| 3 | *Path following (future upgrade)* |

| P02.51 | Label | Velocity feedforward compensation coefficient | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | -10000~10000 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0267 | | |
| | Valid | Immediate | | | | | | |
| To compensate for velocity feedforward | | | | | | | | |

| P02.52 | Label | Torque feedforward compensation coefficient | | | Valid mode(s) | P | S | |
|---|---|---|---|---|---|---|---|---|
| | Range | -10000~10000 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0269 | | |
| | Valid | Immediate | | | | | | |
| To compensate for torque feedforward | | | | | | | | |

| P02.53 | Label | Dynamic friction compensation coefficient | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x026B | | |
| | Valid | Immediate | | | | | | |

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 P02.53 to reduce the deviation to 0.

| P02.54 | Label | Overshoot time coefficient | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x026D | | |
| | Valid | Immediate | | | | | | |
| To set overshoot time coefficient | | | | | | | | |

| P02.55 | Label | Overshoot supP0Ession gain | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x026F | | |
| | Valid | Immediate | | | | | | |
| SupP0Ession improves with larger set value but might affect the performance of MFC. Please use with caution for any value above 100. | | | | | | | | |

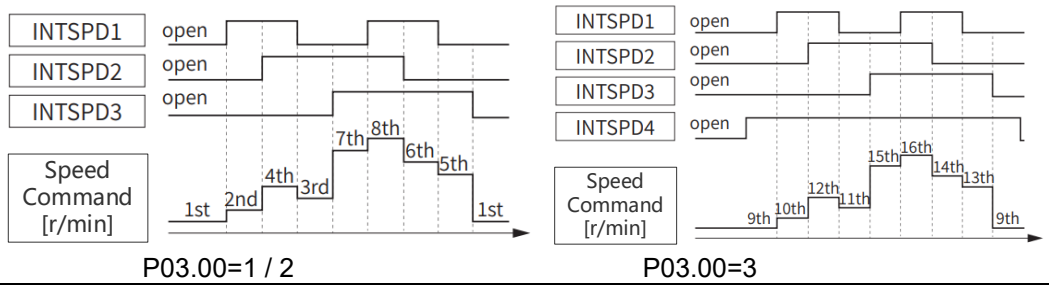
[Class 3] Velocity/Torque Control

| P03.00 | Label | Velocity internal/external switching | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | — | Default | 1 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0301 |
| | Valid | Immediate | | | | |

·Connect to the right DI to control internal command velocity settings.

| Value | Velocity settings |
|---|---|
| 0 | Reserved |
| 【1】 | Internal velocity settings 1st – 8th speed（P03.04～P03.11 ） |
| 2 | Internal velocity settings 1st – 7th speed（P03.04～P3.10） |
| 3 | Internal velocity settings 1st – 16th speed（P03.04～P03.11，P03.36～P3.43） |

| Value | Internal Command velocity 1（INTSPD 1） | Internal command velocity 2（INTSPD2 ） | Internal command velocity 3（INTSPD3 ） | Internal command velocity 4（INTSPD4 ） | Velocity command |
|---|---|---|---|---|---|
| 1 | OFF | OFF | OFF | - | 1st speed |
| | ON | OFF | OFF | - | 2nd speed |
| | OFF | ON | OFF | - | 3rd speed |
| | ON | ON | OFF | - | 4th speed |
| | OFF | OFF | ON | - | 5th speed |
| | ON | OFF | ON | - | 6th speed |
| | OFF | ON | ON | - | 7th speed |
| | ON | ON | ON | - | 8th speed |
| 2 | OFF | OFF | OFF | - | 1st speed |
| | ON | OFF | OFF | - | 2nd speed |
| | OFF | ON | OFF | - | 3rd speed |
| | ON | ON | OFF | - | 4th speed |
| | OFF | OFF | ON | - | 5th speed |
| | ON | OFF | ON | - | 6th speed |
| | OFF | ON | ON | - | 7th speed |
| 3 | Similar to (P03.00=ON) | | | OFF | 1st speed~ 8th speed |
| | OFF | OFF | OFF | ON | 9th speed |
| | ON | OFF | OFF | ON | 10th speed |
| | OFF | ON | OFF | ON | 11th speed |
| | ON | ON | OFF | ON | 12th speed |
| | OFF | OFF | ON | ON | 13th speed |
| | ON | OFF | ON | ON | 14th speed |
| | OFF | ON | ON | ON | 15th speed |
| | ON | ON | ON | ON | 16th speed |

| | |
|---|---|
| | Please change internal command velocity as per diagram below as unexpected axis movement might occurs if 2 command velocities are changed at the same time<br><br><br>P03.00=1 / 2 P03.00=3 |

| P03.01 | Label | Velocity command rotational direction selection | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0303 |
| | Valid | Immediate | | | | |

To set positive/negative direction of velocity command

| Value | Velocity settings（Analog or internal velocity） | Velocity command sign selection（VC-SIGN） | Velocity command sign selection（VC-SIGN 2） | Velocity command direction | note |
|---|---|---|---|---|---|
| 【0】 | + | No effect | No effect | Positive | Direction determined by +/- |
| | — | No effect | No effect | Negative | Direction determined by VC-SIGN |
| 1 | No effect | OFF | No effect | Positive | The direction is determined by +/-, VC-SIGN and VC-SIGN2;<br>1.when the VC-SIGN and VC-SIGN2 are valid or invalid at the same time, the motor is stationary;<br>2. when the VC-SIGN is valid and the VC-SIGN2 is invalid, the speed command direction is the same as the speed setting value direction;<br>3. when the VC-SIGN is invalid and the VC-SIGN2 is valid, the speed command direction is opposite to the speed setting value direction |
| | No effect | ON | No effect | Negative | |
| 2 | + | ON | OFF | Positive | |
| | | OFF | ON | Negative | |
| | | ON | ON | STOP | |
| | | OFF | OFF | STOP | |
| | - | ON | OFF | Negative | |
| | | OFF | ON | Positive | |
| | | ON | ON | STOP | |
| | | OFF | OFF | STOP | |

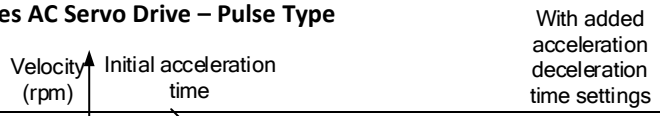
| | | | | | | |
|---|---|---|---|---|---|---|
| **P03.04** | **Label** | 1st speed of velocity setting | | | **Valid mode(s)** | S |
| | **Range** | -10000~10000 | **Unit** | r/min | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0309 |
| | **Valid** | Immediate | | | | |
| **P03.05** | **Label** | 2nd speed of velocity setting | | | **Valid mode(s)** | S |
| | **Range** | -10000~10000 | **Unit** | r/min | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x030B |
| | **Valid** | Immediate | | | | |
| **P03.06** | **Label** | 3rd speed of velocity setting | | | **Valid mode(s)** | S |
| | **Range** | -10000~10000 | **Unit** | r/min | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x030D |
| | **Valid** | Immediate | | | | |
| **P03.07** | **Label** | 4th speed of velocity setting | | | **Valid mode(s)** | S |
| | **Range** | -10000~10000 | **Unit** | r/min | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x030F |
| | **Valid** | Immediate | | | | |
| **P03.08** | **Label** | 5th speed of velocity setting | | | **Valid mode(s)** | S |
| | **Range** | -10000~10000 | **Unit** | r/min | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0311 |
| | **Valid** | Immediate | | | | |
| **P03.09** | **Label** | 6th speed of velocity setting | | | **Valid mode(s)** | S |
| | **Range** | -10000~10000 | **Unit** | r/min | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0313 |
| | **Valid** | Immediate | | | | |
| **P03.10** | **Label** | 7th speed of velocity setting | | | **Valid mode(s)** | S |
| | **Range** | -10000~10000 | **Unit** | r/min | **Default** | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0315 |
| | **Valid** | Immediate | | | | |
| **P03.11** | **Label** | 8th speed of velocity setting | | | **Valid mode(s)** | S |
| | **Range** | -10000~10000 | **Unit** | r/min | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0317 |
| | **Valid** | Immediate | | | | |
| To set internal velocity command 1st -8th speed | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P03.12** | **Label** | Acceleration time settings | | | **Valid mode(s)** | S |
| | **Range** | 0~10000 | **Unit** | ms/ (1000rpm) | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0319 |
| | **Valid** | Immediate | | | | |
| **P03.13** | **Label** | Deceleration time settings | | | **Valid mode(s)** | S |
| | **Range** | 0~10000 | **Unit** | ms/ (1000rpm) | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x031B |
| | **Valid** | Immediate | | | | |

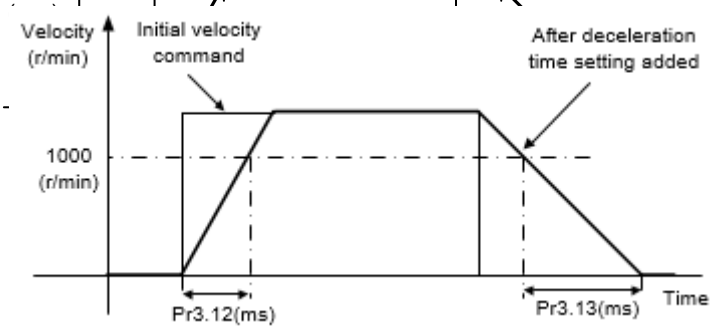
Set max acceleration/deceleration for velocity command.

If target velocity = *x* [rpm], max acceleration = *a* [unit: rpm/ms], acceleration time = *t* [ms]
P03.12 = *1000/a*
P03.13 = *1000/a*
*a = x/t*

For example: If motor is to achieve 1500rpm in 30s, *a=1500/30=50rpm/ms*



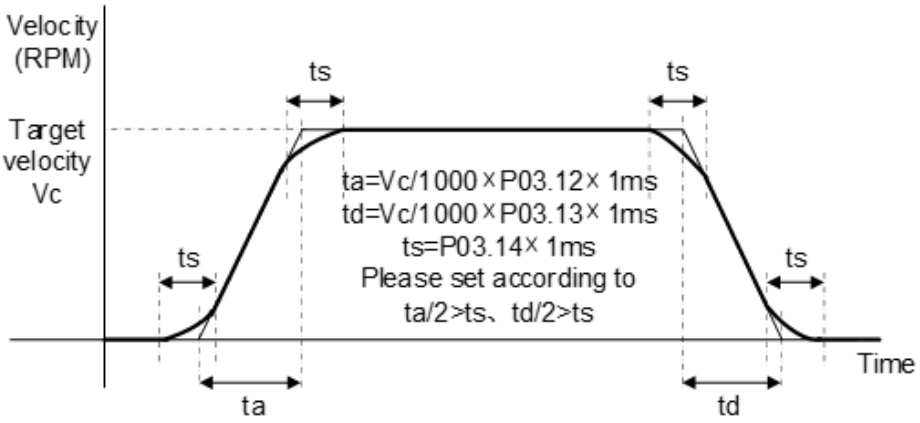

P03.12 = 1000/*a*= 20. Hence when P03.12 = 20, motor can achieve 1500rpm in 30s.




Usually used when there is rapid acceleration or trapezoidal wave velocity command due to many different internal speed segments under velocity control mode which causes instable while motor in motion.
*Under velocity control mode, 6083 and 6084 is limited by P03.12 and P03.13 correspondingly.*

| P03.14 | Label | Sigmoid acceleration/deceleration settings | | | Valid mode(s) | | S |
|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | ms | Default | 0 | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x031D | |
| | Valid | After restart | | | | | |

Sets the S-curve ramp time for speed command input.
This is the S-curve time centered around the acceleration/deceleration transition point, based on the values set in P03.12 (Acceleration Time) and P03.13 (Deceleration Time).




Note: This parameter takes effect after power-off and restart.

| P03.15 | Label | Zero speed clamp function selection | | | Valid mode(s) | S | |
|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | — | Default | 0 | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x031F | |
| | Valid | Immediate | | | | | |

| Value | Zero speed clamp function |
|---|---|
| 0 | Invalid: zero speed clamp deactivated |
| 1 | Velocity command is forced to 0 when the zero speed clamp (ZEROSPD) input signal is valid. |
| 2 | Velocity command is forced to 0 when actual velocity is lower than P03.16. |
| 3 | Includes conditions from 1 or 2 |
| 4 | When the Zero Speed Clamp (ZEROSPD) input signal is valid and when the speed command in speed control mode is less than the P03.16 Zero Speed Clamp Level setpoint, the speed command is forcibly set to 0. |

| P03.16 | Label | Zero speed clamp level | | | Valid mode(s) | S | |
|---|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 30 | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0321 | |
| | Valid | Immediate | | | | | |

Set the decision level of zero speed.
P03.15 is valid when 2 and 3 are set. When the speed given command in the speed control mode is less than the zero speed clamp level setting, the speed command can be forcibly set to 0.

| P03.17 | Label | Torque internal/external switching | | | Valid mode(s) | | T |
|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | | Default | 2 | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0323 | |
| | Valid | Immediate | | | | | |

| Value | Torque command input | Velocity limit input |
|---|---|---|
| 【0】 | Reserved | |
| 1 | | |
| 2 | P03.22 set value | P03.21 set value |

| P03.18 | Label | Torque command direction selection | | | Valid mode(s) | | T |
|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0325 | |
| | Valid | Immediate | | | | | |

To set torque command positive/negative direction

| Value | Direction settings |
|---|---|
| 【0】 | TC-SIGN ON/OFF has no effect on torque direction<br>Torque command input「Positive」→Positive direction、<br>「Negative」→Negative direction |
| 1 | Use TC-SIGN ON/OFF status for torque direction<br>OFF: *Positive direction* ON: *Negative direction* |

| P03.21 | Label | Velocity limit in torque mode | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x032B | | |
| | Valid | Immediate | | | | | | |
| | Sets the speed limit value during torque control.<br>In torque control mode, the operating speed is limited and will not exceed the value set in parameter P03.21. | | | | | | | |

| P03.22 | Label | Torque command | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~300 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x032D | | |
| | Valid | Immediate | | | | | | |
| | To set torque limit in torque control mode. | | | | | | | |

| P03.23 | Label | Zero speed delay time in velocity mode | | | Valid mode(s) | | S | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2000 | Unit | ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x032F | | |
| | Valid | Immediate | | | | | | |
| | Zero-speed standstill delay time in set speed mode; that is, the time from when the speed reaches below the zero-speed clamp to when the motion stops. Prevents the position from creeping slowly when stationary in speed mode.<br>When 0 is set, the speed mode zero speed standstill function is invalid.<br>When 1~2000 is set, the speed reaches P03.16 zero speed clamp level below and the motor stops after the set time. | | | | | | | |

| P03.24 | Label | Maximum motor rotational speed | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0331 | | |
| | Valid | Immediate | | | | | | |
| | To set maximum motor rotational speed but not higher than motor rated speed<br>If P03.24 = 0, maximum motor rotational speed = max. speed in motor parameter. | | | | | | | |

| P03.36 | Label | 9th speed of velocity setting | | | Valid mode(s) | | S | |
|---|---|---|---|---|---|---|---|---|
| | Range | -10000~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0349 | | |
| | Valid | Immediate | | | | | | |
| | To set internal velocity command 9th speed | | | | | | | |
| P03.37 | Label | 10th speed of velocity setting | | | Valid mode(s) | | S | |
| | Range | -10000~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x034B | | |
| | Valid | Immediate | | | | | | |
| | To set internal velocity command 10th speed | | | | | | | |
| P03.38 | Label | 11th speed of velocity setting | | | Valid mode(s) | | S | |
| | Range | -10000~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x034D | | |
| | Valid | Immediate | | | | | | |
| | To set internal velocity command 11th speed | | | | | | | |
| P03.39 | Label | 12th speed of velocity setting | | | Valid mode(s) | | S | |
| | Range | -10000~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x034F | | |
| | Valid | Immediate | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | To set internal velocity command 12th speed | | | | | |
| P03.40 | Label | 13th speed of velocity setting | | | Valid mode(s) | S |
| | Range | -10000~10000 | Unit | r/min | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0351 |
| | Valid | Immediate | | | | |
| | To set internal velocity command 13th speed | | | | | |
| P03.41 | Label | 14th speed of velocity setting | | | Valid mode(s) | S |
| | Range | -10000~10000 | Unit | r/min | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0353 |
| | Valid | Immediate | | | | |
| | To set internal velocity command 14th speed | | | | | |
| P03.42 | Label | 15th speed of velocity setting | | | Valid mode(s) | S |
| | Range | -10000~10000 | Unit | r/min | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0355 |
| | Valid | Immediate | | | | |
| | To set internal velocity command 15th speed | | | | | |
| P03.43 | Label | 16th speed of velocity setting | | | Valid mode(s) | S |
| | Range | -10000~10000 | Unit | r/min | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0357 |
| | Valid | Immediate | | | | |
| | To set internal velocity command 16th speed | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| P03.58 | Label | Speed regulation ratio 1 | | | Valid mode(s) | S |
| | Range | 0~150 | Unit | % | Default | 10 |
| | Byte length | 16bit | Attribute | R/W | 485 address | H: 0x0374<br>L: 0x0375 |
| | Valid | Immediate | | | | |

To set speed regulation ratio for each input signal. If ratio is more than 150% in total, rotational speed of the motor will remain unchanged. If the rotational speed of the motor exceeds P03.24, then motor will rotate at maximum speed.
Speed regulation ratio = 100% if SPDREG signal is not valid.

Please refer to the following table as an example for users' required settings.
Assuming (1) P03.58-P03.61 = default
(2)Motor rated rotational speed = 2000rpm
(3) SPDREG input signal = ON

| SPDREG1 P03.58 | SPDREG2 P03.59 | SPDREG 3 P03.60 | SPDREG 4 P03.61 | Ratio (%) | Actual speed (rpm) |
|---|---|---|---|---|---|
| OFF | OFF | OFF | OFF | 0 | 0 |
| ON | OFF | OFF | OFF | 10 | 200 |
| OFF | ON | OFF | OFF | 20 | 400 |
| OFF | OFF | ON | OFF | 40 | 800 |
| OFF | OFF | OFF | ON | 80 | 1600 |
| ON | ON | OFF | OFF | 30 | 600 |
| ON | ON | ON | OFF | 70 | 1400 |

| | | | | | | |
|---|---|---|---|---|---|---|
| P03.59 | Label | Speed regulation ratio 2 | | | Valid mode(s) | S |
| | Range | 0~150 | Unit | % | Default | 20 |
| | Byte length | 16bit | Attribute | R/W | 485 address | H: 0x0376<br>L: 0x0377 |
| | Valid | Immediate | | | | |
| | Same as P03.58 | | | | | |
| P03.60 | Label | Speed regulation ratio 3 | | | Valid mode(s) | S |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Range** | 0~150 | **Unit** | % | **Default** | 40 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | H: 0x0378<br>L: 0x0379 |
| | **Valid** | Immediate | | | | |
| | Same as P03.58 | | | | | |
| **P03.61** | **Label** | Speed regulation ratio 4 | | | **Valid mode(s)** | S |
| | **Range** | 0~150 | **Unit** | % | **Default** | 80 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | H: 0x037A<br>L: 0x037B |
| | **Valid** | Immediate | | | | |
| | Same as P03.58 | | | | | |

## [Class 4] I/O Monitoring Settings

| P04.00 | Label | Input selection DI1 | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|
| | Range | 0x00~0xFF | Unit | — | Default | 0x2 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0401 |
| | Valid | Immediate | | | | |

Please refer to the table below to set DI signals and table on the right for corresponding pin and parameters

| Signal | Symbol | Value | |
|---|---|---|---|
| | | NO | NC |
| Invalid | — | 0 | - |
| Positive limit switch | POT | 1 | 81 |
| Negative limit switch | NOT | 2 | 82 |
| Servo enabled | SRV-ON | 3 | 83 |
| Clear alarm | A-CLR | 4 | - |
| Control mode switching | C-MODE | 5 | 85 |
| Gain switching | GAIN | 6 | 86 |
| Clear deviation count | CL | 7 | - |
| Command pulse prohibited | INH | 8 | 88 |
| Torque limit switching | TL-SEL | 9 | 89 |
| Command frequency divider/multiplier switching | DIV1 | C | 8C |
| Internal command velocity 1 | INTSPD1 | E | 8E |
| Internal command velocity 2 | INTSPD2 | F | 8F |
| Internal command velocity 3 | INTSPD3 | 10 | 90 |
| Internal command velocity 4 | INTSPD4 | 31 | B1 |
| Zero speed clamp | ZEROSPD | 11 | 91 |
| Velocity command sign | VC-SIGN | 12 | 92 |
| Torque command sign | TC-SIGN | 13 | 93 |
| Forced alarm | E-STOP | 14 | 94 |
| Vibration supP0Ession 1 | VS-SEL1 | 0A | 8A |
| Vibration supP0Ession 2 | VS-SEL2 | 0B | 8B |

| CN1 PIN | Input | Parameters |
|---|---|---|
| 9 | DI1 | P04.00 |
| 10 | DI2 | P04.01 |
| 34 | DI3 | P04.02 |
| 8 | DI4 | P04.03 |
| 33 | DI5 | P04.04 |
| 32 | DI6 | P04.05 |
| 12 | DI7 | P04.06 |
| 30 | DI8 | P04.07 |

Please don't set anything other than listed in table above.
**Normally open (NO) :** Valid when input = ON
**Normally close (NC):** Valid when input = OFF
Er210 might occur if same function is allocated to different channels at the same time

Servo enabled（SRV-ON）has to be allocated to enabled servo driver.

Inputs related to PR-mode:

| Signal | Symbol | Value | |
|---|---|---|---|
| | | NO | NC |
| Trigger command | CTRG | 20 | A0 |
| Home | HOME | 21 | A1 |
| Forced stop | STP | 22 | A2 |

The input settings related to PR mode are as follows:

| Signal | Symbol | Value | |
|---|---|---|---|
| | | NO | NC |
| Positive JOG | PJOG | 23 | A3 |
| Negative JOG | NJOG | 24 | A4 |
| Positive limit | PL | 25 | A5 |
| Negative limit | NL | 26 | A6 |
| Origin | ORG | 27 | A7 |

| | | | |
|---|---|---|---|
| Path address 0 | ADD0 | 28 | A8 |
| Path address 1 | ADD1 | 29 | A9 |
| Path address 2 | ADD2 | 2A | AA |
| Path address 3 | ADD3 | 2B | AB |

*Note: CTRG, HOME are edge triggered, please make sure electronic bits last 1ms or above.*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P04.01** | **Label** | Input selection DI2 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x1 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0403 | | |
| | **Valid** | Immediate | | | | | | |
| **P04.02** | **Label** | Input selection DI3 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0405 | | |
| | **Valid** | Immediate | | | | | | |
| **P04.03** | **Label** | Input selection DI4 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x6 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0407 | | |
| | **Valid** | Immediate | | | | | | |
| **P04.04** | **Label** | Input selection DI5 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0xC | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0409 | | |
| | **Valid** | Immediate | | | | | | |
| **P04.05** | **Label** | Input selection DI6 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x3 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x040B | | |
| | **Valid** | Immediate | | | | | | |
| **P04.06** | **Label** | Input selection DI7 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x7 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x040D | | |
| | **Valid** | Immediate | | | | | | |
| **P04.07** | **Label** | Input selection DI8 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x4 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x040F | | |
| | **Valid** | Immediate | | | | | | |
| DI2~DI8allocation is the same as DI1. Please refer to P04.00. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P04.10** | **Label** | Output selection DO1 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x3 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0415 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Valid** | Immediate | | | | |

Please allocate DO as per table below. ALARM logic is the opposite of others

| Signal | Symbol | Value | |
|---|---|---|---|
| | | NO | NC |
| Invalid | — | 00 | 80 |
| Alarm | ALARM | 01 | 81 |
| Servo-Ready | SRDY | 02 | 82 |
| External brake released | BRK-OFF | 03 | 83 |
| Positioning completed | INP | 04 | 84 |
| At-speed | AT-SPPED | 05 | 85 |
| Torque limit signal | TLC | 06 | 86 |
| Zero speed clamp detection | ZSP | 07 | 87 |
| Velocity coincidence | V-COIN | 08 | 88 |
| Servo Status | SRV-ST | 12 | 92 |
| Positive limit valid | POT-OUT | 15 | 95 |
| Negative limit valid | NOT-OUT | 16 | 96 |
| Position command ON/OFF | P-CMD | 0B | 8B |
| Velocity command ON/OFF | V-CMD | 0F | 8F |
| Velocity limit signal | V-LIMIT | 0D | 8D |
| Z phase output | — | 2E | AD |

| CN1 PIN | Output | Parameters |
|---|---|---|
| 7 | DO1+ | P04.10 |
| 6 | DO1- | |
| 5 | DO2+ | P04.11 |
| 4 | DO2- | |
| 3 | DO3+ | P04.12 |
| 2 | DO3- | |
| 1 | DO4+ | P04.13 |
| 26 | DO4- | |
| 28 | DO5 | P04.14 |
| 27 | DO6 | P04.15 |

*Same signal can be assigned to multiple different outputs.*
**Normally open (NO)**：Active low
**Normally close (NC)**：Active high
Err212 might occur if output is allocated to signals other than listed in the table above.

Outputs related to PR-mode

| Signal | Symbol | Value | |
|---|---|---|---|
| | | NO | NC |
| Command completed | CMD-OK | 20 | A0 |
| Path completed | PR-OK | 21 | A1 |
| Homing done | HOME-OK | 22 | A2 |

*Note: CMD-OK indicates PR command is sent by axis might not yet be in position. PR-OK indicates axis is in place.*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P04.11** | **Label** | Output selection DO2 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x4 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0417 | | |
| | **Valid** | Immediate | | | | | | |
| **P04.12** | **Label** | Output selection DO3 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x3 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0419 | | |
| | **Valid** | Immediate | | | | | | |
| **P04.13** | **Label** | Output selection DO4 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x81 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x041B | | |
| | **Valid** | Immediate | | | | | | |
| **P04.14** | **Label** | Output selection DO5 | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0xFF | **Unit** | — | **Default** | 0x22 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x041D | | |
| | **Valid** | Immediate | | | | | | |
| DO2-DO5 is allocated by the same method as per DO1. Please refer to P04.10. | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P04.31** | **Label** | Positioning complete range | | **Valid mode(s)** | **P** | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Range** | 0～10000 | **Unit** | P05.20 set unit | **Default** | 20 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x043F |
| | **Valid** | Immediate | | | | |

To set position deviation range of INP1 positioning completed output signal. INP1 output signal will be valid once position is complete within the range of deviation set.
*The default unit is the command unit. Through P05.20 position setting unit can be set to command unit (Pulse), encoder unit (Pulse)*

| **P04.32** | | | | | | |
|---|---|---|---|---|---|---|
| | **Label** | Positioning complete output setting | | | **Valid mode(s)** | **P** |
| | **Range** | 0~4 | **Unit** | — | **Default** | 1 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0441 |
| | **Valid** | Immediate | | | | |

To set conditions for INP1 output signal to be valid

| Value | Positioning completed signal |
|---|---|
| 0 | Signal valid when the position deviation is smaller than P04.31 |
| 1 | Signal valid when there is no position command and position deviation is smaller than P04.31 |
| 2 | Signal valid when there is no position command, zero-speed clamp detection (ZSP) signal is ON and the positional deviation is smaller than P04.31 |
| 3 | Signal valid when there is no position command and position deviation is smaller than P04.31. Signal ON when within the time set in P04.33 otherwise OFF. |
| 4 | When there is no command, position detection starts after the delay time set in P04.33.<br>Signal valid when there is no position command and positional deviation is smaller than P04.31. |

| **P04.33** | | | | | | |
|---|---|---|---|---|---|---|
| | **Label** | INP positioning delay time | | | **Valid mode(s)** | **P** |
| | **Range** | 0~15000 | **Unit** | 1ms | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0443 |
| | **Valid** | Immediate | | | | |

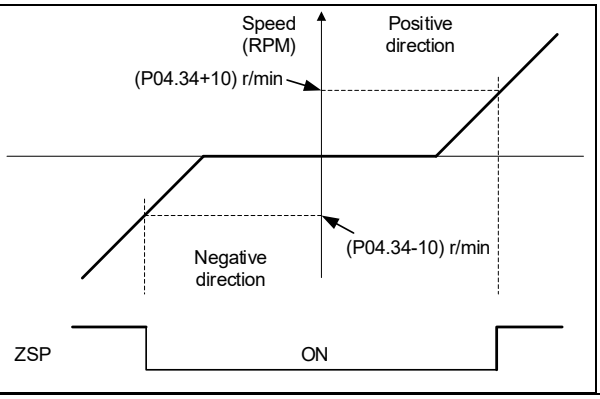
Valid when P04.32 = 3.

| Set value | Positioning completed signal |
|---|---|
| 0 | Indefinite delay time, signal ON until next position command |
| 1-15000 | OFF within the time set; ON after time set. Switch OFF after receiving next position command. |

| **P04.34** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Label** | Zero speed | | | **Valid mode(s)** | **P** | **S** **T** |
| | **Range** | 1~2000 | **Unit** | r/min | **Default** | 50 | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0445 | |
| | **Valid** | Immediate | | | | | |

To set threshold value for zero speed clamp detection.
Zero speed clamp detection (ZSP) output signal valid when motor speed goes under the value set in P04.34

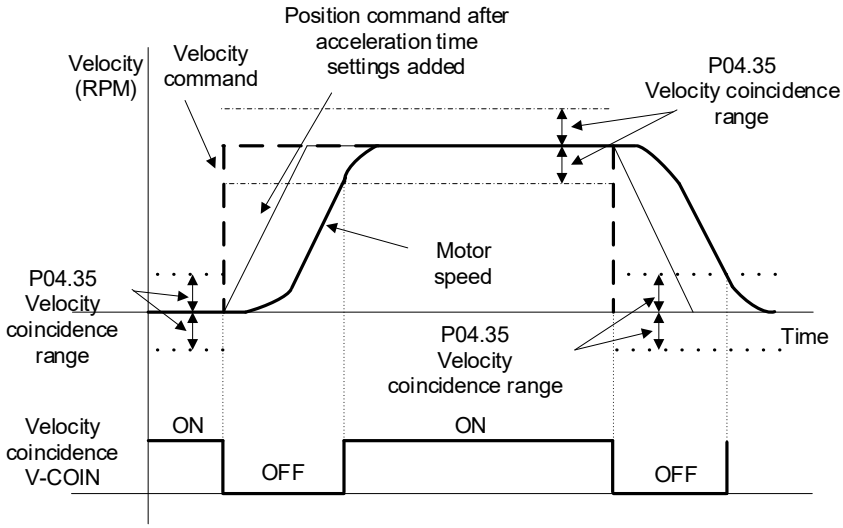
- Disregard the direction of rotation, valid for both directions.
- Hysteresis of 10RPM. Please refer to diagram on the right side.




| P04.35 | Label | Velocity coincidence range | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 50 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0447 |
| | Valid | Immediate | | | | |

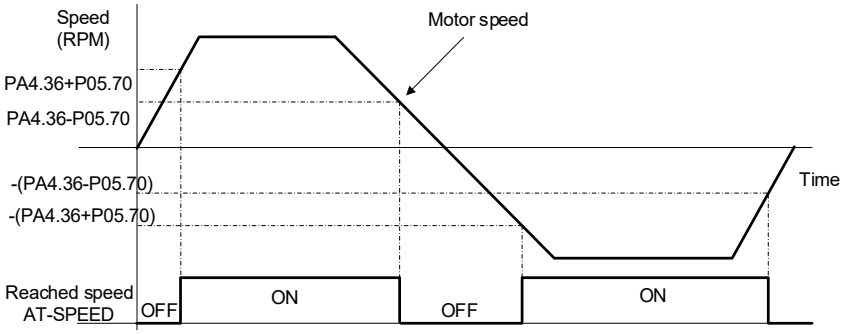
If the difference between velocity command and motor actual speed is below P04.35, Velocity coincidence (V-COIN) output signal valid.

Due to 10RPM hysteresis:
Velocity coincidence output OFF -> ON timing (P04.35 –P05.70) r/min
Velocity coincidence output ON -> OFF timing (P04.35 + P05.70) r/min



| P04.36 | Label | Target velocity | | | Valid mode(s) | S |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 1000 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0449 |
| | Valid | Immediate | | | | |

When motor velocity > P04.36, AT-speed output signal is valid.
Detection using 10RPM hysteresis.

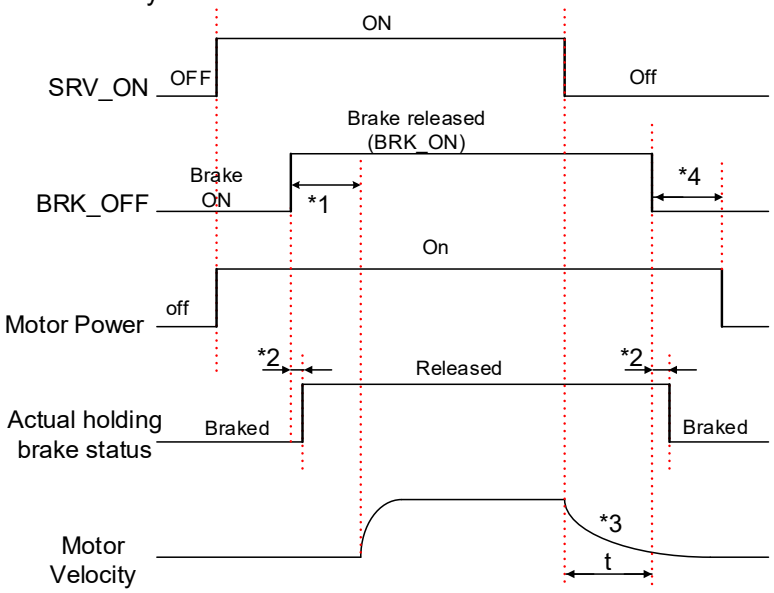



| P04.37 | Label | Motor power-off delay time | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3000 | Unit | 1ms | Default | 150 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x044B | | |
| | Valid | Immediate | | | | | | |

To set delay time for holding brake to be activated after motor power off to P0Event axis from sliding.
When P05.06 = 0, SRV-ON signal is off, holding brake is activated (delay time is determined by P04.39 or P06.14). Motor powered-off once delay time set in P04.37 is due.

| P04.38 | Label | Holding brake release time | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3000 | Unit | 1ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x044D | | |
| | Valid | Immediate | | | | | | |

- 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 P04.38
*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 P06.14 or if motor speed goes below P04.39, whichever comes first. BRK_OFF given after deceleration time.
*4: P04.37 set time value.

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

| P04.39 | Label | Holding brake activation speed | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 30~3000 | Unit | r/min | Default | 30 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x044F | | |
| | Valid | Immediate | | | | | | |

To set the activation speed for which holding brake will be activated.
When SRV-OFF signal is given, motor decelerates, after it reaches below P04.39 and P06.14 is not yet reached, BRK_OFF is given.

BRK_OFF signal is determined by P06.14 or if motor speed goes below P04.39, whichever comes first.

Application:
1. After disabling axis, P06.14 has been reached but motor speed is still above P04.39, BRK_OFF signal given.
2. After disabling axis, P06.14 has not been reached but motor speed is below P04.39, BRK_OFF signal given.

Deceleration max duration: 2s. Servo disabled after 2s.

| P04.43 | Label | Emergency stop function | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0457 | | |
| | Valid | Immediate | | | | | | |

| Value | Description. |
|---|---|
| 【0】 | Emergency stop is valid, servo driver will be forced to STOP and Err570 occurs. |
| 1 | Emergency stop is invalid, servo driver will not be forced to STOP. Servo can be enabled once E-STOP signal is cleared. |

| P04.62 | Label | Position/Speed/Torque Feedback Polarity Setting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x047D | | |
| | Valid | Immediate | | | | | | |

Set the position/speed/torque feedback polarity:
0: feedback does not reverse
1: feedback reverse

## [Class 5] Extension Settings

| P05.00 | Label | 2nd pulse count per revolution | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0-8388608 | Unit | PULSE | Default | 10000 | | |
| | Byte length | 32bit | Attribute | R/W | 485 address | H: 0x0500<br>L: 0x0501 | | |
| | Valid | After restart | | | | | | |
| | Switch between P00.08 and P05.00 with DI signal DIV1.<br>When switch to P05.00:<br>（1）P05.00 valid when ≠ 0:<br>Motor revolution = Input pulse count / [P05.00 set value]<br>（2）P05.00 invalid when = 0:<br>Actual position pulse count is according to P05.01 and P05.02.<br>Switching with DIV1 signal only valid when servo driver is re-enabled. | | | | | | | |

| P05.01 | Label | 2nd Command frequency divider/multiplier numerator | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~1073741824 | Unit | — | Default | 1 | | |
| | Byte length | 32bit | Attribute | R/W | 485 address | H: 0x0502<br>L: 0x0503 | | |
| | Valid | After restart | | | | | | |
| | To set command pulse input frequency division and multiplication numerator | | | | | | | |

| P05.02 | Label | 2nd Command frequency divider/multiplier denominator | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~1073741824 | Unit | — | Default | 1 | | |
| | Byte length | 32bit | Attribute | R/W | 485 address | H: 0x0504<br>L: 0x0505 | | |
| | Valid | After restart | | | | | | |
| | To set command pulse input frequency division and multiplication denominator. Please refer to P00.09 and P00.10. Switch using DIV1 signal. | | | | | | | |

| P05.04 | Label | Driver prohibition input settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0/1/2 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0509 | | |
| | Valid | Immediate | | | | | | |

To set driver prohibition input (POT/NOT)

| Value | Description |
|---|---|
| 0 | POT → Positive direction drive prohibited<br>NOT → Negative direction drive prohibited |
| 1 | POT and NOT invalid |
| 2 | Any single sided input from POT or NOT might cause Er260 |

| P05.05 | Label | Limit stop deceleration | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~32767 | Unit | ms/krpm | Default | 10 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x050B | | |
| | Valid | Immediate | | | | | | |
| | When bit8 of P06.10 is set to 1, the limit stop deceleration function is turned on (software limit is not supported);<br>When the external limit is encountered (DI signal POT/NOT is valid), the system will decelerate from the current speed according to the deceleration set by P05.05 until it stops completely. | | | | | | | |

| P05.06 | Label | Servo-off mode | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Range** | 0~5 | **Unit** | — | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x050D |
| | **Valid** | Immediate | | | | |

To set servo driver disable mode and status.

| Value | Description | |
|---|---|---|
| | *Mode* | *Status* |
| 0 | Servo braking | Dynamic braking |
| 1 | Free stopping | Dynamic braking |
| 2 | Dynamic braking | Dynamic braking |
| 3 | Servo braking | Free-run |
| 4 | Free stopping | Free-run |
| 5 | Dynamic braking | Free-run |

*Servo braking: Stop servo axis quickly using braking torque*
*P05.06 only effective for stopping under normal circumstances. For stopping on alarm occurrence but refer to P05.10*

| **P05.07** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Label** | E-STOP emergency stop deceleration | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 1~32767 | **Unit** | ms/krpm | **Default** | 50 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x050F | | |
| | **Valid** | Immediate | | | | | | |

When bit9 of P06.10 is set to 1, the E-STOP emergency stop deceleration function will be started.
The shutdown mode is servo braking mode, and the system will decelerate from the current speed according to the deceleration set in P05.07 until it stops completely.

| **P05.09** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Label** | Main power-off detection time | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 50~200 | **Unit** | ms | **Default** | 50 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0513 | | |
| | **Valid** | Immediate | | | | | | |

To set delay time for detection of main power-off or low voltage supply.

| **P05.10** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Label** | Servo-off due to alarm mode | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~5 | **Unit** | — | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0515 | | |
| | **Valid** | After restart | | | | | | |

To set servo driver disable mode and status if alarm is triggered.
Alarm type 2:

| Value | Explanation | |
|---|---|---|
| | *Mode* | *Status* |
| 0 | Servo braking | Dynamic braking |
| 1 | Free stopping | Dynamic braking |
| 2 | Dynamic braking | Dynamic braking |
| 3 | Servo braking | Free-run |
| 4 | Free stopping | Free-run |
| 5 | Dynamic braking | Free-run |

Alarm type 1:

| Value | Explanation | |
|---|---|---|
| | *Mode* | *Status* |
| 0 | Dynamic braking | Dynamic braking |
| 1 | | |
| 2 | | |
| 3 | Dynamic braking | Free-run |

| | | | |
|---|---|---|---|
| | 4 | Free stopping | Free-run |
| | 5 | Dynamic braking | Free-run |

| P05.11 | Label | Servo braking torque setting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0517 | | |
| | Valid | Immediate | | | | | | |

To set torque limit for servo braking mode.
If P05.11 = 0, use torque limit as under normal situation.
Please note that if P05.11 set value is too low, emergency stop will take longer.

| P05.12 | Label | Overload level setting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~115 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0519 | | |
| | Valid | Immediate | | | | | | |

· When set to 0, overload level = 100%.
·Set to 0 under regular usage. Lowering overload level will cause motor to overload in shorter time.
·Er100 occurs when driver output current higher than motor rated current (overload)
Er101 occurs when driver output current lower than motor rated current

| P05.13 | Label | Overspeed level settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x051B | | |
| | Valid | Immediate | | | | | | |

If motor speed exceeds P05.13, Er1A0 might occur.
When P05.13 = 0, overspeed level = max. motor speed x 1.2

| P05.15 | Label | I/O digital filter | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~255 | Unit | 0.1ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x051F | | |
| | Valid | After restart | | | | | | |

Digital filtering of I/O input. Overly large value set will cause control delay.

| P05.17 | Label | Counter clearing input mode | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | — | Default | 3 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0523 | | |
| | Valid | Immediate | | | | | | |

To set the clearing conditions for deviation counter clearing input signal.

| Value | Condition |
|---|---|
| 0/2/4 | Invalid |
| 1 | Always clear |
| 3 | Clear only once (Rising edge trigger) |

| P05.20 | Label | Position unit settings | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 1 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0529 | | |
| | Valid | Immediate | | | | | | |

Set unit for position related parameters

| Value | Unit |
|---|---|
| 0 | Encoder unit |
| 1 | Command unit |
| 2 | 0.0001rev |

| |
|---|
| Command unit: Pulse from host (Affected by electronic gear ratio)<br>Encoder unit: Pulse from encoder (Related to encoder resolution)<br>P05.20 can only be modified when axis is disabled as it will clear position data |

| P05.21 | Label | Torque limit selection | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~6 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x052B | | |
| | Valid | Immediate | | | | | | |

| Value | | Limit |
|---|---|---|
| 【0】 | | 1st torque limit P00.13 |
| 1 | | 2nd torque limitP05.22 |
| 2 | TL-SEL OFF | P00.13 |
| | TL-SEL ON | P05.22 |
| 3~4 | | Reserved |
| 5 | | P00.13 →Positive torque limit<br>P05.22 →Negative torque limit |

| P05.22 | Label | 2nd torque limit | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 300 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x052D | | |
| | Valid | Immediate | | | | | | |

P05.22 is limited by max. torque set in motor parameter.

| P05.23 | Label | Positive torque warning threshold | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~300 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x052F | | |
| | Valid | Immediate | | | | | | |

Default = 0, which is 95%. Other values are only valid when P05.21 = 5.
If actual torque is higher than threshold, TLC torque limit signal will be valid.

| P05.24 | Label | Negative torque warning threshold | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~300 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0531 | | |
| | Valid | Immediate | | | | | | |

Default = 0, which is 95%. Other values are only valid when P05.21 = 5.
If actual torque is higher than threshold, TLC torque limit signal will be valid.

| P05.28 | Label | LED initial status | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~35 | Unit | — | Default | 1 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0539 | | |
| | Valid | Immediate | | | | | | |

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

| Value | Status | Value | Status | Value | Status |
|---|---|---|---|---|---|
| 0 | Position deviation | 14 | Regenerative load rate | 28 | Software version |
| 1 | Motor speed | 15 | Overload rate | 29 | Internal usage |
| 2 | Position command deviation | 16 | Inertia load ratio | 30 | Encoder communication failure counts |
| 3 | Velocity control command | 17 | Cause(s) of non-rotation | 31 | Accumulated uptime |
| 4 | Actual feedback torque | 18 | No. of I/O changes | 32 | Internal usage |
| 5 | Feedback pulse sum | 19 | Internal usage | 33 | Driver temperature |
| 6 | Command pulse sum | 20 | Absolute encoder data | 34 | Servo status |
| 7 | Max. torque | 21 | Encoder single turn data | 35 | Internal usage |
| 8 | Position command frequency | 22 | Encoder multiturn data | | |
| 9 | Control mode | 23 | 485 receive frame | | |
| 10 | I/O status | 24 | Encoder position deviation | | |
| 11 | - | 25 | Internal usage | | |
| 12 | Alarm cause & history record | 26 | Internal usage | | |
| 13 | Warning ID | 27 | PN Voltage | | |

| P05.29 | Label | RS485 communication mode | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~255 | Unit | — | Default | 5 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x053B | | |
| | Valid | After restart | | | | | | |

| Value | Bit | Checksum | Stop |
|---|---|---|---|
| 0 | 8 | Even | 2 |
| 1 | 8 | Odd | 2 |
| 2 | 8 | Even | 1 |
| 3 | 8 | Odd | 1 |
| 4 | 8 | Null | 1 |
| 【5】 | 8 | Null | 2 |

| P05.30 | Label | RS485 communication Baud rate | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~15 | Unit | — | Default | 4 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x053D | | |
| | Valid | After restart | | | | | | |

| Value | Baud rate |
|---|---|
| 0 | 2400bps |
| 1 | 4800bps |
| 2 | 9600bps |
| 3 | 19200bps |

| Value | Baud rate |
|---|---|
| 【4】 | 38400bps |
| 5 | 57600bps |
| 6 | 115200bps |

Baud rate tolerance: 2400～38400bps±0.5%, 57600～115200bps±2%

| P05.31 | Label | RS485 axis address | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~127 | Unit | — | Default | 1 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x053F | | |
| | Valid | After restart | | | | | | |

When controller is connected to multiple axis and controller needs to identify the axis, P05.31 can be used to set the axis ID/address.
Please set to a max of 31 if the communication is between RS232 and RS485

| P05.32 | Label | Max. command pulse input frequency | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~8000 | Unit | kHz | Default | 4100 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0541 | | |
| | Valid | Immediate | | | | | | |

Please set the max. frequency required for command pulse input. Er1B0 will occur, if command pulse input frequency exceeds P05.32.

| P05.35 | Label | Front panel lock setting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0547 | | |
| | Valid | Immediate | | | | | | |

| Value | Description |
|---|---|
| 【0】 | Front panel not lock |
| 1 | Only parameter modification through front panel is locked |

| P05.37 | Label | Torque saturation alarm detection time | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~5000 | Unit | ms | Default | 500 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0549 | | |
| | Valid | Immediate | | | | | | |

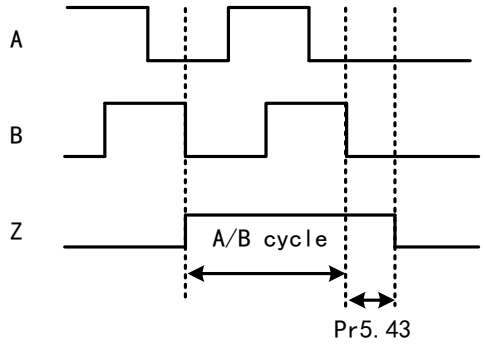
| | |
|---|---|
| | To set the delay time for detection of torque over limit under torque homing mode.<br>Under homing mode, when torque exceeds limit and the time set in P05.37, TLC output signal will be valid. |

| P05.42 | Label | Frequency divider output – Z-signal polarity | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0555 | | |
| | Valid | Disabled | | | | | | |

Set the polarity of the frequency division output Z signal:
0: positive polarity,
1: negative polarity

| P05.43 | Label | Frequency divider output – Z-signal width | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 2~100 | Unit | 0.1ms | Default | 2 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0557 | | |
| | Valid | After restart | | | | | | |

| Value | Description |
|---|---|
| 2~100 | The length of the corresponding setting value is delayed on the basis of the width of one cycle of A/B; |




| P05.46 | Label | Vent overload level | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~115 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x055D | | |
| | Valid | After restart | | | | | | |

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

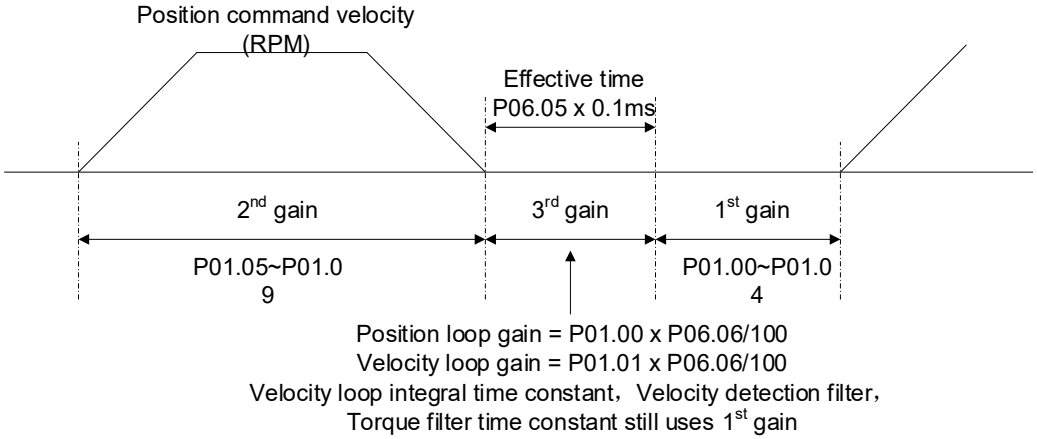
## [Class 6] Other Settings

| P06.01 | Label | Encoder zero position compensation | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~360 | Unit | Electrical angel | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0603 | | |
| | Valid | Power-off | | | | | | |
| | Zero position compensation for encoder zero drift to avoid abnormality due to zero drift. | | | | | | | |

| P06.03 | Label | JOG trial run torque command | | | Valid mode(s) | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~350 | Unit | % | Default | 350 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0607 | | |
| | Valid | Immediate | | | | | | |
| | To set torque for JOG trial run command. | | | | | | | |
| P06.04 | Label | JOG trial run velocity command | | | Valid mode(s) | P | S | T |
| | Range | 0~10000 | Unit | r/min | Default | 30 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0609 | | |
| | Valid | Immediate | | | | | | |
| | To set velocity for JOG trial run command. | | | | | | | |

| P06.05 | Label | Position 3rd gain valid time | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x060B | | |
| | Valid | Immediate | | | | | | |
| | To set time for 3rd gain to be valid<br>Only available in position mode<br>When not in use, set P06.05=0, P06.06=100 | | | | | | | |
| P06.06 | Label | Position 3rd gain scale factor | | | Valid mode(s) | P | | |
| | Range | 50~1000 | Unit | 100% | Default | 100 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x060D | | |
| | Valid | Immediate | | | | | | |

Set up the 3rd gain by multiplying factor of the 1st gain




Above diagram is illustrated using P01.15 = 7.
3rd gain= 1st gain * P06.06/100
Only effective under position control mode. 3rd gain valid when P06.05 ≠ 0. Set 3rd gain value in P06.06. When 2nd gain switches to 1st gain, it will go through 3rd, switching time is set in P01.19.

| P06.07 | Label | Torque command additional value | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | -100~100 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x060F | | |
| | Valid | Immediate | | | | | | |

To set torque forward feed additional value of vertical axis.
Applicable for loaded vertical axis, compensate constant torque.
Application: When load move along vertical axis, pick any point from the whole motion and stop the load at that particular point with motor enabled but not rotating. Record output torque value from d04, use that value as torque command additional value (compensation value)

| P06.08 | Label | Positive direction torque compensation value | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | -100~100 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0611 | | |
| | Valid | Immediate | | | | | | |
| P06.09 | Label | Negative direction torque compensation value | | | Valid mode(s) | P | S | T |
| | Range | -100~100 | Unit | % | Default | 0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0613 | | |
| | Valid | Immediate | | | | | | |

To reduce the effect of mechanical friction in the movement(s) of the axis. Compensation values can be set according to needs for both rotational directions.
Applications:
1. When motor is at constant speed, d04 will deliver torque values.
Torque value in positive direction = T1;
Torque value in negative direction = T2

P06.08/P06.09 = $T_f = \frac{|T1-T2|}{2}$

*Positive/Negative compensation corresponds to actual position feedback.*
*Positive torque compensation value = +(P06.08=+$T_f$)*
*Negative torque compensation value = -(P06.08=+$T_f$)*
*P06.08 =x, P06.09=y; friction compensation value = |x-y|/2*

| P06.10 | Label | Function extension setting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | - | Default | 0x0 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0615 | | |
| | Valid | After restart | | | | | | |

P06.10 Use bit to set, for function extension setting: bit1/bit2 only takes effect in P00.07 = 3 mode

| value | bit | function |
|---|---|---|
| 0x0 | - | Pulse input and direction input polarity does not change |
| 0x2 | Bit 1=1 | Pulse Input Polarity Inverse |
| 0x4 | Bit 2=1 | Direction Input Polarity Inverse |
| 0x6 | Bit 1=1, Bit 2=1 | Pulse input and direction input polarity are inverted |
| 0x1000 | Bit 12=1 | When turned on, when the PR mode is stopped, the driver can receive external pulse commands |

| P06.11 | Label | Current response settings | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50~100 | Unit | % | Default | 100 | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0617 | | |
| | Valid | Immediate | | | | | | |

To set driver current loop related effective value ratio.

| P06.14 | Label | Max. time to stop after disabling | | | Valid mode(s) | P S T |
|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | ms | Default | 500 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x061D |
| | Valid | Immediate | | | | |
| | 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 P06.14 is reached, BRK_ON given and holding brake activated.<br>BRK_ON given time is determined by P06.14 or when motor speed goes below P04.39, whichever comes first.<br><br>Applications:<br>1. After disabling axis, if motor speed is still higher than P04.39 but the time set in P06.14 is reached, BRK_ON given and holding brake activated.<br>2. After disabling axis, if motor speed is already lower than P04.39 but the time set in P06.14 is not yet reached, BRK_ON given and holding brake activated.<br>Dynamic brake will be provide the braking function if the function is activated for motors without holding brake. | | | | | |

| P06.20 | Label | Trial run distance | | | Valid mode(s) | P |
|---|---|---|---|---|---|---|
| | Range | 0~1200 | Unit | 0.1rev | Default | 10 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0629 |
| | Valid | Immediate | | | | |
| | JOG (Position control) : Distance travel of each motion. | | | | | |
| P06.21 | Label | Trial run waiting time | | | Valid mode(s) | P |
| | Range | 0~10000 | Unit | ms | Default | 300 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x062B |
| | Valid | Immediate | | | | |
| | JOG (Position control): Waiting time interval after each motion cycle | | | | | |
| P06.22 | Label | No. of trial run cycles | | | Valid mode(s) | P |
| | Range | 0~10000 | Unit | — | Default | 5 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x062D |
| | Valid | Immediate | | | | |
| | JOG (Position control): No. of cycles<br>When P06.22, trial run goes into endless cycles. | | | | | |
| P06.25 | Label | Trial run acceleration | | | Valid mode(s) | P S |
| | Range | 0~10000 | Unit | ms | Default | 200 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0633 |
| | Valid | Immediate | | | | |
| | To set the acceleration/deceleration time for JOG command between 0 rpm to 1000 rpm | | | | | |

| P06.28 | Label | Observer gain | | | Valid mode(s) | P S |
|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | % | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0639 |
| | Valid | Immediate | | | | |
| | 0: Default stable gain 1: OFF<br>X: (unit: %) Manual, related to motor, load and encoder | | | | | |
| P06.29 | Label | Observer filter | | | Valid mode(s) | P S |
| | Range | 0~32767 | Unit | μs | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x063B |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Valid** | Immediate | | | | |
| 0: Default stable observer filter 1: OFF<br>X: (unit: μs) Manual, related to motor, load and encoder | | | | | | |
| **P06.36** | **Label** | Vibration Alarm Threshold | | | **Valid mode(s)** | P S T |
| | **Range** | 0~1000 | **Unit** | % | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0649 |
| | **Valid** | Immediate | | | | |
| Set the ER190 vibration alarm out threshold. | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P06.37** | **Label** | Vibration switching mode | | | **Valid mode(s)** | P S T |
| | **Range** | 0~1000 | **Unit** | | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x064B |
| | **Valid** | Immediate | | | | |

Set P00.03 Rigidity and P00.02 Auto Adjustment mode for vibration to allow automatic change:

| Bit | value | function |
|---|---|---|
| 0 | 0 | Self-reducing rigidity and switching load mode are not allowed during vibration |
| | 1 | Allows self-reducing stiffness and switching load modes |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P06.56** | **Label** | Blocked rotor alarm torque threshold | | | **Valid mode(s)** | P S |
| | **Range** | 0~300 | **Unit** | % | **Default** | 300 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0671 |
| | **Valid** | Immediate | | | | |

To set the torque threshold of blocked rotor to trigger alarm. (Alarm triggered if torque output% larger than threshold value & under 10rpm)
If P06.56 = 0, blocked rotor alarm deactivated.
If motor speed is 10rpm or above, Er102 won't be triggered.

| | | | | | | |
|---|---|---|---|---|---|---|
| **P06.57** | **Label** | Blocked rotor alarm delay time | | | **Valid mode(s)** | P S |
| | **Range** | 1~10000 | **Unit** | ms | **Default** | 400 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0673 |
| | **Valid** | Immediate | | | | |

To set delay time for blocked rotor alarm. Err102 won't be triggered if time doesn't exceed set time in P06.57.
Blocked rotor alarm is activated by default, alarm torque threshold = 300%, delay time = 400ms; speed threshold = 10rpm;

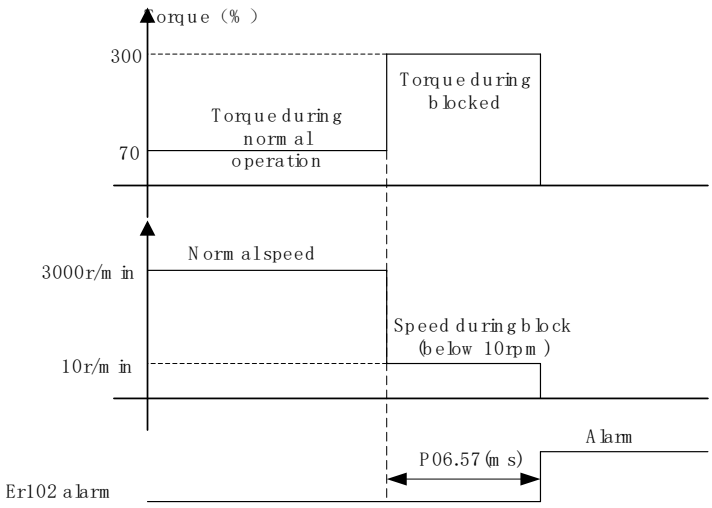



Diagram shows blocked rotor with speed under 10rpm

*If the rotor is blocked but with speed over 10rpm, Er102 would not be triggered but Er100 might occur*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P06.61** | **Label** | Z signal holding time | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 1~100 | **Unit** | ms | **Default** | 10 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x067B | | |
| | **Valid** | Immediate | | | | | | |
| | Sets the time for which the DO output Z signal is maintained. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P06.63** | **Label** | Absolute multiturn data upper limit | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~32766 | **Unit** | rev | **Default** | 0 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x067F | | |
| | **Valid** | After restart | | | | | | |
| | Sets the upper limit of multi-turn data when the absolute encoder is in rotation mode.<br>Used in conjunction with P06.54, suitable for rotation mode when P00.15 = 2, feedback position range is 0 ~[(P06.63 1)/P06.54]x number of pulses per revolution; calculated as 1 when P06.54 = 0.<br>Note: When P00.08 ≠ 0, the number of pulses per revolution = P00.08; When P00.08 = 0, the number of pulses per revolution = encoder resolution × electronic gear ratio) | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P06.66** | **Label** | Initial overload rate of driver overload | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0~80 | **Unit** | - | **Default** | 50 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x0685 | | |
| | **Valid** | After restart | | | | | | |
| | The overload rate is accumulated from 0% to 100 by default, and the overload rate of 380V driver is related to temperature. When the temperature exceeds 50 degrees, the overload rate increases directly from 50%. | | | | | | | |

## [Class 7] Factory Settings

**Please take P0Ecaution when modifying Class 7 parameters. Might cause driver errors*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P07.15** | **Label** | Motor model | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | 0x0~0x7FFF | **Unit** | — | **Default** | 0x200 | | |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x071F | | |
| | **Valid** | After restart | | | | | | |

| Value | Description |
|---|---|
| 0x100 | Read from EEPROM |
| [0x200] | Read from Encoder |

When P07.15 = 0x200(2xx):

| Parameter | Label |
|---|---|
| P07.00 | Current loop gain |
| P07.01 | Current loop integral time |
| P07.05 | No. of motor pole pairs |
| P07.06 | Motor phase resistance |
| P07.07 | Motor D/Q induction |
| P07.08 | Motor back EMF coefficient |
| P07.09 | Motor torque coefficient |
| P07.10 | Motor rated rotational speed |
| P07.11 | Motor max. rotational speed |
| P07.12 | Motor rated current |
| P07.13 | Motor rotor inertia |
| P07.14 | Driver power rating |
| P07.16 | Encoder |

| | |
|---|---|
| P07.17 | Motor max. current |
| P07.18 | Encoder index angle compensation |

| P07.16 | Label | Encoder | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0x0~0x200 | Unit | — | Default | | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x0721 | | |
| | Valid | After restart | | | | | | |

To select encoder type. Typically, encoder specifications are automatically read.

| Value | Description |
|---|---|
| 0x0 | 17-bit encoder |
| 0x7 | 23-bit encoder |

| P07.31 | Label | Discharge control mode setting | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | | | |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x073F | | |
| | Valid | After restart | | | | | | |

Sets the discharge mode (default is **1** for drivers with 400W or lower power):

- **0**: Use regenerative resistor
- **1**: Do not use regenerative resistor (regenerative energy is absorbed by capacitors)

## [Class B] Status Parameters

| P0B.00 | Label | Software version 1（DSP） | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | / | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B00 | | |
| | Show DSP software version info. | | | | | | | |
| P0B.01 | Label | Software version 2（CPLD） | | | Valid mode(s) | P | S | T |
| | Range | / | Unit | / | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B01 | | |
| | Show software version info. | | | | | | | |
| P0B.02 | Label | Software version 3（Others） | | | Valid mode(s) | P | S | T |
| | Range | / | Unit | / | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B02 | | |
| | Show software version info. | | | | | | | |

| P0B.03 | Label | Current alarm | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | / | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B03 | | |
| | Show current alarm | | | | | | | |

| P0B.04 | Label | Motor not rotating cause | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | / | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B04 | | |
| | Show cause of motor not rotating | | | | | | | |

| P0B.05 | Label | Driver operation status | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | / | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B05 | | |

| Bit | Status | Description |
|---|---|---|
| 0 | RDY | Servo is ready |
| 1 | RUN | Servo is running |
| 2 | ERR | Driver error |

| | | | |
|---|---|---|---|
| | 3 | HOME_OK | Homing completed |
| | 4 | INP | In position |
| | 5 | AT-SPEED | Velocity reached |
| | 6~15 | | Reserved |

| P0B.06 | Label | Motor speed (Before filter) | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | rpm | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B06 | | |
| | Motor actual speed | | | | | | | |

| P0B.07 | Label | Motor output torque (1% unit) | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | % | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B07 | | |
| | Percentage of actual torque and rated torque of motor | | | | | | | |

| P0B.08 | Label | Motor current | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | 0.01A | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B08 | | |
| | Motor actual current | | | | | | | |

| P0B.09 | Label | Motor speed (After filter) | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | rpm | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B09 | | |
| | Motor speed after motor actual speed filtering | | | | | | | |

| P0B.10 | Label | DC bus voltage | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | V | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B0A | | |
| | Driver DC bus actual voltage | | | | | | | |

| P0B.11 | Label | Driver temperature | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | °C | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B0B | | |
| | Actual driver temperature | | | | | | | |

| P0B.15 | Label | Motor overload rate | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | % | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B0F | | |
| | Motor overload rate | | | | | | | |

| P0B.16 | Label | Vent overload rate | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | % | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B10 | | |
| | Vent overload rate | | | | | | | |

| P0B.17 | Label | Physical I/O input status | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | / | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B04 | | |
| | Driver physical I/O input bit0 corresponds to DI1, bit1 to DI2 and so on;<br>Bitn=1, DIn+1 high level signal input; Bitn=0, DIn+1 low level signal input | | | | | | | |

| P0B.18 | Label | Cause of motor not rotating | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | / | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B04 | | |
| | Driver physical I/O output bit0 corresponds to DO1, bit1 to DO2 and so on;<br>Bitn=1, DOn+1 high level signal output; Bitn=0 indicates DOn+1 low level signal output | | | | | | | |

| P0B.20 | Label | Command position (Command unit) | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | P | Default | / | | |
| | Byte length | 32bit | Attribute | R | 485 address | H: 0x0B14<br>L: 0x0B15 | | |
| | Driver receives command pulse count. Driver command unit: 10000 pulses/rev, Encoder unit: 8388608 pulses/rev. If driver receives 8388608 pulses, 10000P will be shown. | | | | | | | |

| P0B.21 | Label | Motor position (Command unit) | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | P | Default | / | | |
| | Byte length | 32bit | Attribute | R | 485 address | H: 0x0B16<br>L: 0x0B17 | | |
| | Motor position feedback. Driver command unit: 10000 pulses/rev, Encoder unit: 8388608 pulses/rev. If driver receives 8388608 pulses, 10000P will be shown. | | | | | | | |

| P0B.22 | Label | Position deviation (Command unit) | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | P | Default | / | | |
| | Byte length | 32bit | Attribute | R | 485 address | H: 0x0B18<br>L: 0x0B19 | | |
| | Shows position deviation. Please refer to P0B.20. | | | | | | | |

| P0B.23 | Label | Command position (Encoder unit) | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | P | Default | / | | |
| | Byte length | 32bit | Attribute | R | 485 address | H: 0x0B1A<br>L: 0x0B1B | | |
| | Driver receives command pulse count. Driver command unit: 10000 pulses/rev, Encoder unit: 8388608 pulses/rev. If driver receives 10000 pulses, 8388608 pulses will be shown. | | | | | | | |

| P0B.24 | Label | Motor position (Encoder unit) | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | P | Default | / | | |
| | Byte length | 32bit | Attribute | R | 485 address | H: 0x0B1C<br>L: 0x0B1D | | |
| | Driver receives motor encoder feedback pulses | | | | | | | |

| P0B.25 | Label | Position deviation (Encoder unit) | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | P | Default | / | | |
| | Byte length | 32bit | Attribute | R | 485 address | H: 0x0B1E<br>L: 0x0B1F | | |
| | Shows position deviation. Please refer to P0B.23. | | | | | | | |

| P0B.26 | Label | Rotational encoder position feedback (Command unit) | | | Valid mode(s) | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | P | Default | / | | |
| | Byte length | 32bit | Attribute | R | 485 address | H: 0x0B20<br>L: 0x0B21 | | |
| | Motor position under rotary mode. Please refer to P0B.21 | | | | | | | |

| P0B.30 | Label | Maximum torque | | | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | / | Unit | % | Default | / | | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x0B26 | | |
| | Show maximum torque | | | | | | | |

| P0B.31 | Label | Average load rate (1‰ units) | Valid mode(s) | P | S | T |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Range** | / | **Unit** | 0.1% | **Default** | / |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x0B27 |
| | Average load rate (1‰ units) | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P0B.34** | **Label** | Motor speed (before filtering) | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | / | **Unit** | 0.1r/min | **Default** | / | | |
| | **Byte length** | 32bit | **Attribute** | R | **485 address** | H: 0x0B2A<br>L: 0x0B2B | | |
| | Display motor speed before filtering | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P0B.35** | **Label** | Motor speed (after filtering) | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | / | **Unit** | 0.1r/min | **Default** | / | | |
| | **Byte length** | 32bit | **Attribute** | R | **485 address** | H: 0x0B2C<br>L: 0x0B2D | | |
| | Display motor speed after filtering | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P0B.36** | **Label** | Motor output torque (1‰ unit) | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | / | **Unit** | 0.1r/min | **Default** | / | | |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x0B2E | | |
| | Motor output torque (1‰ unit) | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P0B.37** | **Label** | Motor current | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | / | **Unit** | 0.001A | **Default** | / | | |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x0B2F | | |
| | Displays the motor current. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **P0B.38** | **Label** | Inertia ratio | | | **Valid mode(s)** | **P** | **S** | **T** |
| | **Range** | / | **Unit** | % | **Default** | / | | |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x0B30 | | |
| | Displays the inertia ratio. | | | | | | | |

## [Class 8] PR Control Parameters

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.00** | **Label** | PR Control | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6000 |

It is recommended to modify PR control parameters using EDrive.

| **Bit** | **3** | **2** | **1** | **0** |
|---|---|---|---|---|
| Description | =1, absolute value memory<br>=0, absolute value with no memory | =1, homing upon power on<br>=0, no homing upon power on | =1, software position limit valid<br>=0, software position limit not valid | =0, CTRG rising edge trigger<br>=1, double edges trigger |

If parameter modifications are done through the front panel or parameters list, please keep in mind that PR control parameters byte are decimal system.
For example: If Bit 3, 2, 1, 0 are to be set to 1 (1111). Conversion using decimal system, 1111 = 15, P08.00 is to be set to 15.

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.01** | **Label** | Path count | | | **Valid mode(s)** | **PR** |
| | **Range** | 16 | **Unit** | / | **Default** | 16 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x6001 |
| | 16 paths | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.02** | **Label** | Control Operation | | | **Valid mode(s)** | **PR** |
| | **Range** | 0x0 ~ 0xFFFF | **Unit** | / | **Default** | 0x0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6002 |

Attributes of P08.02 functions are divided into Read/Write. P refers to positioning motion of *N* path. Please refer to the following table.

| Attribute | Address | Description |
|---|---|---|
| Write | 0x01P | *N* path positioning |
| Write | 0x020 | Reset |
| Write | 0x021 | Manually set currently position as 0 (Origin) |
| Write | 0x040 | Emergency stop |
| Read | 0x000P | Positioning completed. Ready to receive new data |
| Read | 0x01P, 0x020, 0x040 | Yet to respond to command |
| Read | 0x10P | Path motion undergoing |
| Read | 0x200 | Command completed. Waiting for positioning |
| Read | 0x20P | Indicates that the P-segment path is positioned. |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.06** | **Label** | Software positive limit H | | | **Valid mode(s)** | **PR** |
| | **Range** | 0~ 65535 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6006 |
| | High bit of software positive limit (Only valid using 485 communication) | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.07** | **Label** | Software positive limit (L) | | | **Valid mode(s)** | **PR** |
| | **Range** | -2147483648~ 2147483647 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | 0x6007 |
| | To set software positive limit position (32 bit base)<br>Using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P08.06<br>When software positive limit = 994817, 0x000F2E01(Hexadecimal)<br>high16bit = 0x000F, hence P08.05 reading = 0x000F, controller = 15.<br>R/W of high/low bit data is similar when using 485 communication. | | | | | |
| **P08.08** | **Label** | Software negative limit H | | | **Valid mode(s)** | **PR** |
| | **Range** | 0~ 0x65535 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6008 |
| | High bit of software negative limit (Only valid using 485 communication) | | | | | |
| **P08.09** | **Label** | Software negative limit (L) | | | **Valid mode(s)** | **PR** |
| | **Range** | -2147483648~ 2147483647 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | 0x6009 |
| | To set software positive limit position.<br>Using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P08.08. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.10** | **Label** | Homing mode | | | **Valid mode(s)** | **PR** |
| | **Range** | 0~ 0xFFFF | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x600A |

To set homing method in PR mode. It is recommended to modify PR control parameters using EDrive.

| Bit | 8（Z-signal homing） | 2-7（Homing mode） | 1（Specific position after homing） | 0（Homing direction） |
|---|---|---|---|---|
| Description | =1, homing with Z-signal<br>=0, homing without Z-signal | =0 Limit homing<br>=1 Origin homing<br>=2 Single turn Z homing<br>=3 Torque homing<br>=8 Immediate homing | =1, Yes<br>=0, No | =1, Forward<br>=0, Reverse |

| P08.11 | Label | Zero position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x600B |
| | High bit of zero position (Only valid using 485 communication) | | | | | |

| P08.12 | Label | Zero position (L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | p | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x600C |
| | To set zero position.<br>Using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P08.11. | | | | | |
| P08.13 | Label | Home position offset H | | | Valid mode(s) | PR |
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x600D |
| | High bit of home position offset (Only valid using 485 communication) | | | | | |
| P08.14 | Label | Home position offset (L) | | | Valid mode(s) | PR |
| | Range | -2147483648~ 2147483647 | Unit | p | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x600E |
| | To set home position offset.<br>Using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P08.13. | | | | | |
| P08.15 | Label | High homing velocity | | | Valid mode(s) | PR |
| | Range | 1 ~ 6000 | Unit | rpm | Default | 200 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x600F |
| | To set high homing velocity in PR mode. | | | | | |
| P08.16 | Label | Low homing velocity | | | Valid mode(s) | PR |
| | Range | 1 ~ 6000 | Unit | rpm | Default | 50 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6010 |
| | To set low homing velocity in PR mode. | | | | | |
| P08.17 | Label | Homing acceleration | | | Valid mode(s) | PR |
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6011 |
| | To set homing acceleration time in PR mode, time needed for 0rpm to accelerate to 1000rpm | | | | | |
| P08.18 | Label | Homing deceleration | | | Valid mode(s) | PR |
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6012 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | To set homing deceleration time in PR mode, time needed for 1000rpm to decelerate to 0rpm | | | | | |
| **P08.19** | **Label** | Homing torque holding time | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | ms | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6013 |
| | To set homing torque holding time | | | | | |
| **P08.20** | **Label** | Homing torque | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | % | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6014 |
| | To set homing torque | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.21** | **Label** | Homing overtravel alarm range | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | 0.1r | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6015 |
| | To set homing overtravel alarm threshold. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.22** | **Label** | Emergency stop at limit deceleration | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~ 32767 | **Unit** | ms/Krpm | **Default** | 10 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6016 |
| | To set position limit emergency stop deceleration. | | | | | |
| **P08.23** | **Label** | STP emergency stop deceleration | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~ 32767 | **Unit** | ms/Krpm | **Default** | 50 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6017 |
| | To set STP emergency stop deceleration. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P08.26** | **Label** | I/O combination trigger mode | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x601A |

| Value | Description |
|---|---|
| 【0】 | Disable I/O combination trigger mode. Uses I/O CTRG signal edge trigger. |
| 1 | Enable I/O combination trigger. Valid when HOME-OK signal is valid. |
| 2 | Enable I/O combination trigger. HOME-OK signal not required. |

IO combination trigger select path using ADD0~ADD3. Trigger mode is set in P08.26.

| ADD3 | ADD2 | ADD1 | ADD0 | Path selection |
|---|---|---|---|---|
| OFF | OFF | OFF | OFF | Path 0 (Non-action) |
| OFF | OFF | OFF | ON | Path1 |
| OFF | OFF | ON | OFF | Path2 |
| OFF | OFF | ON | ON | Path3 |
| OFF | ON | OFF | OFF | Path4 |
| OFF | ON | OFF | ON | Path5 |
| OFF | ON | ON | OFF | Path6 |
| OFF | ON | ON | ON | Path7 |
| ON | OFF | OFF | OFF | Path8 |
| ON | OFF | OFF | ON | Path9 |
| ON | OFF | ON | OFF | Path10 |
| ON | OFF | ON | ON | Path11 |
| ON | ON | OFF | OFF | Path12 |
| ON | ON | OFF | ON | Path13 |
| ON | ON | ON | OFF | Path14 |

| | | | | |
|---|---|---|---|---|
| ON | ON | ON | ON | Path15 |

| P08.27 | Label | I/O combination filter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | ms | Default | 5 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x601B |

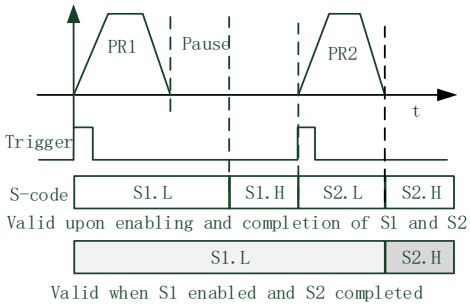
To set I/O combination filter time.

| P08.28 | Label | S-code current output value | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x601C |

S-code（Status code）is the S-code of currently operating PR positioning data.
Every PR path has a S-code setting.

| S-code | Sx.H | | Sx.L | |
|---|---|---|---|---|
| Bit | 15 | 8-14 | 7 | 0-6 |
| Description | S-code valid when completed.<br>0: Invalid, retain P0Evious value<br>1: Valid | S-code upon completion | S-code valid upon activation<br>0: Invalid<br>1: Valid | S-code upon activation |

Sequence diagram




| S-code bit | bit0/8 | bit1/9 | bit2/10 | bit3/11 | bit4/12 | bit5/13 | Bit6/14 |
|---|---|---|---|---|---|---|---|
| SDx | SD0 | SD1 | SD2 | SD3 | SD4 | SD5 | SD6 |

| P08.29 | Label | PR warning | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0x20F | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x601D |

| Address | Warning |
|---|---|
| 0 | Reset new command automatically |
| 0x100 | Position limit error during homing |
| 0x101 | Emergency stop. Homing not completed |
| 0x102 | Homing overtravel alarm |
| 0x20x | Position limit error on Path *N* |

| P08.39 | Label | JOG velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | rpm | Default | 100 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6027 |

Set JOG velocity in PR mode.

| P08.40 | Label | JOG acceleration | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6028 |

Set JOG acceleration in PR mode.

| P08.41 | Label | JOG deceleration | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6029 |
| | Set JOG deceleration in PR mode. | | | | | |

| P08.42 | Label | Command position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x602A |
| | High bit of command position (Only valid using 485 communication) | | | | | |
| P08.43 | Label | Command position（L） | | | Valid mode(s) | PR |
| | Range | -2147483648~ 2147483647 | Unit | p | Default | |
| | Byte length | 32bit | Attribute | R | 485 address | 0x602B |
| | To set PR-motion command position.<br>Using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P08.42. | | | | | |
| P08.44 | Label | Motor position H | | | Valid mode(s) | PR |
| | Range | 0~ 0xFFFF | Unit | / | Default | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x602C |
| | High bit of command position (Only valid using 485 communication) | | | | | |
| P08.45 | Label | Motor position（L） | | | Valid mode(s) | PR |
| | Range | -2147483648~ 2147483647 | Unit | p | Default | |
| | Byte length | 32bit | Attribute | R | 485 address | 0x602D |
| | Using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P08.44. | | | | | |

| P08.46 | Label | Input I/O status | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x602E |
| | Input I/O status, displays in decimal system. Convert to binary system to determine which bit is valid. | | | | | |
| P08.47 | Label | Output I/O status | | | Valid mode(s) | PR |
| | Range | 0 ~ 65535 | Unit | / | Default | |
| | Byte length | 16bit | Attribute | R | 485 address | 0x602F |
| | Output I/O status, displays in decimal system. Convert to binary system to determine which bit is valid. | | | | | |

| P08.48 | Label | Path 0 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6030 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.49 | Label | Path 1 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6031 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.50 | Label | Path 2 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6032 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.51 | Label | Path 3 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6033 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.52 | Label | Path 4 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6034 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.53 | Label | Path 5 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6035 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.54 | Label | Path 6 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6036 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.55 | Label | Path 7 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6037 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.56 | Label | Path 8 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6038 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.57 | Label | Path 9 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6039 |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.58 | Label | Path 10 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x603A |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.59 | Label | Path 11 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x603B |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.60 | Label | Path 12 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x603C |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.61 | Label | Path 13 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x603D |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.62 | Label | Path 14 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x603E |
| | Please refer to P08.28 for S-code setting. | | | | | |

| P08.63 | Label | Path 15 S-code | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x603F |
| | Please refer to P08.28 for S-code setting. | | | | | |

## [Class 9] PR Control Path Parameters

*It is more convenient to set Class 9 parameters on EDrive*

| P09.00 | Label | PR0 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6200 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.01 | Label | PR0 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6201 |
| | High bit of Path 0 position (Only valid using 485 communication) | | | | | |

| P09.02 | Label | PR0 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x6202 |
| | For Path 0 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.02. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P09.03** | **Label** | PR0 velocity | | | **Valid mode(s)** | **PR** |
| | **Range** | -10000～10000 | **Unit** | rpm | **Default** | 60 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6203 |
| | To set PR path 0 velocity. | | | | | |
| **P09.04** | **Label** | PR0 acceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~ 32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6204 |
| | To set PR path 0 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |
| **P09.05** | **Label** | PR0 deceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6205 |
| | To set PR path 0 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |
| **P09.06** | **Label** | PR0 pause time | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 32767 | **Unit** | ms | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6206 |
| | To set pause time for PR path 0 from completion to next path | | | | | |
| **P09.07** | **Label** | PR0 special parameter | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x6207 |
| | Reserved | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P09.08** | **Label** | PR1 mode | | | **Valid mode(s)** | **PR** |
| | **Range** | 0x0~0xFFFF | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6208 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P09.09** | **Label** | PR1 position H | | | **Valid mode(s)** | **PR** |
| | **Range** | 0~ 0xFFFF | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6209 |
| | High bit of Path 1 position (Only valid using 485 communication) | | | | | |
| **P09.10** | **Label** | PR1 position(L) | | | **Valid mode(s)** | **PR** |
| | **Range** | -2147483648~ 2147483647 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | 0x620A |
| | For Path position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.09. | | | | | |
| **P09.11** | **Label** | PR1 velocity | | | **Valid mode(s)** | **PR** |
| | **Range** | -10000～10000 | **Unit** | rpm | **Default** | 60 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x620B |
| | To set PR path 1 velocity. | | | | | |
| **P09.12** | **Label** | PR1 acceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~ 32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x620C |
| | To set PR path 1 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |
| **P09.13** | **Label** | PR1 deceleration time | | | **Valid mode(s)** | **PR** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Range** | 1 ~32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x620D |
| To set PR path 1 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | | |
| **P09.14** | **Label** | PR1 pause time | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 32767 | **Unit** | ms | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x620E |
| To set pause time for PR path 2 from completion to next path | | | | | | |
| **P09.15** | **Label** | PR1 special parameter | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x620F |
| Reserved | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P09.16** | **Label** | PR2 mode | | | **Valid mode(s)** | **PR** |
| | **Range** | 0x0~0xFFFF | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6210 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P09.17** | **Label** | PR2 position H | | | **Valid mode(s)** | **PR** |
| | **Range** | 0~ 0xFFFF | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6211 |
| High bit of Path 2 position (Only valid using 485 communication) | | | | | | |
| **P09.18** | **Label** | PR2 position(L) | | | **Valid mode(s)** | **PR** |
| | **Range** | -2147483648~ 2147483647 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | 0x6212 |
| For Path 2 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.17. | | | | | | |
| **P09.19** | **Label** | PR2 velocity | | | **Valid mode(s)** | **PR** |
| | **Range** | -10000～10000 | **Unit** | rpm | **Default** | 60 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6213 |
| To set PR path 2 velocity. | | | | | | |
| **P09.20** | **Label** | PR2 acceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~ 32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6214 |
| To set PR path 2 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | | |
| **P09.21** | **Label** | PR2 deceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6215 |
| To set PR path 2 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | | |
| **P09.22** | **Label** | PR2 pause time | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 32767 | **Unit** | ms | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6216 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | To set pause time for PR path 2 from completion to next path | | | | | |
| P09.23 | **Label** | PR2 special parameter | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x6217 |
| | Reserved | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| P09.24 | **Label** | PR3 mode | | | **Valid mode(s)** | **PR** |
| | **Range** | 0x0~0xFFFF | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6218 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| | | | | | | |
|---|---|---|---|---|---|---|
| P09.25 | **Label** | PR3 position H | | | **Valid mode(s)** | **PR** |
| | **Range** | 0~ 0xFFFF | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6219 |
| | High bit of Path 3 position (Only valid using 485 communication) | | | | | |
| P09.26 | **Label** | PR3 position(L) | | | **Valid mode(s)** | **PR** |
| | **Range** | -2147483648~ 2147483647 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | 0x621A |
| | For Path 3 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.25. | | | | | |
| P09.27 | **Label** | PR3 velocity | | | **Valid mode(s)** | **PR** |
| | **Range** | -10000～10000 | **Unit** | rpm | **Default** | 60 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x621B |
| | To set PR path 3 velocity. | | | | | |
| P09.28 | **Label** | PR3 acceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~ 32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x621C |
| | To set PR path 3 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |
| P09.29 | **Label** | PR3 deceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x621D |
| | To set PR path 0 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |
| P09.30 | **Label** | PR3 pause time | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 32767 | **Unit** | ms | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x621E |
| | To set pause time for PR path 3 from completion to next path | | | | | |
| P09.31 | **Label** | PR3 special parameter | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x621F |
| | Reserved | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| P09.32 | **Label** | PR4 mode | | | **Valid mode(s)** | **PR** |
| | **Range** | 0x0~0xFFFF | **Unit** | / | **Default** | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6220 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| **P09.33** | **Label** | PR4 position H | | | **Valid mode(s)** | **PR** |
|---|---|---|---|---|---|---|
| | **Range** | 0~ 0xFFFF | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6221 |
| | High bit of Path 0 position (Only valid using 485 communication) | | | | | |

| **P09.34** | **Label** | PR4 position(L) | | | **Valid mode(s)** | **PR** |
|---|---|---|---|---|---|---|
| | **Range** | -2147483648~ 2147483647 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | 0x6222 |
| | For Path 4 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.33. | | | | | |

| **P09.35** | **Label** | PR4 velocity | | | **Valid mode(s)** | **PR** |
|---|---|---|---|---|---|---|
| | **Range** | -10000～10000 | **Unit** | rpm | **Default** | 60 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6223 |
| | To set PR path 4 velocity. | | | | | |

| **P09.36** | **Label** | PR4 acceleration time | | | **Valid mode(s)** | **PR** |
|---|---|---|---|---|---|---|
| | **Range** | 1 ~ 32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6224 |
| | To set PR path 4 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| **P09.37** | **Label** | PR4deceleration time | | | **Valid mode(s)** | **PR** |
|---|---|---|---|---|---|---|
| | **Range** | 1 ~32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6225 |
| | To set PR path 4 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| **P09.38** | **Label** | PR4 pause time | | | **Valid mode(s)** | **PR** |
|---|---|---|---|---|---|---|
| | **Range** | 0 ~ 32767 | **Unit** | ms | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6226 |
| | To set pause time for PR path 4 from completion to next path | | | | | |

| **P09.39** | **Label** | PR4 special parameter | | | **Valid mode(s)** | **PR** |
|---|---|---|---|---|---|---|
| | **Range** | 0 ~ 65535 | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x6227 |
| | Reserved | | | | | |

| **P09.40** | **Label** | PR5 mode | | | **Valid mode(s)** | **PR** |
|---|---|---|---|---|---|---|
| | **Range** | 0x0~0xFFFF | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6228 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.41 | Label | PR5 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6229 |
| | High bit of Path 5 position (Only valid using 485 communication) | | | | | |

| P09.42 | Label | PR5 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x622A |
| | For Path 0 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.41. | | | | | |

| P09.43 | Label | PR5 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x622B |
| | To set PR path 5 velocity. | | | | | |

| P09.44 | Label | PR5 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x622C |
| | To set PR path 5 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.45 | Label | PR5 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x622D |
| | To set PR path 5 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.46 | Label | PR5 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x622E |
| | To set pause time for PR path 5 from completion to next path | | | | | |

| P09.47 | Label | PR5 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x622F |
| | Reserved | | | | | |

| P09.48 | Label | PR6 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6230 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.49 | Label | PR6 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6231 |
| | High bit of Path 6 position (Only valid using 485 communication) | | | | | |

| P09.50 | Label | PR6 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x6232 |
| | For Path 6 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.49. | | | | | |

| P09.51 | Label | PR6 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6233 |
| | To set PR path 6 velocity. | | | | | |

| P09.52 | Label | PR6 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6234 |
| | To set PR path 6 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.53 | Label | PR6 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6235 |
| | To set PR path 6 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.54 | Label | PR6 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6236 |
| | To set pause time for PR path 6 from completion to next path | | | | | |

| P09.55 | Label | PR6 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6237 |
| | Reserved | | | | | |

| P09.56 | Label | PR7 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6238 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| | | | | | | |
|---|---|---|---|---|---|---|
| **P09.57** | **Label** | PR7 position H | | | **Valid mode(s)** | **PR** |
| | **Range** | 0~ 0xFFFF | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6239 |
| | High bit of Path 7 position (Only valid using 485 communication) | | | | | |
| **P09.58** | **Label** | PR7 position(L) | | | **Valid mode(s)** | **PR** |
| | **Range** | -2147483648~ 2147483647 | **Unit** | Pulse | **Default** | 0 |
| | **Byte length** | 32bit | **Attribute** | R/W | **485 address** | 0x623A |
| | For Path 7 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.57. | | | | | |
| **P09.59** | **Label** | PR7 velocity | | | **Valid mode(s)** | **PR** |
| | **Range** | -10000～10000 | **Unit** | rpm | **Default** | 60 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x623B |
| | To set PR path 7 velocity. | | | | | |
| **P09.60** | **Label** | PR7 acceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~ 32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x623C |
| | To set PR path 7 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |
| **P09.61** | **Label** | PR7 deceleration time | | | **Valid mode(s)** | **PR** |
| | **Range** | 1 ~32767 | **Unit** | ms/Krpm | **Default** | 100 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x623D |
| | To set PR path 0 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |
| **P09.62** | **Label** | PR7 pause time | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 32767 | **Unit** | ms | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x623E |
| | To set pause time for PR path 7 from completion to next path | | | | | |
| **P09.63** | **Label** | PR7 special parameter | | | **Valid mode(s)** | **PR** |
| | **Range** | 0 ~ 65535 | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R | **485 address** | 0x623F |
| | Reserved | | | | | |
| **P09.64** | **Label** | PR8 mode | | | **Valid mode(s)** | **PR** |
| | **Range** | 0x0~0xFFFF | **Unit** | / | **Default** | 0 |
| | **Byte length** | 16bit | **Attribute** | R/W | **485 address** | 0x6240 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.65 | Label | PR8 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6241 |
| | High bit of Path 0 position (Only valid using 485 communication) | | | | | |

| P09.66 | Label | PR8 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x6242 |
| | For Path 8 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.65. | | | | | |

| P09.67 | Label | PR8 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6243 |
| | To set PR path 8 velocity. | | | | | |

| P09.68 | Label | PR8 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6244 |
| | To set PR path 8 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.69 | Label | PR8 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6245 |
| | To set PR path 8 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.70 | Label | PR8 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6246 |
| | To set pause time for PR path 8 from completion to next path | | | | | |

| P09.71 | Label | PR8 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6247 |
| | Reserved | | | | | |

| P09.72 | Label | PR9 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6248 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.73 | Label | PR9 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6249 |
| | High bit of Path 9 position (Only valid using 485 communication) | | | | | |

| P09.74 | Label | PR9 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x624A |
| | For Path 9 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.73. | | | | | |

| P09.75 | Label | PR9 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x624B |
| | To set PR path 0 velocity. | | | | | |

| P09.76 | Label | PR9 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x624C |
| | To set PR path 9 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.77 | Label | PR9 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x624D |
| | To set PR path 9 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.78 | Label | PR9 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x624E |
| | To set pause time for PR path 9 from completion to next path | | | | | |

| P09.79 | Label | special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x624F |
| | Reserved | | | | | |

| P09.80 | Label | PR10 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6250 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.81 | Label | PR10 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6251 |
| | High bit of Path10 position (Only valid using 485 communication) | | | | | |

| P09.82 | Label | PR10 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x6252 |
| | For Path 10 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.81. | | | | | |

| P09.83 | Label | PR10 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6253 |
| | To set PR path 10 velocity. | | | | | |

| P09.84 | Label | PR10 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6254 |
| | To set PR path 10 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.85 | Label | PR10 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6255 |
| | To set PR path 10 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.86 | Label | PR10 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6256 |
| | To set pause time for PR path 10 from completion to next path | | | | | |

| P09.87 | Label | PR10 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6257 |
| | Reserved | | | | | |

| P09.88 | Label | PR11 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6258 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.89 | Label | PR11 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6259 |
| | High bit of Path 11 position (Only valid using 485 communication) | | | | | |

| P09.90 | Label | PR11 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x625A |
| | For Path 11 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.89. | | | | | |

| P09.91 | Label | PR11 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x625B |
| | To set PR path 11 velocity. | | | | | |

| P09.92 | Label | PR11 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x625C |
| | To set PR path 11 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.93 | Label | PR11 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x625D |
| | To set PR path 11 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.94 | Label | PR11 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x625E |
| | To set pause time for PR path 11 from completion to next path | | | | | |

| P09.95 | Label | PR11 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x625F |
| | Reserved | | | | | |

| P09.96 | Label | PR12 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6260 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.97 | Label | PR12 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6261 |

High bit of Path 12 position (Only valid using 485 communication)

| P09.98 | Label | PR12 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x6262 |

For Path 12 position, using 485 communication, only able to R/W low 16 bit.
R/W high 16 bit needs to be realized through P09.97.

| P09.99 | Label | PR12 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6263 |

To set PR path 12 velocity.

| P09.100 | Label | PR12 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6264 |

To set PR path 12 acceleration time, time needed for 0rpm to accelerate to 1000rpm

| P09.101 | Label | PR12 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6265 |

To set PR path 12 deceleration time, time needed for 1000rpm to decelerate to 0rpm

| P09.102 | Label | PR12 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6266 |

To set pause time for PR path 12 from completion to next path

| P09.103 | Label | PR12 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6267 |

Reserved

| P09.104 | Label | PR13 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6268 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.105 | Label | PR13 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6269 |
| | High bit of Path 13 position (Only valid using 485 communication) | | | | | |

| P09.106 | Label | PR13 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x626A |
| | For Path 13 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.105. | | | | | |

| P09.107 | Label | PR13 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x626B |
| | To set PR path 13 velocity. | | | | | |

| P09.108 | Label | PR13 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x626C |
| | To set PR path 13 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.109 | Label | PR13 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x626D |
| | To set PR path 13 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.110 | Label | PR13 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x626E |
| | To set pause time for PR path 13 from completion to next path | | | | | |

| P09.111 | Label | PR13 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x626F |
| | Reserved | | | | | |

| P09.112 | Label | PR14 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6270 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.113 | Label | PR14 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6271 |
| | High bit of Path 14 position (Only valid using 485 communication) | | | | | |

| P09.114 | Label | PR14 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x6272 |
| | For Path 14 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.113. | | | | | |

| P09.115 | Label | PR14 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6273 |
| | To set PR path 14 velocity. | | | | | |

| P09.116 | Label | PR14 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6274 |
| | To set PR path 14 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.117 | Label | PR14 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6275 |
| | To set PR path 14 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.118 | Label | PR14 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6276 |
| | To set pause time for PR path 14 from completion to next path | | | | | |

| P09.119 | Label | PR14 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x6277 |
| | Reserved | | | | | |

| P09.120 | Label | PR15 mode | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6278 |

| Bit | 14 | 8-13 | 6-7 | 5 | 4 | 0-3 |
|---|---|---|---|---|---|---|
| Definition | 0: No Jump, indicates with END<br>1: Jump. Jump to SJ or CJ | 0-15: Jump to correspond path | 0: absolute<br>1: correspond command<br>2: correspond motor | 0: No overlap, indicates with SJ<br>1 Overlap, indicated with CJ | 0: Can be Interrupt<br>1: Can't be Interrupt, indicates using ! | 0: null<br>1: Positioning<br>2: Velocity motion<br>3: Homing<br>4: Emergency stop<br>Indicates using P/V/H/S |

| P09.121 | Label | PR15 position H | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0~ 0xFFFF | Unit | Pulse | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x6279 |
| | High bit of Path 15 position (Only valid using 485 communication) | | | | | |

| P09.122 | Label | PR15 position(L) | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -2147483648~ 2147483647 | Unit | Pulse | Default | 0 |
| | Byte length | 32bit | Attribute | R/W | 485 address | 0x627A |
| | For Path 15 position, using 485 communication, only able to R/W low 16 bit.<br>R/W high 16 bit needs to be realized through P09.121. | | | | | |

| P09.123 | Label | PR15 velocity | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | -10000～10000 | Unit | rpm | Default | 60 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x627B |
| | To set PR path 15 velocity. | | | | | |

| P09.124 | Label | PR15 acceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~ 32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x627C |
| | To set PR path 15 acceleration time, time needed for 0rpm to accelerate to 1000rpm | | | | | |

| P09.125 | Label | PR15 deceleration time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 1 ~32767 | Unit | ms/Krpm | Default | 100 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x627D |
| | To set PR path 15 deceleration time, time needed for 1000rpm to decelerate to 0rpm | | | | | |

| P09.126 | Label | PR15 pause time | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 32767 | Unit | ms | Default | 0 |
| | Byte length | 16bit | Attribute | R/W | 485 address | 0x627E |
| | To set pause time for PR path 15 from completion to next path | | | | | |

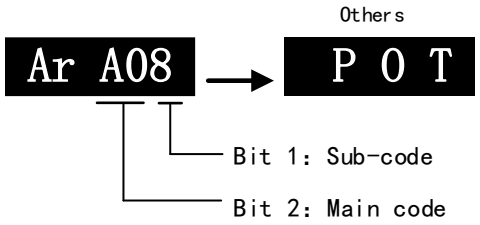
| P09.127 | Label | PR15 special parameter | | | Valid mode(s) | PR |
|---|---|---|---|---|---|---|
| | Range | 0 ~ 65535 | Unit | / | Default | 0 |
| | Byte length | 16bit | Attribute | R | 485 address | 0x627F |
| | Reserved | | | | | |

# Appendix II Warning and Alarm

## Servo Driver 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 | |
| A0 | 1 | Overload warning |
| | 2 | Regeneration energy overload warning(**85% of the regeneration threshold**) |
| | 3 | Absolute encoder **battery voltage low (<3.1V)**. Valid when P00.15 is set to 1. |
| | 4 | Change the parameter to a non-real time valid warning |
| | 7 | Low temperature warning **(< 20℃)** |
| | 8 | Positive limit switch valid. **POT** blinking on front panel |
| | 9 | Negative limit switch valid. **NOT** blinking on front panel |
| | A | Positive and negative limit switch valid. **PNOT** blinking on front panel |
| | B | Current position is beyond software positive limit. **SPOT** blinking on front panel |
| | C | Current position is beyond software negative limit. **NPOT** blinking on front panel |
| | D | Current position is beyond software negative, positive limit. **SPNOT** blinking on front panel |
| | E | Parameters reset to factory default. Restart needed |

**Servo Driver Warning Handling**
When a warning occurs, the driver will not stop the motor, and the front panel will automatically display the corresponding warning code.
For example, when warning *ArA03* is triggered, replacing the battery during power-on to ensure the absolute encoder battery voltage exceeds 3.0V will clear the warning.
Appropriate handling methods can be taken based on the specific warning content.

## Servo Driver Alarm

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".

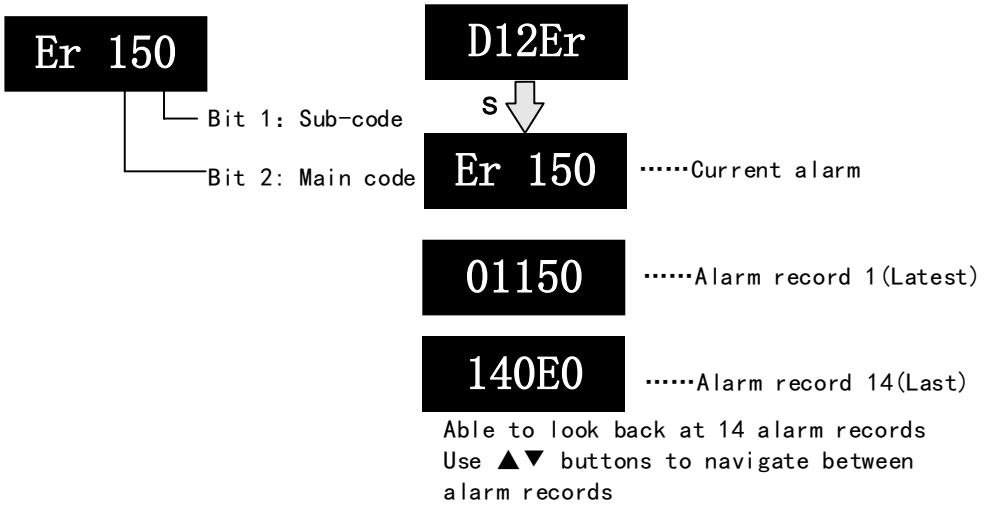
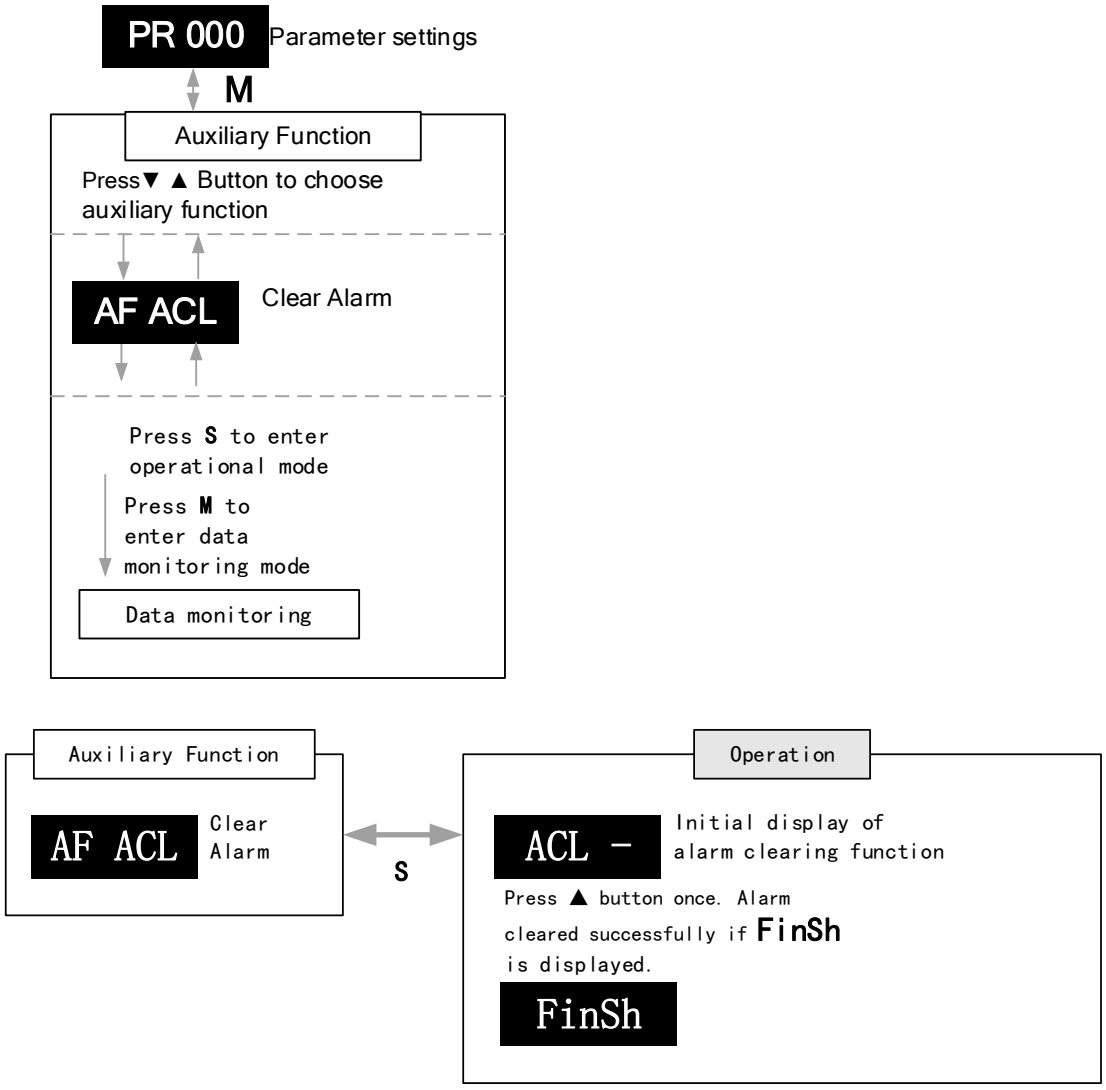



**Table 9.1 Error Code List**

| Error code | | Content | Attribute | | |
|---|---|---|---|---|---|
| Main | Sub | | Save | Type | Clearable |
| 09 | 0~F | FPGA communication error | ● | 2 | |
| 0A | 0~1 | Circuit current detection error | ● | 2 | |
| | 2 , 4 | Analog input error | ● | 2 | |
| | 3 | Motor power cable not connected | ● | 1 | |
| | 5 | DC bus error | ● | 2 | |
| | 6 | Temperature measuring error | ● | 2 | |
| 0b | 0 | Control circuit power supply voltage too low | | 2 | |
| | 1 | Control circuit power supply voltage too high | | 2 | ● |
| 0c | 0 | DC bus overvoltage | ● | 1 | ● |
| 0d | 0 | DC bus undervoltage | ● | 1 | ● |
| | 1 | Single phasing of main power supply | ● | 2 | |
| | 2 | No main power supply detected | | 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 | |
| 0F | 0 | Driver overheated | ● | 2 | |
| 10 | 0 | Motor overloaded | ● | 1 | ● |
| | 1 | Driver overloaded | ● | 1 | ● |
| | 2 | Motor rotor blocked | ● | 1 | ● |
| 12 | 0 | Regenerative resistor overvoltage | ● | 2 | |
| | 1 | Holding brake error | ● | 1 | |
| | 2 | Regenerative resistor value too low | ● | 2 | |
| 15 | 0 | Encoder disconnected | ● | 1 | |
| | 1 | Encoder communication error | ● | 1 | |
| | 2 | Encoder initial position error | ● | 1 | |
| | 3 | Multiturn encoder error | ● | 2 | |
| | 4 | Encoder parameter settings error | ● | 2 | |
| | 5 | Encoder data overflow | ● | 2 | ● |
| | 6 | Encoder overheated | ● | 2 | ● |
| | 7 | Encoder counter error | ● | 2 | ● |
| 17 | 0 | Encoder data error | ● | 1 | |
| | 1 | Encoder parameter initialization error | ● | 1 | |
| 18 | 0 | Excessive position deviation | ● | 2 | ● |
| | 1 | Excessive velocity deviation | ● | 2 | ● |
| 19 | 0 | Motor vibration too strong | ● | 2 | ● |
| | 1 | Excessive hybrid position deviation | ● | 1 | ● |
| 1A | 0 | Overspeed | ● | 2 | ● |
| | 1 | Velocity out of control | ● | 1 | ● |
| 1b | 0 | Bus input signal dithering | ● | 2 | ● |
| | 1 | Incorrect electronic gear ratio | ● | 2 | ● |
| | 3 | External encoder frequency divider parameter error | ● | 1 | |
| | 4 | Excessive synchronous position command | ● | 2 | ● |
| 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 | CRC correction during EEPROM parameter saving | | 2 | |
| | 1 | I2C communication status error | | 2 | |
| | 2 | Error r/w alarm history record | | 2 | |
| | 3 | Error r/w diagnostic data | | 2 | |
| | 4 | Error r/w 402 parameters | | 2 | |
| | 5 | Error r/w communication parameters | | 2 | |
| 25 | 0 | Gantry deviation error | ● | 1 | |
| | 1 | Gantry communication error | ● | 1 | |
| 26 | 0 | Positive/Negative position limit triggered under non-homing mode | ● | 2 | ● |
| 29 | 0 | Control mode not match under full closed loop mode | ● | 1 | |
| | 1 | Encoder mode not match under full closed loop mode | ● | 1 | |
| 57 | 0 | Forced alarm input valid(E-stop) | ● | 2 | ● |
| 5F | 0 | Motor model no. detection error | | 2 | |
| | 1 | Driver power module detection error | | 2 | |
| 60 | 0 | Main loop interrupted timeout | | 2 | |
| | 1 | Velocity loop interrupted timeout | | 2 | |
| 70 | 0 | Encryption error | | 2 | |
| 89 | 0 | Homing error | | 2 | ● |

**Save:** Save error messages to alarm history.
**Type**: The type 1 and type 2 fault stop mode can be set via P05.10 [Sequence at alarm].
**Clearable:** Clearable alarm by operating the front panel and use auxiliary function **AFACL** as below. Besides clearable alarms, please first solve the error and restart the servo driver to clear alarm.



## Alarm Handling

***When error occurs, please solve accordingly. Then, restart. If the solutions described don't work, please consider replacing the driver.*

| **Error code** | Main | Sub | **Display:** "Er 090"--"Er 09F" | |
|---|---|---|---|---|
| | 09 | 0~F | **Content:** FPGA communication error | |
| Cause | | | Diagnosis | Solution |
| L1, L2 terminal voltage too low | | | Verify L1, L2 terminal voltage | Make sure L1, L2 terminal voltage is within recommended range |

| **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 |

| **Error code** | Main | Sub | **Display:** "Er 0A3" | |
|---|---|---|---|---|
| | 0A | 3 | **Content:** Motor power cable not connected | |
| Cause | | | Diagnosis | Solution |
| Motor power cable not connected | | | Verify motor power cable wiring | Measure **resistance values between U, V, W terminals**, make sure the values are almost equal. If not, might be due to damaged motor or motor winding open circuit. |
| Motor fault | | | / | Replace motor |

| **Error code** | Main | Sub | **Display:** "Er 0A5" | |
|---|---|---|---|---|
| | 0A | 5 | **Content:** DC Bus error | |
| Cause | | | Diagnosis | Solution |
| L1, L2 terminal voltage too low | | | Verify L1, L2 terminal voltage. Check if power on indicator light on servo driver is on and d27 DC bus voltage. | Make sure L1, L2 terminal voltage is within recommended range |

| **Error code** | Main | Sub | **Display:** "Er 0A6" | |
|---|---|---|---|---|
| | 0A | 6 | **Content:** Temperature measuring error | |
| Cause | | | Diagnosis | Solution |
| L1, L2 terminal voltage too low | | | Verify L1, L2 terminal voltage | Make sure L1, L2 terminal voltage is within recommended range |

| Error code | Main | Sub | Display: "Er 0b0" | |
|---|---|---|---|---|
| | 0b | 0 | Content: Control circuit power supply voltage too low | |
| Cause | | | Diagnosis | Solution |
| Control circuit power supply voltage too low | | | Verify L1C, L2C terminal voltage; check if wiring connection is tight | Increase L1C, L2C terminal voltage;<br>Tighten L1C, L2C terminal connection |
| Power supply under capacity | | | / | Increase power supply capacity for L1C, L2C terminals |

| Error code | Main | Sub | Display: "Er 0b1" | |
|---|---|---|---|---|
| | 0b | 1 | Content: Control circuit power supply abnormal | |
| Cause | | | Diagnosis | Solution |
| USB power supply too low | | | Verify if USB cable is properly connected and not damaged. | Replace USB Type-C cable |

| Error code | Main | Sub | Display: "Er 0c0" | |
|---|---|---|---|---|
| | 0c | 0 | Content: DC bus overvoltage | |
| Cause | | | Diagnosis | Solution |
| Main power supply overvoltage | | | Verify L1, L2, L3 terminal voltage | Decrease main power supply voltage |
| Acceleration/deceleration time too short | | | Verify if the time is actually too short | Increase the duration time or change to a regenerative resistor with higher resistance. |
| Regenerative brake parameter anomaly | | | Verify P07.32/P07.33 | Modify vent overload parameter |
| Inner brake circuit damaged | | | / | Replace driver |

| Error code | Main | Sub | Display: "Er 0d0" | |
|---|---|---|---|---|
| | 0d | 0 | Content: DC bus undervoltage | |
| Cause | | | Diagnosis | Solution |
| Main power supply undervoltage | | | Verify L1, L2, L3 terminal voltage | Increase main power supply voltage |
| L1C, L2C connected when USB cable is connected | | | Control circuit power on before driver initialization. Alarm might occur. | Please disconnect the USB cable before powering on control circuit. |

| Error code | Main | Sub | Display: "Er 0d1" | |
|---|---|---|---|---|
| | 0d | 1 | Content: Single phasing of main power supply | |
| 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 |

| Error code | Main | Sub | Display: "Er 0d2" | |
|---|---|---|---|---|
| | 0d | 2 | **Content**: No main power supply detected | |
| Cause | | | Diagnosis | Solution |
| No main power supply | | | Verify L1, L2, L3 terminal voltage | 1. Increase main power supply voltage<br>2. Secure connections |

| Error code | Main | Sub | Display: "Er 0E0" | |
|---|---|---|---|---|
| | 0E | 0 | **Content:** 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.<br>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 |
| Control parameter anomaly | | | Verify if parameter exceeds recommended range | Set parameter within recommended range. |
| Control command anomaly | | | Verify if command motion is too acute | Modify control command; use filter |

| 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.<br>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 |
| Control parameter anomaly | | | Verify if parameter exceeds recommended range | Set parameter within recommended range. |
| Control command anomaly | | | Verify if command motion is too acute | Modify control command; use filter |

| 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.<br>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 |

| Error code | Main | Sub | Display: "Er 0E4" | |
|---|---|---|---|---|
| | 0E | 2 | **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.<br>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 |

| Error code | Main | Sub | Display: "Er 0F0" | |
|---|---|---|---|---|
| | 0F | 0 | **Content**: Driver overheated | |
| Cause | | | Diagnosis | Solution |
| Temperature of power module exceeded upper limit | | | Measure the temperature of driver radiator. | 1. Improve cooling condition. Please check installation guide;<br>2. Replace driver and motor with higher power rating;<br>3. Increase duration time for acceleration and deceleration;<br>4. Decrease load |

| Error code | Main | Sub | Display: "Er 100" | |
|---|---|---|---|---|
| | 10 | 0 | **Content:** Motor overloaded | |
| Cause | | | Diagnosis | Solution |
| Load too heavy | | | Verify if actual load exceeds maximum value allowed | 1. Decrease load<br>2. Adjust limit values |
| Strong mechanical vibration | | | Look for mechanical vibration from machine system | 1. Adjust gain value of control loop<br>2. Increase duration time for acceleration and deceleration |
| Motor or encoder cable wiring error | | | Verify motor and encoder wiring | 1. Reconnect wiring<br>2. Replace motor and encoder cable |
| Holding brake engaged | | | Verify holding brake terminal voltage | Cut off holding brake |

| Error code | Main | Sub | Display: "Er 101" | |
|---|---|---|---|---|
| | 10 | 1 | **Content:** Driver overloaded | |
| Cause | | | Diagnosis | Solution |
| Motor power cable wiring error | | | UVW terminals wiring error | Make sure motor power cable wiring connection is correct |
| Motor not matched | | | Motor current is too high | Motor rated current is higher than driver rated current. Please change to a driver with higher rated current. |

| Error code | Main | Sub | Display: "Er 102" |
|---|---|---|---|
| | 10 | 2 | **Content:** Motor rotor blocked |

| Cause | Diagnosis | Solution |
|---|---|---|
| Motor rotor blocked | Look for mechanical blockages | Check the machinery |
| Motor rotor blocking time threshold value too low | Verify value of P06.57 | Adjust value of P06.57 |

| **Error code** | Main | Sub | **Display:** "Er 120" | |
|---|---|---|---|---|
| | 12 | 0 | **Content:** Regenerative resistor overvoltage | |
| Cause | | | Diagnosis | Solution |
| Regenerative energy exceeded capacity of regenerative resistor | | | 1. Verify if velocity is too high<br>2. Verify if load is too large | 1. Decrease motor rotational velocity;<br>2. Decrease load inertia;<br>3. Add an external regenerative resistor; |
| Power supply voltage too high | | | 1. Verify if power supply voltage is within the rated range.<br>2. Interval regenerative resistor value is too low | 1. Decrease power supply voltage<br>2. Increase regeneration resistance value(add external regenerative resistor) |
| Unstable power supply voltage | | | Verify if power supply voltage is stable | Add a surge supP0Essor to main power supply. |
| Regenerative energy discharge circuit damaged | | | / | 1. Add an external regenerative resistor;<br>2. Replace driver |

| **Error code** | Main | Sub | **Display:** "Er 121" | |
|---|---|---|---|---|
| | 12 | 1 | **Content:** Holding brake error | |
| Cause | | | Diagnosis | Solution |
| Holding brake circuit damaged | | | Regenerative resistor disconnected | Replace regenerative resistor |
| | | | Holding brake IGBT damaged | Replace driver |

| **Error code** | Main | Sub | **Display:** "Er 122" | |
|---|---|---|---|---|
| | 12 | 2 | **Content:** Regenerative resistor value too low | |
| Cause | | | Diagnosis | Solution |
| External regenerative resistor value is less than the minimum value allowed by the driver | | | / | Replace the regenerative resistor with the right resistance value which meets the specification of the driver |

| Error code | Main | Sub | Display: "Er 150" |
|---|---|---|---|
| | 15 | 0 | **Content:** Encoder disconnected |

| Cause | Diagnosis | Solution |
|---|---|---|
| Encoder cable disconnected | Verify encoder cable connection | Make sure encoder cable properly connected |
| Encoder cable wiring error | Verify if encoder wiring is correct | Reconnect encoder wiring |
| Encoder damaged | / | Replace motor |
| Encoder measuring circuit damaged | / | Replace driver |

| Error code | Main | Sub | Display: "Er 151" |
|---|---|---|---|
| | 15 | 1 | **Content:** Encoder communication error |

| Cause | Diagnosis | Solution |
|---|---|---|
| Encoder wire shielding layer is missing | Verify if encoder cable has shielding layer | Replace with standard encoder cable |
| Encoder cable wiring error | Verify if encoder wiring is correct | Reconnect encoder wiring |
| Encoder damaged | / | Replace motor |

| Error code | Main | Sub | Display: "Er 152" |
|---|---|---|---|
| | 15 | 2 | **Content:** Encoder initial position error |

| Cause | Diagnosis | Solution |
|---|---|---|
| Communication data abnormal | 1. Verify if encoder power supply voltage is DC5V ± 5%;<br>2. Verify if encoder cable and shielded layer is not damaged;<br>3. Verify if encoder cable is close to high-powered power supply cable | 1. Make sure encoder power supply voltage is stable<br>2. Make sure encoder cable is not damaged.<br>3. Make sure encoder cable shielded layer is grounded to frame<br>4. Make sure encoder cable is away from high-powered power supply cable |
| Encoder damaged | / | Replace motor |
| Encoder measuring circuit damaged | / | Replace driver |

| Error code | Main | Sub | Display: "Er 153" |
|---|---|---|---|
| | 15 | 3 | **Content:** Multiturn encoder error |

| Cause | Diagnosis | Solution |
|---|---|---|
| Initial use | Origin calibration not performed | Perform origin positioning and multiturn position initialization, calibrate the origin of coordinate system. |
| Encoder without multiturn absolute function used | Verify if encoder has multiturn absolute function | 1. Replace the motor with a multiturn absolute encoder.<br>2. Set P00.15 = 0 to deactivate multiturn absolute function. |
| Low battery power | Replace battery and restart driver to clear alarm | Replace battery |
| Battery has no power or has been dismantled | Alarm not cleared after replacing battery and restart | Absolute position lost. Return to origin and perform multiturn initialization, calibrate the origin of coordinate system |

| Error code | Main | Sub | Display: "Er 154" |
|---|---|---|---|
| | 15 | 4 | Content: Encoder parameter settings error |
| Cause | | Diagnosis | Solution |
| Absolute encoder mode is incorrectly set. | | Verify if encoder has multi-turn absolute value function. | Modify absolute encoder mode settings |

| Error code | Main | Sub | Display: "Er 155" |
|---|---|---|---|
| | 15 | 5 | Content: Encoder data overflow |
| Cause | | Diagnosis | Solution |
| Encoder data overflow | | Verify if encoder is not damaged | Initialize multiturn data |
| Absolute value applications, motor rotates in one direction | | Verify if encoder is not damaged | Adjust absolute value application mode, set to turntable mode |

| Error code | Main | Sub | Display: "Er 156" |
|---|---|---|---|
| | 15 | 6 | Content: Encoder overheated |
| Cause | | Diagnosis | Solution |
| The encoder temperature is too high. | | Verify if motor temperature is too high | Reduce encoder temperature. |

| Error code | Main | Sub | Display: "Er 157" |
|---|---|---|---|
| | 15 | 7 | Content: Encoder counter error |
| Cause | | Diagnosis | Solution |
| Encoder data overflow | | Verify if encoder is not damaged | Initialize multiturn data |
| Absolute value applications, motor rotates in one direction | | Verify if encoder is not damaged | Adjust absolute value application mode, set to turntable mode |

| Error code | Main | Sub | Display: "Er 170" |
|---|---|---|---|
| | 17 | 0 | Content: Encoder data error |
| Cause | | Diagnosis | Solution |
| Communication data abnormal | | 1. Verify if encoder power supply voltage is DC5V ± 5%;<br>2. Verify if encoder cable and shielded layer is not damaged;<br>3. Verify if encoder cable is close to high-powered power supply cable | 1. Make sure encoder power supply voltage is stable<br>2. Make sure encoder cable is not damaged.<br>3. Make sure encoder cable shielded layer is grounded to frame<br>4. Make sure encoder cable is away from high-powered power supply cable |
| Encoder damaged | | / | Replace motor |
| Encoder measuring circuit damaged | | / | Replace driver |

| | Main | Sub | Display: "Er 171" |
|---|---|---|---|

| Error code | 17 | 1 | **Content:** Encoder parameter initialization error | |
|---|---|---|---|---|
| Cause | | | Diagnosis | Solution |
| Driver and motor not matched | | | Verify driver and motor models. | Replace with matching driver and motor |
| Error while getting parameters from encoder | | | 1. Verify if encoder cable is standard.<br>2. Verify if encoder has no peeled insulator, broken connection or improper contact. | Use standard encoder cable, verify the connection of both sides of driver and motor, change encoder cable if necessary |

| Error code | Main | Sub | **Display:** "Er 180" | |
|---|---|---|---|---|
| | 18 | 0 | **Content:** Excessive position deviation | |
| Cause | | | Diagnosis | Solution |
| Improper position deviation settings | | | Verify if value of Pr_014 is too low | Increase value of Pr_014 |
| Position gain setting too low | | | Verify if values of P01.00 & P01.05 are too low | Increase values of P01.00 & P01.05 |
| Torque limit too low | | | Verify if values of P00.13 & P05.22 are too low | Increase values of P00.13 & P05.22 |
| Excessive external load | | | 1. Verify if acceleration and deceleration duration time is too low.<br>2. Verify if rotational velocity is too high<br>3. Verify if load is too large | 1. Increase duration time for acceleration and deceleration<br>2. Decrease rotational velocity<br>3. Decrease load |

| 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;<br>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;<br>2. Adjust velocity gain to reduce velocity lag error |

| Error code | Main | Sub | **Display:** "Er 190" | |
|---|---|---|---|---|
| | 19 | 0 | **Content:** Vibration too strong | |
| Cause | | | Diagnosis | Solution |
| Resonance | | | Mechanical stiffness is too high, resonance occurs | Reduce mechanical stiffness or use filter |
| Current loop gain too large | | | Verify current loop gain value | Reduce current loop gain |
| **Error code** | Main | Sub | **Display:** "Er 191" | |
| | 19 | 1 | **Content:** Excessive hybrid position deviation | |
| Cause | | | Diagnosis | Solution |
| Driver UVW terminal output single phasing or wiring error | | | Verify if UVW terminal wiring connection is right | Make sure UVW terminals are correctly connected to UVW of motor; change motor power cable. |
| Motor rotor blocked | | | Look for mechanical blockages | Check the machinery |

| | | |
|---|---|---|
| Driver stiffness too low | Verify if position loop and velocity loop gain is too low | Increase position loop and velocity loop gain |
| Full closed loop position deviation (**Deviation between external encoder feedback position and motor feedback position**) exceeds P00.33 | Verify if P00.33 is set too low | Increase P00.33 set value accordingly but please aware that doing so might cause the position deviation to be higher. |

| **Error code** | Main | Sub | **Display:** "Er 1A0" |
|---|---|---|---|
| | 1A | 0 | **Content:** Overspeed |

| Cause | Diagnosis | Solution |
|---|---|---|
| Motor velocity exceeded first speed limit (P03.21) | 1. Verify if velocity command is too high;<br>2. Verify if simulated velocity command voltage is too high;<br>3. Verify if parameter value of P03.21 is too low;<br>4. Verify if input frequency and division frequency coefficient of pulse train is proper;<br>5. Verify if encoder is wired correctly | 1. Adjust velocity input command; 2. Increase P03.21 value;<br>3. Adjust pulse train input frequency and division frequency coefficient;<br>4. Verify encoder wiring; |

| **Error code** | Main | Sub | **Display:** "Er 1A1" |
|---|---|---|---|
| | 1A | 1 | **Content:** Velocity out of control |

| Cause | Diagnosis | Solution |
|---|---|---|
| Motor velocity out of control, Excessive velocity error | Verify encoder phase sequence; Verify if UVW cable is connected to the right terminal | Reconnect UVW if wrongly connected. If still remains unsolved, please contact technical support. |

| **Error code** | Main | Sub | **Display:** "Er 1b0" |
|---|---|---|---|
| | 1b | 0 | **Content:** Bus input signal dithering |

| Cause | Diagnosis | Solution |
|---|---|---|
| Controller synchronization dithering | / | Increase alarm threshold value |

| 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 1b3" | |
|---|---|---|---|---|
| | 1b | 3 | Content: External encoder frequency divider parameter error | |
| 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 1b4" | |
|---|---|---|---|---|
| | 1b | 4 | Content: Excessive synchronous position mode command | |
| 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 210" | |
|---|---|---|---|---|
| | 21 | 0 | Content: I/O input interface assignment error | |
| Cause | | | Diagnosis | Solution |
| Input signal assigned with two or more functions. | | | Verify values of P04.00-P04.09, P04.44-4.47 | Set proper values for P04.00-P04.09, P04.44-4.47 |

| Error code | Main | Sub | Display: "Er 211" | |
|---|---|---|---|---|
| | 21 | 1 | Content: I/O input interface function assignment error | |
| Cause | | | Diagnosis | Solution |
| Input signal assignment error | | | Verify values of P04.00-P04.09, P04.44-4.47 | Set proper values for P04.00-P04.09, P04.44-4.47 |

| Error code | Main | Sub | Display: "Er 212" | |
|---|---|---|---|---|
| | 21 | 2 | Content: I/O output interface function assignment error | |
| Cause | | | Diagnosis | Solution |
| Input signal assigned with two or more functions. | | | Verify values of P04.10-P04.15 | Set proper values for P04.10-P04.15 |
| Input signal not assigned | | | Verify values of P04.10-P04.15 | Set proper values for P04.10-P04.15 |

| Error code | Main | Sub | Display: "Er 240" |
|---|---|---|---|
| | 24 | 0 | Content: CRC correction error during EEPROM parameter saving |
| Cause | | | Diagnosis | Solution |
| L1, L2 terminal voltage too low | | | Verify if L1, L2 terminal voltage too low | Make sure L1, L2 terminal voltage is within recommended range |
| Parameter saving anomaly | | | Save parameter again and restart | Save parameter again |

| Error code | Main | Sub | Display: "Er 260" |
|---|---|---|---|
| | 26 | 0 | Content: Positive/Negative position limit triggered under non-homing mode |
| Cause | | | Diagnosis | Solution |
| Positive/negative position limit triggered | | | Verify position limit signal | / |

| Error code | Main | Sub | Display: "Er 280" |
|---|---|---|---|
| | 28 | 0 | Error description: Output pulse frequency too high |
| Cause | | | Diagnosis | Solution |
| Frequency divided pulse output exceeds 1MHz | | | Verify if motor rotational speed and the number of frequency divided pulse output are too high | Reduce the number of frequency divided pulse output or reduce rotational speed |

| Error code | Main | Sub | Display: " Er 570" |
|---|---|---|---|
| | 57 | 0 | Error description: Forced alarm input valid |
| Cause | | | Diagnosis | Solution |
| Forced alarm input signal occurred | | | Verify forced alarm input signal | Verify if the input wiring connection is correct |

| Error code | Main | Sub | Display: "Er 5F0" |
|---|---|---|---|
| | 5F | 0 | Content: Motor model no. detection error |
| Cause | | | Diagnosis | Solution |
| Automatically detected motor doesn't match set motor | | | / | Please contact our technical support |

| **Error code** | Main | Sub | **Display:** "Er 5F1" | |
|---|---|---|---|---|
| | 5F | 1 | **Error description:** Driver power module detection error | |
| Cause | | | Diagnosis | Solution |
| Driver power rating not within range. | | | Restart driver | Please contact our technical support |

| **Error code** | Main | Sub | **Display:** "Er 5F3" | |
|---|---|---|---|---|
| | 5F | 3 | **Error description:** The driver model matches the motor model abnormally | |
| Cause | | | Diagnosis | Solution |
| Driver model does not match motor model | | | Restart driver | Please contact our technical support |

| **Error code** | Main | Sub | **Display:** "Er 5F6" | |
|---|---|---|---|---|
| | 5F | 6 | **Error description:** Driver power selection fault | |
| Cause | | | Diagnosis | Solution |
| Driver power identified at power-up initialization is not in range | | | Please confirm whether the driver and the motor are the matching relationship recommend by the manufacturer. If the matching relationship is correct, power off and restart to observe whether the fault is still reported. | If the model does not match, replace the motor or driver that can match each other; |

| **Error code** | Main | Sub | **Display:** "Er 600" | |
|---|---|---|---|---|
| | 60 | 0 | **Error description:** Main loop interrupted timeout | |
| Cause | | | Diagnosis | Solution |
| The motor control loop calculation time overflow | | | Check for interference from devices releasing electromagnetic field | Ground driver and motor to reduce interference |
| | | | Restart driver | Replace driver |

| **Error code** | Main | Sub | **Display:** "Er 601" | |
|---|---|---|---|---|
| | 60 | 1 | **Error description:** Velocity loop interrupted timeout | |
| Cause | | | Diagnosis | Solution |
| Motor control loop calculation time overflow | | | Verify if encoder connection is and that the encoder cable is not too long (more than 20 meters) | Replace encoder cable if necessary |
| | | | Restart driver | Replace the drive with a new one |

| | Main | Sub | **Display:** "Er 700" |
|---|---|---|---|

| Error code | 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 890" | |
|---|---|---|---|---|
| | 89 | 0 | **Error description:** Homing error | |
| Cause | | | Diagnosis | Solution |
| 1. Excess homing velocity<br>2. Homing mode is different from given signal<br>3. Sensor signal edge inconsistent | | | 1. Verify if homing velocity is too high<br>2. Verify if homing mode is set correctly<br>3. Verify if sensor signal edge is consistent | 1. Set an optimal homing velocity<br>2. Make sure sensor signal edge is consistent. |
| Inconsistent origin status | | | 1. Homing acceleration/ deceleration is set too low<br>2. Electronic gear ratio is low which causes acceleration/ deceleration to be too low | 1. If electronic gear ratio cannot be changed, please set a suitable 609A.<br>2. Increase electronic gear ratio |

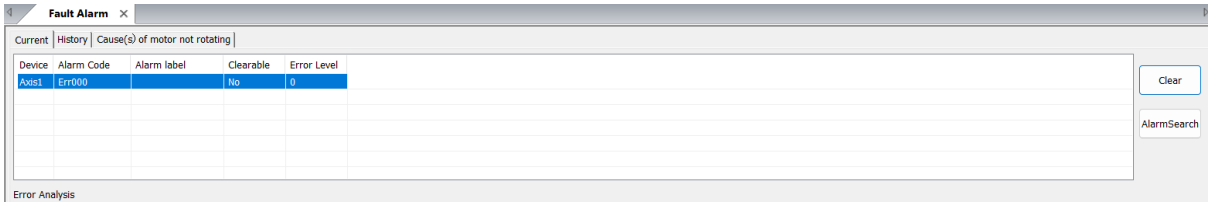
## Alarm Reset

### Clearable Alarms

Method 1:
After resolving the cause of the alarm, press "SET" under the "AF_ACL" menu on the front panel.
Then press the Up Arrow to clear the current alarm.

Method 2:
Refer to "3.11.1 DI Input Signal and Configuration Method".
Assign an IO input parameter to the "Alarm Clear (A-CLR)" function.
Use the appropriate signal level at the IO input terminal to clear the alarm.

Method 3:
After confirming the issue is resolved, use the debugging software.
Click the "Clear Alarm" button in the alarm information section to clear the alarm.




### Unclearable Alarms

For alarms that cannot be cleared, you must power off the driver, resolve the fault, and then restart.
If the alarm still cannot be cleared after restarting, please contact MISUMI support.