# EL7 AC SERVO DRIVE

# USER MANUAL

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# Notice

Read this manual carefully before any assembling and using. Incorrect handling of products in this manual can result in injury and damage to persons and machinery. Strictly adhere to the technical information regarding installation requirements.

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# Record of Revisions

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| Rev 1.0 | 04/13/2022 | Initial Release |
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# EL7 Series Function Guidance

| No. | Function | Details | Section Index |
|---|---|---|---|
| 1 | Position Control | Position control parameter specification, guidance | 8.1 Position Control |
| 2 | Velocity Control | Velocity control parameter specification, guidance | 8.2 Velocity Control |
| 3 | Torque Control | Torque control parameter specification, guidance | 8.3 Torque Control |
| 4 | Encoder Type | 17bit/23bit encoder | |
| 5 | Auxiliary Function | JOG, parameter initialization, Soft Reset, inertia ratio identification etc. | 7.2.3 Auxiliary Function |
| 6 | Vibration Suppression | It can suppress torque oscillation caused by too high rigidity | 8.5 Vibration Suppression |
| 7 | Inertia Ratio Identification | The inertia of the load can be accurately identified by a simple trial run | 8.4 Inertia Ratio Identification |
| 8 | Electronic Gear Function | A certain range of electronic gear ratio can be set | 8.1.2 Electronic Gear Function |
| 9 | Position Command Filter | FIR filter and command smoothing filter are used to smooth the position command | 8.1.3 Position Command Filter |
| 10 | Acceleration And Deceleration | Set the speed command acceleration and deceleration | 8.2.3 Speed Command Acceleration And Deceleration |
| 11 | Third Gain Switching | An additional third gain is added to allow faster positioning by switching between the first and second gain | 8.6 Third Gain Switching |
| 12 | Friction Torque Compensation | The friction torque and gravity torque are compensated for the load. | 8.7 Friction Torque Compensation |
| 13 | Alarm Processing Method | Method for dealing with alarm. | 6.2 Alarm Processing Method |
| 14 | IO Interface Principle | IO input and output functions and each function can be freely configured to any physical IO port, Six IO outputs are available for master station operation through parameter setting | 4.3 IO Interface Principle |
| 15 | Trial Run | Directly through the servo drive panel or PC can achieve servo motor operation | 7.3 Trial Run |
| 16 | Torque Limit | Available to limit torque. | 8.9.2 Torque Limit |
| 17 | Speed Limit | Available to limit speed. | 8.9.1 Speed Limit |
| 18 | Regenerative Resister Setting | Support internal brake resistance and external brake resistance, match the resistance through parameter setting | 8.8 Regenerative Resister Setting |
| 19 | Drive Operating Data Monitor | Drive operating data monitor | 7.2.2 Drive Operating Data Monitor |
| 20 | Alarm And Processing | A variety of alarm code output to protect the servo drive security | Chapter 6 Alarm And Processing |
| 21 | Multi-Turn Absolute Encoder | The drive use the memory position of the motor with multi-turn absolute encoder to realize the function of not losing absolute position after restart power supply | 8.10 Multi-Turn Absolute Encoder |

# Chapter 1 Safety Tips

**Thanks for purchasing Leadshine EL7 series AC servo drive, this instruction manual provides knowledge and attention for using this drive.**

**Contact tech@leadshine.com if you need more technical service.**

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

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

## 1.1 Safety Items

EL7 series servo drive should be mounted in cover type control box during operating.
The mounting of drive, wiring and motor should be under the regulations of EN 61800-5-1.
Safety items indicate a potential for personal injury or equipment damage if the recommended precautions and safe operating practices are not followed.
The following safety-alert symbols are used on the drive and in the documentation:

| | |
|---|---|
| | Indicates great possibility of death or serious injury |
| | Indicates something that must be done. |
| | Indicates something that must not be done. |
| | Indicates dangerous voltage. |
| | Indicates do not touches hot heat sink when power on. |
| | Protective earth |

## 1.2 Safety Precautions

| **Warning** |
|---|
| ● The design and manufacture of product doesn't use in mechanic and system which have a threat to operator.<br>● The safety protection must be provided in design and manufacture when using the product to prevent incorrect operation or abnormal accident. |

# 1.3 Acceptance

**Caution**

- The product that is damaged or have fault is forbidden to use.

# 1.4 Transportation

**Caution**

- The storage and transportation must be in normal condition.
- Don't stack too high, prevent falling.
- The product should be packaged properly in transportation.
- Don't hold the product by the cable, motor shaft or encoder while transporting it.
- The product can't undertake external force and shock.

# 1.5 Installation

**Caution**

**Servo Drive and Servo Motor:**

- Don't install them on inflammable substance or near it to preventing fire hazard.
- Avoid vibration, prohibit direct impact.
- Don't install the product while the product is damaged or incomplete.

**Servo Drive:**

- Must install in control cabinet with sufficient safeguarding grade.
- Must reserve sufficient gap with the other equipment.
- Must keep good cooling condition.
- Avoid dust, corrosive gas, conducting object, fluid and inflammable, explosive object from invading.

**Servo Motor:**

- Installation must be steady, prevent drop from vibrating.
- Prevent fluid from invading to damage motor and encoder.
- Prohibit knocking the motor and shaft, avoid damaging encoder.
- The motor shaft can't bear the load beyond the limits.

# 1.6 Wiring

**Warning**

- The workers of participation in wiring or checking must possess sufficient ability do this job.
- The wiring and check must be going with power off after 10 minutes.

**Caution**

- The wiring must be connected correctly and steadily, otherwise servo motor may run incorrectly, or damage the equipment.
- Servo motor U, V, W terminal should be connected correctly, it is forbidden to connect them directly to AC power.
- Leadshine mustn't connect capacitors, inductors or filters between servo motor and servo drive.
- The wire and temperature-resistant object must not be close to radiator of servo drive and motor.
- The freewheel diode which connect in parallel to output signal DC relay mustn't connect reversely.

## 1.7 Debugging and Running

**Caution**

- Make sure the servo drive and servo motor installed properly before power on, fixed steadily, power voltage and wiring correctly.
- The first time of debugging should be run without loaded, debugging with load can be done after confirming parameter setting correctly, to prevent mechanical damage because of error operation.

## 1.8 Using

**Caution**

- Install a emergency stop protection circuit externally, the protection can stop running immediately to prevent accident happened and the power can be cut off immediately.
- The run signal must be cut off before resetting alarm signal, just to prevent restarting suddenly.
- The servo drive must be matched with specified motor.
- Don't power on and off servo system frequently, just to prevent equipment damaged.
- Forbidden to modify servo system.

## 1.9 Fault Processing

**Warning**

- The high voltage also will contain in several minutes even if the servo drive is powered off, please don't touch terminal strip or separate the wiring.
- The workers of participation in wiring or checking must possess sufficient ability do this job.

**Caution**

- The reason of fault must be figured out after alarm occurs, reset alarm signal before restart.
- Keep away from machine, because of restart suddenly if the drive is powered on again after momentary interruption (the design of the machine should be ensured to avoid danger when restart occurs.

# Chapter 2 Product Introduction

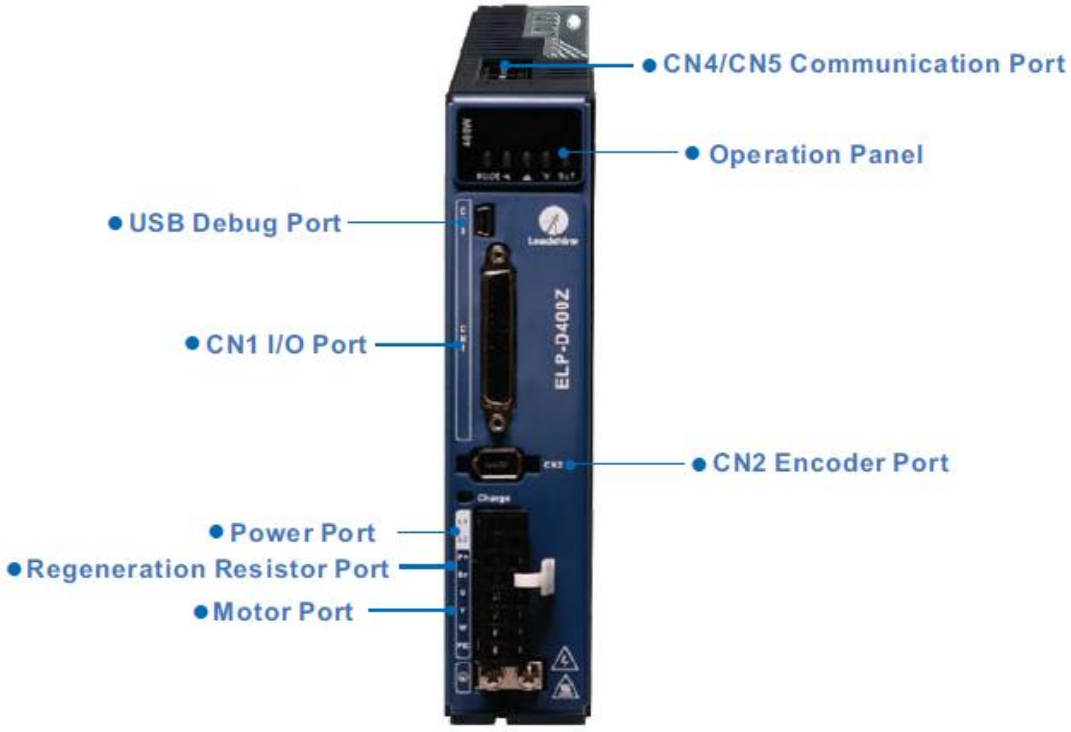
## 2.1 Drive Introduction

### 2.1.1 Ordering Options

EL7-D 2000 Z
① ② ③ ④

| No. | Details | | | |
|---|---|---|---|---|
| ① | Drive series | EL7: EL7 AC servo drive | | |
| ② | Command Source | D: Standard version (Pulse+Direction)<br>RS: RS485 (Modbus/ Pulse+Direction/ Analog)<br>EC: EtherCAT | | |
| ② | Rated Power | 0400: 400W | 0750: 750W | 1000:1000W |
| | | 1500: 1500W | 2000: 2000W | |
| ④ | Version | Z: Standard Version | S: Enhanced Version | |

### 2.1.2 Interface



## 2.1.3 Drive Specifications

**Table 2.1 Specifications A**

| Drive Model | EL7-*0400Z | EL7-*0750Z | EL7-*1000Z | EL7-*1500Z | EL7-*2000Z |
|---|---|---|---|---|---|
| **Rated Output Power (W)** | 400 | 750 | 1000 | 1500 | 2000 |
| **Rated Output Current (Arms)** | 3 | 5.5 | 7 | 9.5 | 12 |
| **Peak Output Current (Arms)** | 9 | 16 | 21 | 28.5 | 36 |
| **Main Power Control Power** | Single phase 220V -15%~+10% 50/60Hz | | | Single phase /Three phase 220V -15%~+10% 50/60Hz | |
| **Control Method** | IGBT SVPWM sinusoidal wave control | | | | |
| **Feedback Mode** | RS485 protocol | | | | |
| **Input Pulse** | 0-500kHz,5V differential input ; 0-200kHz,24V single-ended input | | | | |
| **Speed Frequency Response (Hz)** | 3100 | | | | |
| **Electronic Gear Ratio** | 1~32767/1~32767 | | | | |
| **Analog Input** | -10~10VDC, input resistance 20kΩ, no isolation (Only available for EL7-RS model) | | | | |
| **Input Signal** | DI: 9 inputs (Support two wiring methods of common+ or common-)<br>(1) Servo enable (SRV-ON) (2) Alarm clear (A-CLR) (3) Gain switch (Gain)<br>(4) Deviation counter clear (CL) (5) Command pulse inhibition (INH)<br>(6) Selection 1 of internal command speed (INTSPD1)<br>(7) Selection 2 of internal command speed (INTSPD2)<br>(8) Selection 3 of internal command speed (INTSPD3)<br>(9) Switch 1 of command frequency division and multiplication (DIV1)<br>(10) Switch 2 of command frequency division and multiplication (DIV2)<br>(11) Positive drive inhibition (POT) (12) Negative drive inhibition (NOT)<br>(13) Symbol of command velocity (VC-SIGN) (14) Symbol of command torque (TC-SIGN)<br>(15) Zero-speed clamp (ZEROSPD) (16) Forced alarm (E-STOP) | | | | |
| **Output Signal** | DO: 6 outputs (4 single-ended output, 2 differential output)<br>(1) Servo ready (S-RDY) (2) External brake-off (BRK-OFF)<br>(3) Positioning completed (INP) (4) At-speed (AT-SPEED)<br>(5) Zero-speed clamp detection (ZSP) (6) Alarm (ALM)<br>(7) Command velocity signal (V-CMD) (8) Command position signal (P-CMD)<br>(9) Velocity coincidence (V-COIN) | | | | |
| **Encoder Signal Output** | (1) phase A, phase B, phase Z (2)Long-wire drive mode output | | | | |
| **Alarm Function** | Over-voltage, under-voltage, over-current, over-load, over-heat, over-speed, encoder error, input phase-lacking, abnormal braking status, excess position deviation, excess braking ratio, over-travel, EEPROM error etc. | | | | |
| **Operation and Display** | jog, trapezoidal wave test, each parameter and input output signal can be modified and saved, six-bit LED to display rotational speed, current, position deviation, drive type version and address ID value etc. | | | | |
| **GUI Software** | (1) Able to adjust the parameters of current loop, velocity loop and position loop.<br>(2) Able to adjust the input values, output signals and the parameter of motor, these values are available to be saved to files and also could be downloaded and uploaded. | | | | |

| | | |
|---|---|---|
| | (3) Able to monitor the waveform of velocity and position while testing. | |
| **Communication Interface** | (1) USB: Based on Modbus protocol. (According to USB2.0 specification)<br>(2) RS485: Based on Modbus protocol. | |
| **Brake Mode** | Built-in brake resistor 50Ω/50W (Available for external brake resistor) | |
| **Adapt Load Inertia** | Less than 10 times motor inertia | |
| **Weight** | About 1.5-3Kg | |
| **Environment** | Environment | Avoid dust, oil fog and corrosive gases |
| | Ambient Temp | 0 to +40℃. |
| | Humidity | 40% RH to 90%RH, no condensation |
| | Vibration | 5.9 $m/s^2$ MAX |
| | Storage Temperature | -20~80℃ |
| | Installation | Vertical installation |

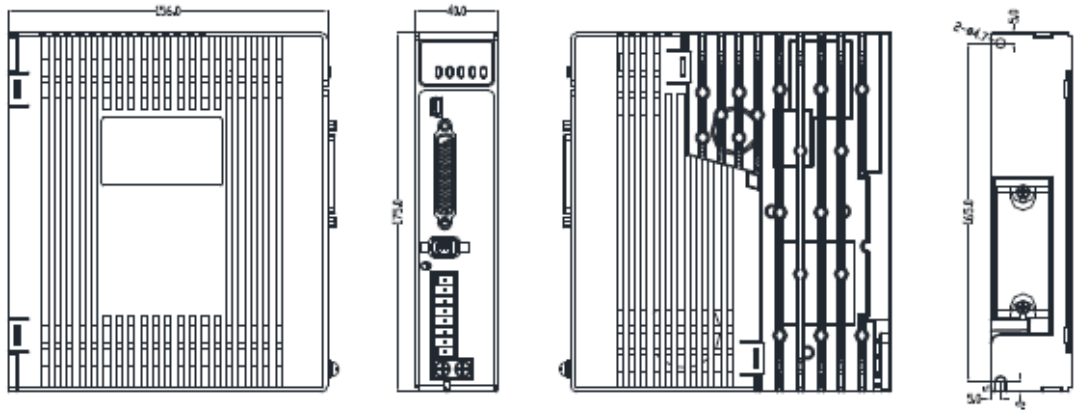
**Table 2.1 Specifications B**

| Drive Model | EL7-D***Z | EL7-RS***Z | EL7-EC***Z |
|---|---|---|---|
| **Control Mode** | ● Position control<br>● JOG | ● Position control<br>● Velocity control<br>● Torque control<br>● JOG | ● CSP(Cyclic Synchronous Position)<br>● CSV(Cyclic Synchronous Velocity)<br>● CST(Cyclic Synchronous Torque)<br>● PP(Profile Position)<br>● PV(Profile Velocity)<br>● PT(Profile Torque)<br>● HM(Homing) |
| **Encoder Output** | 5V differential,0~500kHz<br>24Vsingle-ended,0~200kHz | 5V differential,0~500kHz<br>24Vsingle-ended,0~200kHz | -- |
| **Digital Input** | 9 inputs<br>(common-cathode<br>common-anode) | 9 inputs<br>(common-cathode<br>common-anode) | 14 inputs<br>(common-cathode/common-anode)<br>2 differential (for capture probe) |
| **Digital Output** | 6 outputs(4 single-ended, 2 differential) | | |
| **Analog Input** | -- | 2 analog input:-10~+10Vdc | -- |
| **Network** | -- | Modbus RTU(RJ45) | EtherCAT(RJ45) |
| **Maximum Frequency Of Pulse Input** | 5V differential,0~500kHz<br>24Vsingle-ended,0~200kHz | 5V differential,0~500kHz<br>24Vsingle-ended,0~200kHz | -- |

## 2.1.4 Drive Dimension

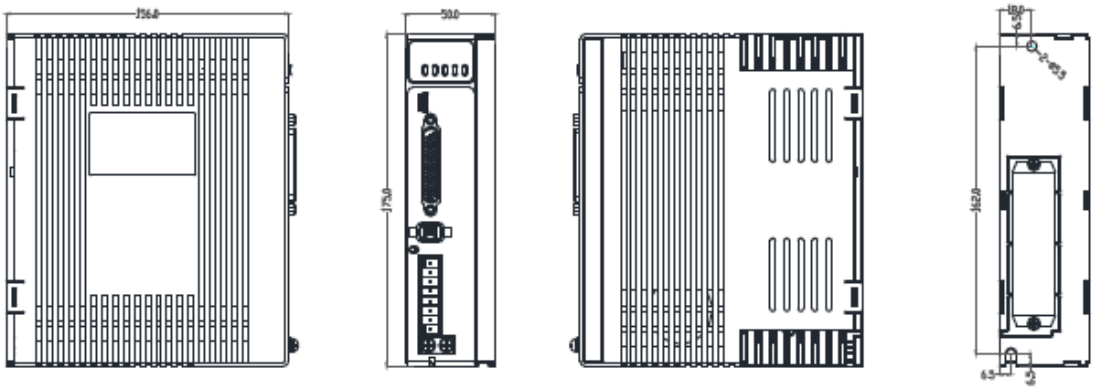
• 200W/400W

V ELP-D Series V ELP-RS Series V ELP-EC Series



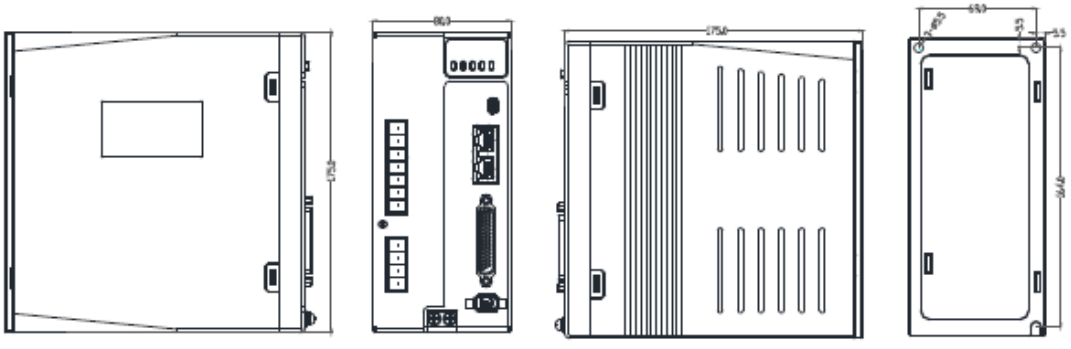
• 750W/1000W

V ELP-D Series V ELP-RS Series V ELP-EC Series



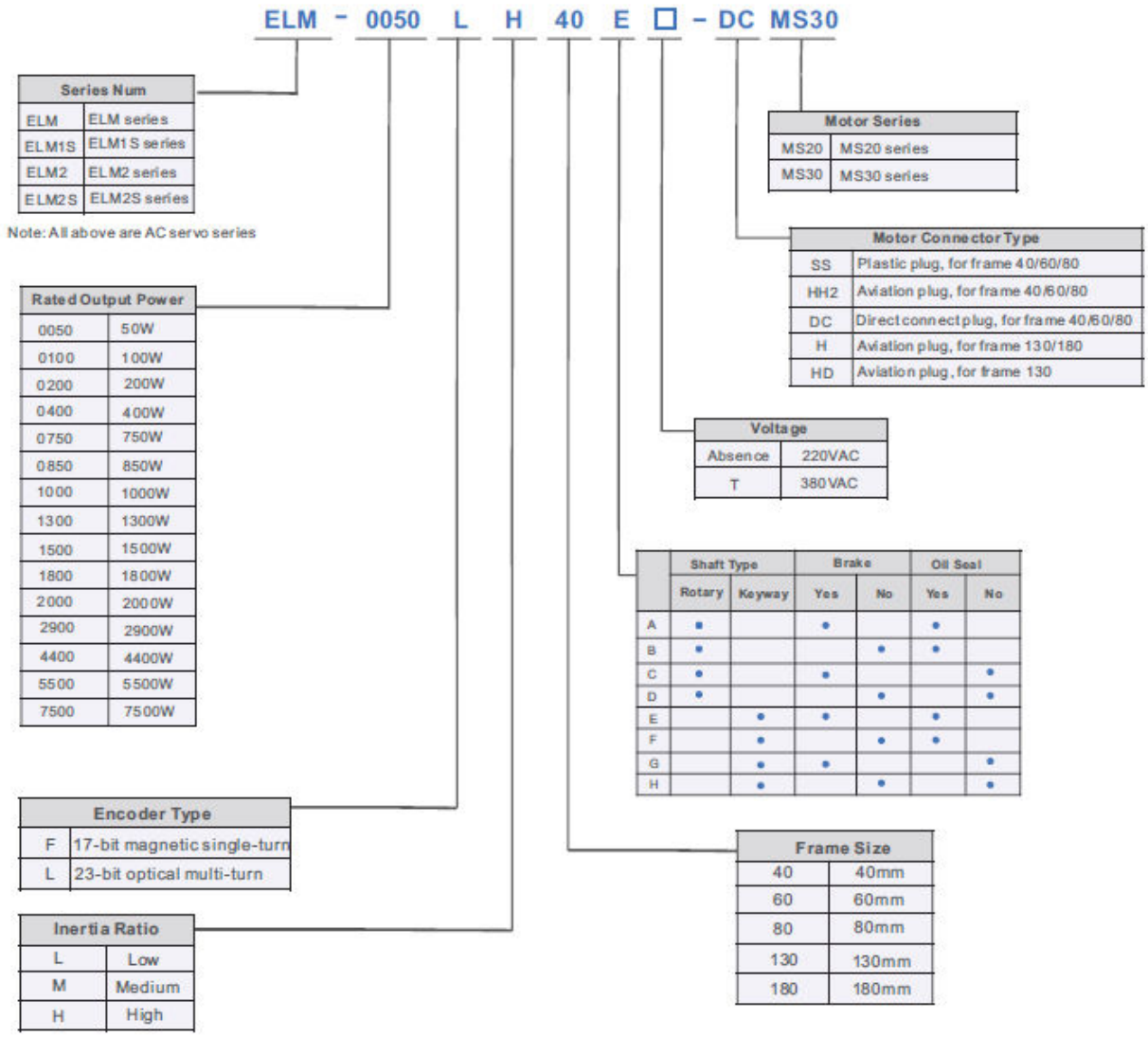
• 1500W/2000W

V ELP-RS Series V ELP-EC Series



# 2.2 Motor Description

## 2.2.1 Model Designation

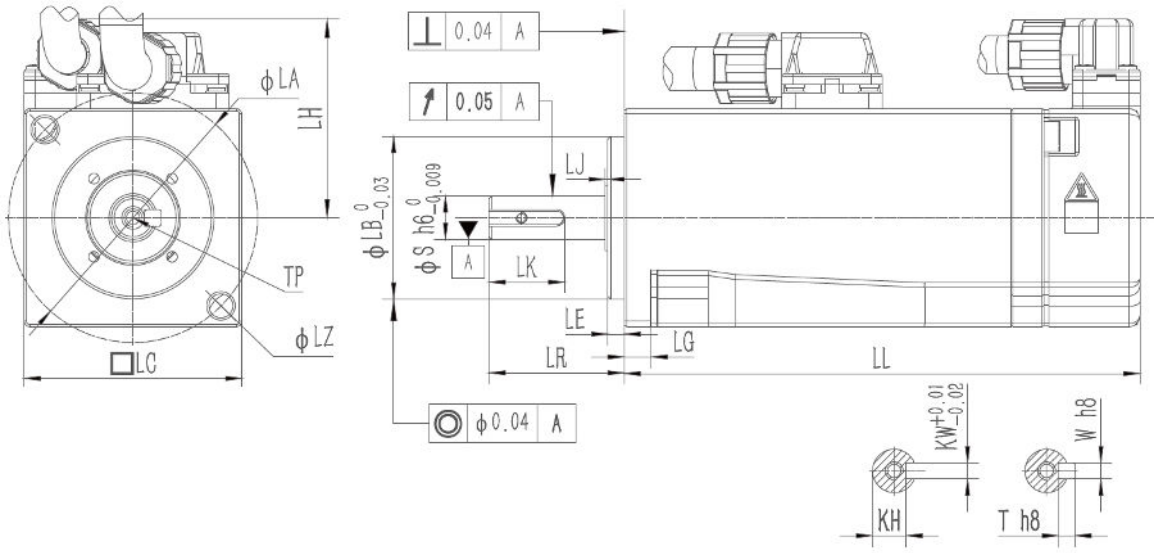



## 2.2.2 Motor Specification

### 2.2.2.1 Servo Motor with 17-bit Magnetic Single-turn Encoder for Frame 40/60/80

| ELM Model | ELM1S-0050 FH40E-** | ELM1S-0100 FH40E-** | ELM1S-0200 FH60E-** | ELM1S-0400 FH60E-** | ELM1S-0750 FH80E-** | ELM1S-1000 FH80E-** |
|---|---|---|---|---|---|---|
| | ELM1S-0050 FH40F-** | ELM1S-0100 FH40F-** | ELM1S-0200 FH60F-** | ELM1S-0400 FH60F-** | ELM1S-0750 FH80F-** | ELM1S-1000 FH80F-** |
| **Frame Size (mm)** | 40 | | 60 | | 80 | |
| **Rated Power (W)** | 50 | 100 | 200 | 400 | 750 | 1000 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Rated Voltage (V)** | | 220 | | | | | |
| **Rated Torque (N·m)** | | 0.16 | 0.32 | 0.64 | 1.27 | 2.39 | 3.19 |
| **Peak Torque (N·m)** | | 0.48 | 0.96 | 2.24 | 4.46 | 8.37 | 11.2 |
| **Rated Current (Arms)** | | 0.85 | 0.85 | 1.5 | 2.1 | 4.1 | 5.7 |
| **Peak Current (Arms)** | | 2.97 | 2.97 | 4.7 | 7.35 | 13.4 | 17.7 |
| **Rated Speed (r/min)** | | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| **Peak Speed (r/min)** | | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| **Inertia ($kg·m^2·10^{-4}$)** | **Without Brake** | 0.0355 | 0.062 | 0.29 | 0.56 | 1.5 | 2.03 |
| | **With Brake** | 0.0456 | 0.0721 | 0.31 | 0.58 | 1.65 | 2.13 |
| **Mass (kg)** | **Without Brake** | 0.32 | 0.46 | 0.9 | 1.3 | 2.12 | 2.7 |
| | **With Brake** | 0.54 | 0.68 | 1.3 | 1.55 | 2.7 | 3.2 |
| **Permissible Load to Shaft (N)** | **Radial** | 147 | 147 | 245 | 245 | 392 | 392 |
| | **Axial** | 88 | 88 | 74 | 74 | 147 | 147 |
| **Plug Type** | | SS Plug and HH2 Plug | | | | | |
| **Matching Cable** | **Motor Cable** | For Motor with SS Plug | CABLE-RZ*M*-S(V3.0) | For Motor with HH2 Plug | CABLE-RZH*M*-113-TS (For Motor without Brake) CABLE-RZSH*M*-113-TS (For Motor with Brake) | | |
| | **Encoder Cable** | | CABLE-7BM*M*-Z(V3.0) | | CABLE-BMH*M*-113-TS | | |
| | **Brake Cable** | | CABLE-SC*M*-S(V3.0) | | / | | |

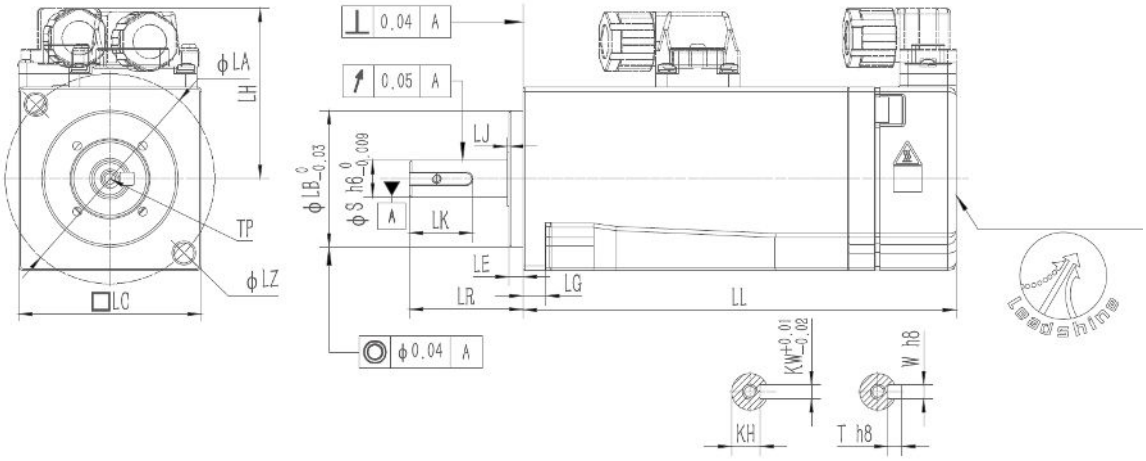



| Model | LL | LC | LR | LA | LZ | LH | LG | LE | LJ | S | LB | TP | LK | KH | KW | W | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ELM1S-0050FH40F-**** | 56.7 | 40 | 25 | 46 | 4.5 | 35MAX | 5 | 3 | 3 | 8 | 30 | M3×8 | 14 | 6.2 | 3 | 3 | 3 |
| **ELM1S-0050FH40E-**** | 84 | 40 | 25 | 46 | 4.5 | 35MAX | 5 | 3 | 3 | 8 | 30 | M3×8 | 14 | 6.2 | 3 | 3 | 3 |
| **ELM1S-0100FH40F-**** | 67.7 | 40 | 25 | 46 | 4.5 | 35MAX | 5 | 3 | 3 | 8 | 30 | M3×8 | 14 | 6.2 | 3 | 3 | 3 |
| **ELM1S-0100FH40E-**** | 95 | 40 | 25 | 46 | 4.5 | 35MAX | 5 | 3 | 3 | 8 | 30 | M3×8 | 14 | 6.2 | 3 | 3 | 3 |
| **ELM1S-0200FH60F-**** | 71.6 | 60 | 30 | 70 | 5.5 | 45MAX | 6.6 | 3 | 3 | 14 | 50 | M5×12 | 22.5 | 11 | 5 | 5 | 5 |
| **ELM1S-0200FH60E-**** | 100.9 | 60 | 30 | 70 | 5.5 | 45MAX | 6.6 | 3 | 3 | 14 | 50 | M5×12 | 22.5 | 11 | 5 | 5 | 5 |
| **ELM1S-0400FH60F-**** | 88.8 | 60 | 30 | 70 | 5.5 | 45MAX | 6.6 | 3 | 3 | 14 | 50 | M5×12 | 22.5 | 11 | 5 | 5 | 5 |
| **ELM1S-0400FH60E-**** | 118.1 | 60 | 30 | 70 | 5.5 | 45MAX | 6.6 | 3 | 3 | 14 | 50 | M5×12 | 22.5 | 11 | 5 | 5 | 5 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ELM1S-0750FH80F-**** | 90.9 | 80 | 35 | 90 | 6.5 | 55MAX | 8.1 | 3 | 3 | 19 | 70 | M5×15 | 25 | 15.5 | 6 | 6 | 6 |
| **ELM1S-0750FH80E-**** | 121.9 | 80 | 35 | 90 | 6.5 | 55MAX | 8.1 | 3 | 3 | 19 | 70 | M5×15 | 25 | 15.5 | 6 | 6 | 6 |
| **ELM1S-1000FH80F-**** | 90.9 | 80 | 35 | 90 | 6.5 | 55MAX | 8.1 | 3 | 3 | 19 | 70 | M5×15 | 25 | 15.5 | 6 | 6 | 6 |
| **ELM1S-1000FH80E-**** | 121.9 | 80 | 35 | 90 | 6.5 | 55MAX | 8.1 | 3 | 3 | 19 | 70 | M5×15 | 25 | 15.5 | 6 | 6 | 6 |

### 2.2.2.2 Servo Motor with 23-bit Optical Multi-turn Encoder for Frame 40/60/80

| **ELM Model** | | **ELM2-0050L H40*-SS**<br>**ELM2S-0050 LH40*-DC** | **ELM2-0100L H40*-SS**<br>**ELM2S-0100 LH40*-DC** | **ELM2-0200L H60*-SS**<br>**ELM2S-0200 LH60*-DC** | **ELM2-0400L H60*-SS**<br>**ELM2S-0400 LH60*-DC** | **ELM2-0750L H80*-SS**<br>**ELM2S-0750 LH80*-DC** | **ELM2-1000L H80*-SS**<br>**ELM2S-1000 LH80*-DC** |
|---|---|---|---|---|---|---|---|
| **Frame Size (mm)** | | 40 | | 60 | | 80 | |
| **Rated Power (W)** | | 50 | 100 | 200 | 400 | 750 | 1000 |
| **Rated Voltage (V)** | | 220 | | | | | |
| **Rated Torque (N·m)** | | 0.16 | 0.32 | 0.64 | 1.27 | 2.39 | 3.19 |
| **Peak Torque (N·m)** | | 0.48 | 0.96 | 2.24 | 4.46 | 8.37 | 11.2 |
| **Rated Current (Arms)** | | 0.85 | 0.85 | 1.5 | 2.1 | 4.1 | 5.7 |
| **Peak Current (Arms)** | | 2.97 | 2.97 | 4.7 | 7.35 | 13.4 | 17.7 |
| **Rated Speed (r/min)** | | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| **Peak Speed (r/min)** | | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| **Inertia ($kg·m^2·10^{-4}$)** | **Without Brake** | 0.0355 | 0.062 | 0.29 | 0.56 | 1.5 | 2.03 |
| | **With Brake** | 0.0456 | 0.0721 | 0.31 | 0.58 | 1.65 | 2.13 |
| **Mass (kg)** | **Without Brake** | 0.32 | 0.46 | 0.9 | 1.3 | 2.12 | 2.7 |
| | **With Brake** | 0.54 | 0.68 | 1.3 | 1.55 | 2.7 | 3.2 |
| **Permissible Load to Shaft (N)** | **Radial** | 147 | 147 | 245 | 245 | 392 | 490 |
| | **Axial** | 88 | 88 | 74 | 74 | 147 | 196 |
| **Plug Type** | | SS Plug and DC Plug | | | | | |
| **Matching Cable** | **Motor Cable** | For Motor with SS Plug | CABLE-RZ*M*-S(V3.0) | For Motor with DC Plug | | CABLE-RZH*M*-114-TS (For Motor without Brake)<br>CABLE-RZSH*M*-114-TS (For Motor with Brake) | |
| | **Encoder Cable** | | CABLE-7BMA*M*-Z(V3.0) | | | CABLE-BMAH*M*-124-TS | |
| | **Brake Cable** | | CABLE-SC*M*-S(V3.0) | | | / | |



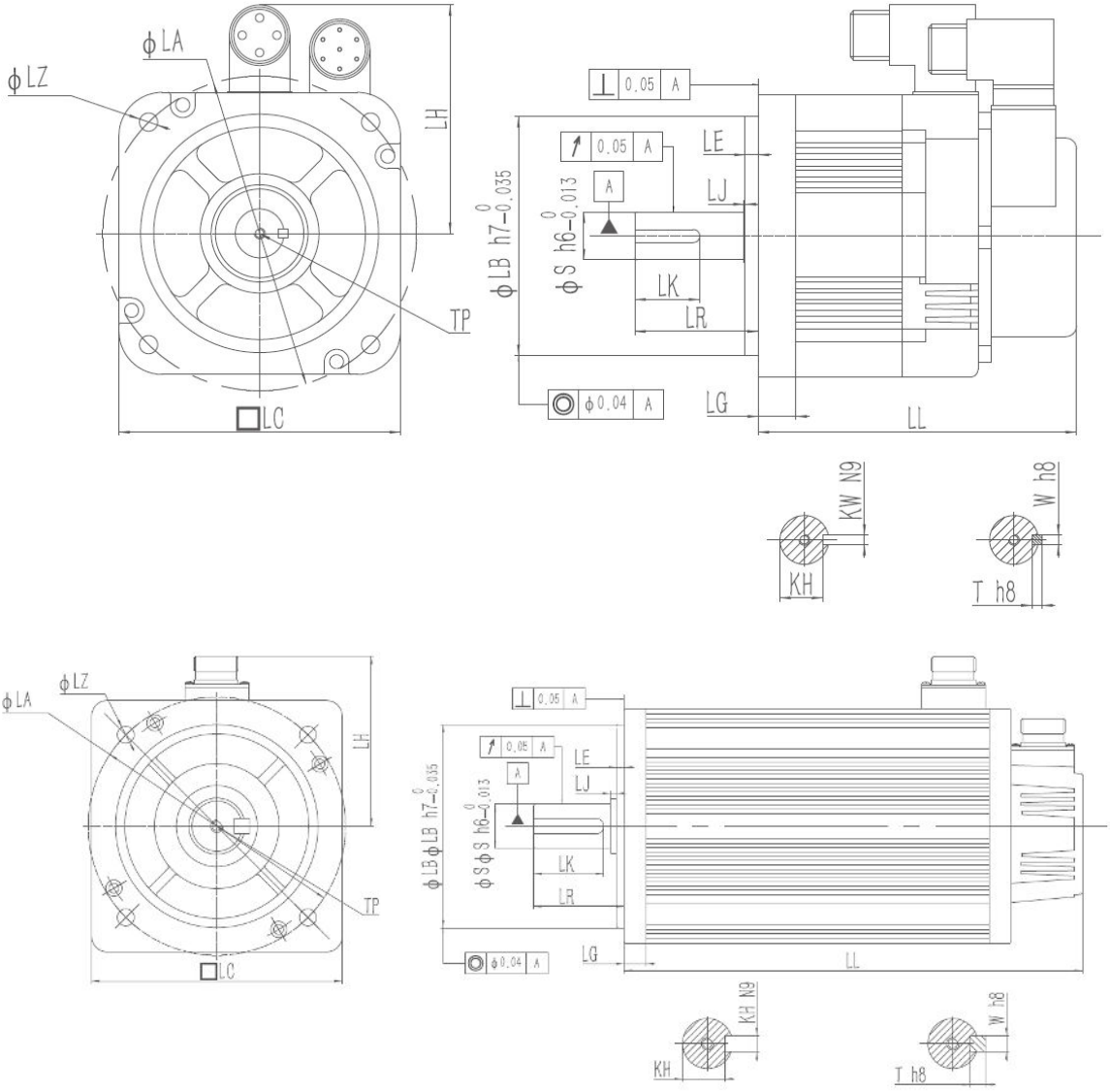

| Model | LL | LC | LR | LA | LZ | LH | LG | LE | LJ | S | LB | TP | LK | KH | KW | W | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELM2*-0050LH40F-** | 56.7 | 40 | 25 | 46 | 4.5 | 35MAX | 5 | 3 | 3 | 8 | 30 | M3×8 | 14 | 6.2 | 3 | 3 | 3 |
| ELM2*-0050LH40E-** | 84 | 40 | 25 | 46 | 4.5 | 35MAX | 5 | 3 | 3 | 8 | 30 | M3×8 | 14 | 6.2 | 3 | 3 | 3 |
| ELM2*-0100LH40F-** | 67.7 | 40 | 25 | 46 | 4.5 | 35MAX | 5 | 3 | 3 | 8 | 30 | M3×8 | 14 | 6.2 | 3 | 3 | 3 |
| ELM2*-0100LH40E-** | 95 | 40 | 25 | 46 | 4.5 | 35MAX | 5 | 3 | 3 | 8 | 30 | M3×8 | 14 | 6.2 | 3 | 3 | 3 |
| ELM2*-0200LH60F-** | 71.6 | 60 | 30 | 70 | 5.5 | 45MAX | 6.6 | 3 | 3 | 14 | 50 | M5×12 | 22.5 | 11 | 5 | 5 | 5 |
| ELM2*-0200LH60E-** | 100.9 | 60 | 30 | 70 | 5.5 | 45MAX | 6.6 | 3 | 3 | 14 | 50 | M5×12 | 22.5 | 11 | 5 | 5 | 5 |
| ELM2*-0400LH60F-** | 88.8 | 60 | 30 | 70 | 5.5 | 45MAX | 6.6 | 3 | 3 | 14 | 50 | M5×12 | 22.5 | 11 | 5 | 5 | 5 |
| ELM2*-0400LH60E-** | 118.1 | 60 | 30 | 70 | 5.5 | 45MAX | 6.6 | 3 | 3 | 14 | 50 | M5×12 | 22.5 | 11 | 5 | 5 | 5 |
| ELM2*-0750LH80F-** | 90.9 | 80 | 35 | 90 | 6.5 | 55MAX | 8.1 | 3 | 3 | 19 | 70 | M5×15 | 25 | 15.5 | 6 | 6 | 6 |
| ELM2*-0750LH80E-** | 121.9 | 80 | 35 | 90 | 6.5 | 55MAX | 8.1 | 3 | 3 | 19 | 70 | M5×15 | 25 | 15.5 | 6 | 6 | 6 |
| ELM2*-1000LH80F-** | 103.9 | 80 | 35 | 90 | 6.5 | 55MAX | 8.1 | 3 | 3 | 19 | 70 | M5×15 | 25 | 15.5 | 6 | 6 | 6 |
| ELM2*-1000LH80E-** | 134.9 | 80 | 35 | 90 | 6.5 | 55MAX | 8.1 | 3 | 3 | 19 | 70 | M5×15 | 25 | 15.5 | 6 | 6 | 6 |

### 2.2.2.3 Servo Motor with 23-bit Optical Multi-turn Encoder for Frame 130

| ELM Model | ELM-1000 LM130E-H | ELM-1500 LM130E-H | ELM-2000 LM130E-H | ELM-0850 LH130E-HD | ELM-1300 LH130E-HD | ELM-1800 LH130E-HD | ELM-1800 LH130ET-H |
|---|---|---|---|---|---|---|---|
| | ELM-1000 LM130F-H | ELM-1500 LM130F-H | ELM-2000 LM130F-H | ELM-0850 LH130F-HD | ELM-1300 LH130F-HD | ELM-1800 LH130F-HD | ELM-1800 LH130FT-H |
| Frame Size (mm) | 130 | | | | | | |
| Rated Power (W) | 1000 | 1500 | 2000 | 850 | 1300 | 1800 | 1800 |
| Rated Voltage (V) | 220 | | | | | | 380 |
| Rated Torque (N·m) | 4 | 6 | 7.7 | 5.39 | 8.4 | 11.5 | 11.5 |
| Peak Torque (N·m) | 10 | 15 | 19.3 | 13.5 | 21 | 28.75 | 34.5 |
| Rated Current (Arms) | 4 | 6 | 7.5 | 6.5 | 9.5 | 9 | 8.2 |
| Peak Current (Arms) | 10 | 15 | 18.8 | 16.3 | 23.8 | 22.5 | 24.6 |
| Rated Speed (r/min) | 2500 | 2500 | 2500 | 1500 | 1500 | 1500 | 1500 |
| Peak Speed (r/min) | 3000 | 3000 | 3000 | 3000 | 3000 | 2000 | 3000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inertia ($kg \cdot m^2 \cdot 10^{-4}$)** | **Without Brake** | 8.5 | 12.6 | 15.3 | 13.88 | 20.6 | 20.59 | 20.59 |
| | **With Brake** | 8.95 | 14.08 | 16.8 | 15.78 | 22.3 | 22.26 | 22.26 |
| **Mass (kg)** | **Without Brake** | 6.2 | 7.4 | 8.3 | 5.6 | 7.5 | 7.5 | 7.5 |
| | **With Brake** | 8.3 | 9.5 | 11 | 6.9 | 8.8 | 8.8 | 8.8 |
| **Permissible Load to Shaft (N)** | **Radial** | 490 | 490 | 490 | 490 | 490 | 490 | 490 |
| | **Axial** | 196 | 196 | 196 | 196 | 196 | 196 | 196 |
| **Plug Type** | | H Plug and HD Plug | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Matching Cable** | **Motor Cable** | For Motor with H Plug | CABLE-RZ*M*-H(V2.0) | For Motor with HD Plug | CABLE-RZ*M*-HD(V2.0) |
| | **Encoder Cable** | | CABLE-7BMA*M*-HZ(V3.0) | | CABLE-7BMA*M*-HD(V3.0) |
| | **Brake Cable** | | CABLE-SC*M*-H(V3.0) | | CABLE-SC*M*-HD(V3.0) |

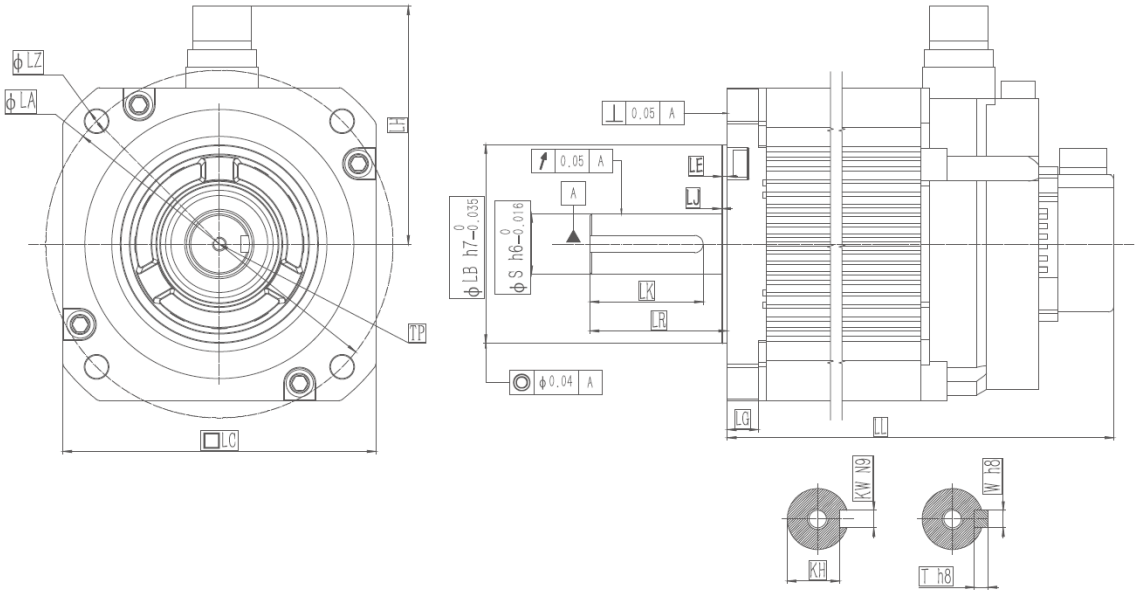



| Model | LL | LC | LR | LA | LZ | LH | LG | LE | LJ | S | LB | TP | LK | KH | KW | W | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ELM-0850LH130F-HD** | 147 | 130 | 57 | 145 | 8.5 | 106 | 17.5 | 6 | 0.5 | 19 | 110 | M5×12 | 30 | 16 | 5 | 5 | 5 |
| **ELM-0850LH130E-HD** | 172 | 130 | 57 | 145 | 8.5 | 106 | 17.5 | 6 | 0.5 | 19 | 110 | M5×12 | 30 | 16 | 5 | 5 | 5 |
| **ELM-1300LH130F-HD** | 168 | 130 | 57 | 145 | 8.5 | 106 | 17.5 | 6 | 0.5 | 22 | 110 | M5×12 | 30 | 18.5 | 6 | 6 | 6 |
| **ELM-1300LH130E-HD** | 192 | 130 | 57 | 145 | 8.5 | 106 | 17.5 | 6 | 0.5 | 22 | 110 | M5×12 | 30 | 18.5 | 6 | 6 | 6 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ELM-1800LH130F*-HD** | 195 | 130 | 57 | 145 | 8.5 | 106 | 17.5 | 6 | 0.5 | 24 | 110 | M5×12 | 30 | 19 | 8 | 8 | 8 |
| **ELM-1800LH130E*-HD** | 219 | 130 | 57 | 145 | 8.5 | 106 | 17.5 | 6 | 0.5 | 24 | 110 | M5×12 | 30 | 19 | 8 | 8 | 8 |
| **ELM-1000LM130F-H** | 166 | 131 | 57 | 145 | 9 | 111 | 14 | 5 | 2 | 22 | 110 | M6×20 | 40 | 18.5 | 6 | 6 | 6 |
| **ELM-1000LM130E-H** | 223 | 131 | 57 | 145 | 9 | 111 | 14 | 5 | 2 | 22 | 110 | M6×20 | 40 | 18.5 | 6 | 6 | 6 |
| **ELM-1500LM130F-H** | 179 | 131 | 57 | 145 | 9 | 111 | 14 | 5 | 2 | 22 | 110 | M6×20 | 40 | 18.5 | 6 | 6 | 6 |
| **ELM-1500LM130E-H** | 236 | 131 | 57 | 145 | 9 | 111 | 14 | 5 | 2 | 22 | 110 | M6×20 | 40 | 18.5 | 6 | 6 | 6 |
| **ELM-2000LM130F-H** | 192 | 131 | 57 | 145 | 9 | 111 | 14 | 5 | 2 | 22 | 110 | M6×20 | 40 | 18.5 | 6 | 6 | 6 |
| **ELM-2000LM130E-H** | 270 | 131 | 57 | 145 | 9 | 111 | 14 | 5 | 2 | 22 | 110 | M6×20 | 40 | 18.5 | 6 | 6 | 6 |

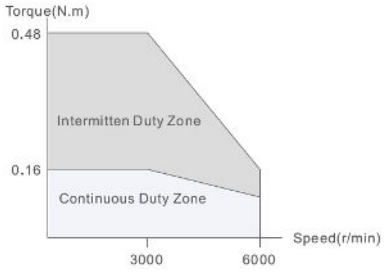
### 2.2.2.4 Servo Motor with 23-bit Optical Multi-turn Encoder for Frame 180

| **ELM Model** | | **ELM-2900LM180ET-H**<br>**ELM-2900LM180FT-H** | **ELM-4400LM180ET-H**<br>**ELM-4400LM180FT-H** | **ELM-5500LM180ET-H**<br>**ELM-5500LM180FT-H** | **ELM-7500LM180ET-H**<br>**ELM-7500LM180FT-H** |
|---|---|---|---|---|---|
| **Frame Size (mm)** | | 180 | | | |
| **Rated Power (W)** | | 2900 | 4400 | 5500 | 7500 |
| **Rated Voltage (V)** | | 380 | | | |
| **Rated Torque (N·m)** | | 18.6 | 28.4 | 35 | 48 |
| **Peak Torque (N·m)** | | 46.5 | 71.1 | 87.5 | 119 |
| **Rated Current (A)** | | 11.8 | 15.7 | 20.6 | 25.7 |
| **Peak Current (A)** | | 29.5 | 39.3 | 51.5 | 64.5 |
| **Rated Speed (r/min)** | | 1500 | 1500 | 1500 | 1500 |
| **Peak Speed (r/min)** | | 3000 | 3000 | 3000 | 3000 |
| **Inertia ($kg·m^2·10^{-4}$)** | **Without Brake** | 56.8 | 78.2 | 109 | 130 |
| | **With Brake** | 65.3 | 86 | 118 | 140 |
| **Mass (kg)** | **Without Brake** | 16.3 | 21.4 | 25.8 | 32.3 |
| | **With Brake** | 21.8 | 26.5 | 31.1 | 37.6 |
| **Permissible Load to Shaft (N)** | **Radial** | 1470 | 1750 | 1750 | 1750 |
| | **Axial** | 490 | 580 | 580 | 580 |
| **Plug Type** | | H Plug | | | |
| **Matching Cable** | **Motor Cable** | CABLE-RZA*M*-H-180(V1.0) For Motor of 2900W<br>CABLE-RZB*M*-H-180(V1.0) For Motor of 4400W/5500W/7500W | | | |
| | **Encoder Cable** | CABLE-7BMA*M*-HZ-180(V1.0) | | | |
| | **Brake Cable** | CABLE-SC*M*-H-180(V1.0) | | | |

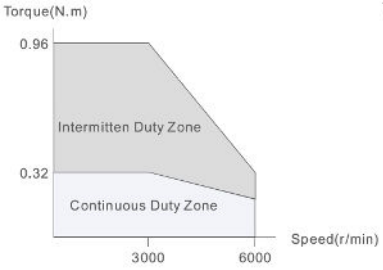



| Model | LL | LC | LR | LA | LZ | LH | LG | LE | LJ | S | LB | TP | LK | KH | KW | W | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ELM-2900LM180FT-H** | 201 | 180 | 79 | 200 | 4-Φ13.5 | 134 | 18 | 3.2 | 0.3 | 35 | 114 | M12×25 | 65 | 30 | 10 | 10 | 8 |
| **ELM-2900LM180ET-H** | 249 | 180 | 79 | 200 | 4-Φ13.5 | 134 | 18 | 3.2 | 0.3 | 35 | 114 | M12×25 | 65 | 30 | 10 | 10 | 8 |
| **ELM-4400LM180FT-H** | 230 | 180 | 79 | 200 | 4-Φ13.5 | 134 | 18 | 3.2 | 0.3 | 35 | 114 | M12×25 | 65 | 30 | 10 | 10 | 8 |
| **ELM-4400LM180ET-H** | 278 | 180 | 79 | 200 | 4-Φ13.5 | 134 | 18 | 3.2 | 0.3 | 35 | 114 | M12×25 | 65 | 30 | 10 | 10 | 8 |
| **ELM-5500LM180FT-H** | 257 | 180 | 113 | 200 | 4-Φ13.5 | 134 | 18 | 3.2 | 0.3 | 42 | 114 | M16×32 | 96 | 37 | 12 | 12 | 8 |
| **ELM-5500LM180ET-H** | 3.5 | 180 | 113 | 200 | 4-Φ13.5 | 134 | 18 | 3.2 | 0.3 | 42 | 114 | M16×32 | 96 | 37 | 12 | 12 | 8 |
| **ELM-7500LM180FT-H** | 297 | 180 | 113 | 200 | 4-Φ13.5 | 134 | 18 | 3.2 | 0.3 | 42 | 114 | M16×32 | 96 | 37 | 12 | 12 | 8 |
| **ELM-7500LM180ET-H** | 345 | 180 | 113 | 200 | 4-Φ13.5 | 134 | 18 | 3.2 | 0.3 | 42 | 114 | M16×32 | 96 | 37 | 12 | 12 | 8 |

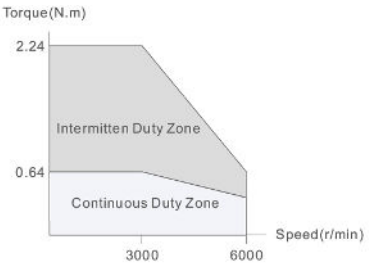
## 2.2.3 N-T Characteristics



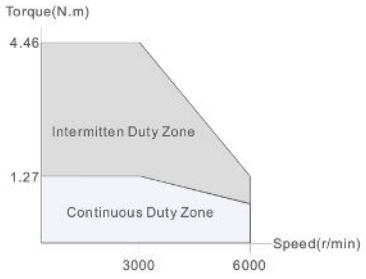

50W Motor



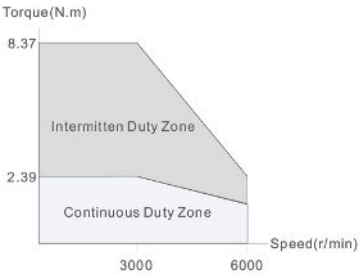

100W Motor



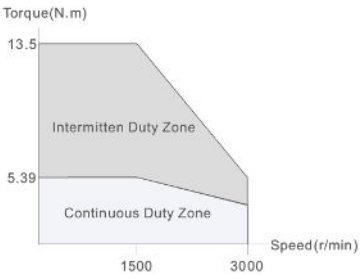

200W Motor



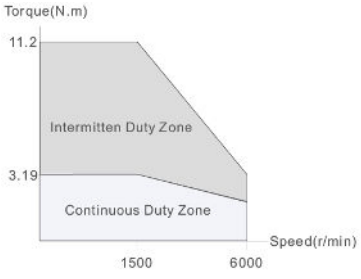

400W Motor



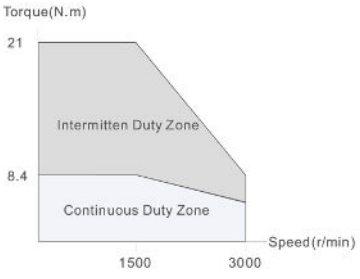

750W Motor



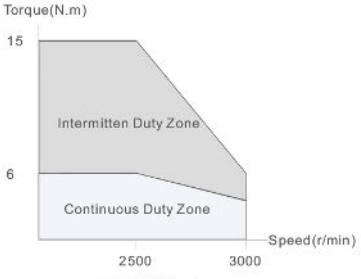

850W Motor



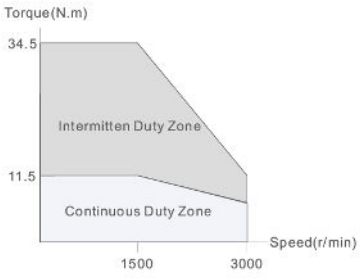

1000W Motor



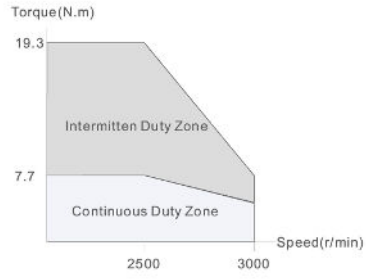

1300W Motor



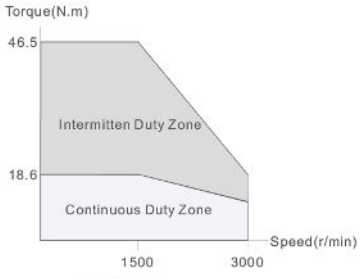

1500W Motor



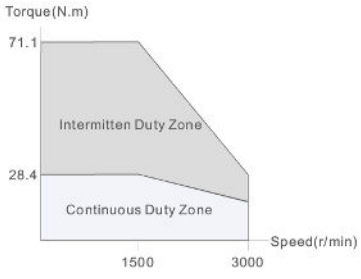

1800W Motor



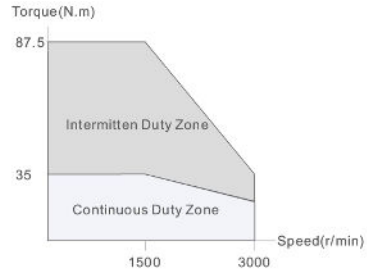

2000W Motor



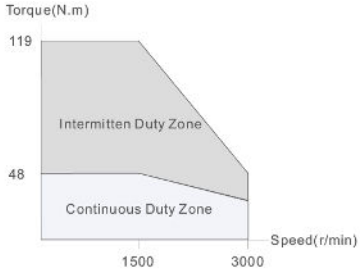

2900W Motor




4400W Motor




5500W Motor




7500W Motor

# 2.3 Cable Description

## 2.3.1 Matching Cable

➢ **Motor Cable**

- **Length options:** 1.5M, 3M, 5M, 7M, 10M, 13M
- **Connector options:** Plastic plug Optional: Injection plug

➢ **Encoder Cable**

- **Length options:** 1.5M, 3M, 5M, 7M, 10M, 13M
- **Connector options:** Plastic plug Optional: Injection plug

➢ **Brake Cable**

- **Length options:** 1.5M, 3M, 5M, 7M, 10M, 13M
- **Connector options:** Plastic plug Optional: Injection plug

➢ **GUI Debug Cable**

- Connect the drive to computer
- The interface standard is USB
- Model: CABLE-USB1M5, CABLE-L6TS1M5

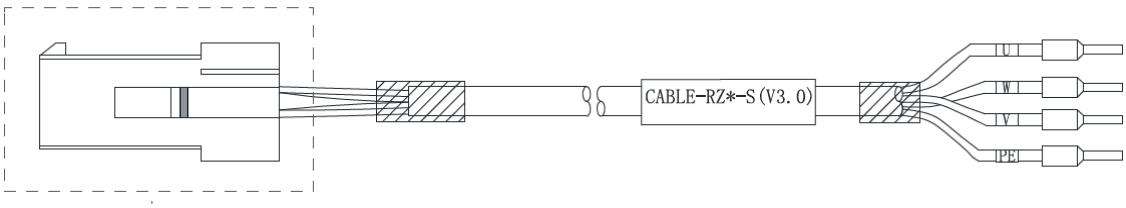
➢ **RS485/ EtherCAT Communication Cable**

- **Model:** CABLE-TX0M2-BUS
- **Length options:** 1.5M, 3M, 5M, 7M, 10M, 13M

## 2.3.2 Cable Detail

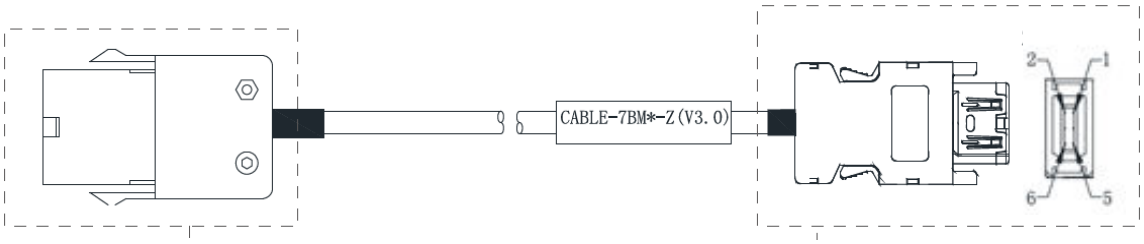
### 2.3.2.1 Cable with SS Plug for Frame 40/60/80

➢ **CABLE-RZ*M*-S1(V3.0) Motor Cable**



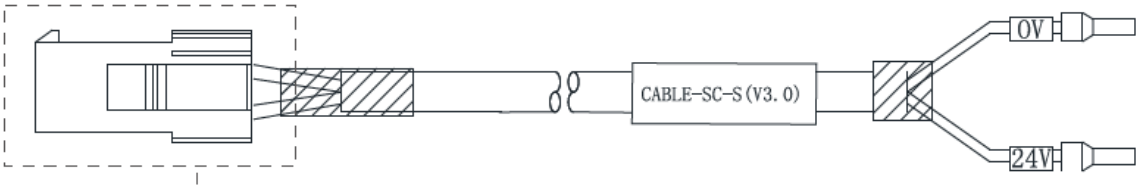

| Material | | Part No. | Quantity |
|---|---|---|---|
| Motor Cable Part | Plastic Shell | 11600371 | 1 |
| | Pin Needle | 11600353 | 4 |

➢ **CABLE-7BM*M*-Z(V3.0) Encoder Cable**




| Material | | Part No. | Quantity |
|---|---|---|---|
| Encoder Cable Parts | Plastic Shell | 11600372 | 1 |
| | Pin Needle | 11600354 | 5 |
| Plug Connected to Drive | | 11600383 | 1 |

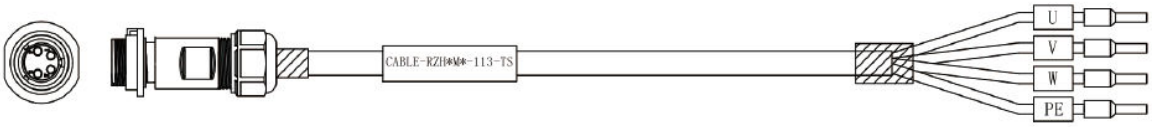
➢ **CABLE-SC*M*-S1(V3.0) Brake Cable**




| Material | | Part No. | Quantity |
|---|---|---|---|
| Brake Cable Parts | Plastic Shell | 11600369 | 1 |
| | Pin Needle | 11600353 | 2 |

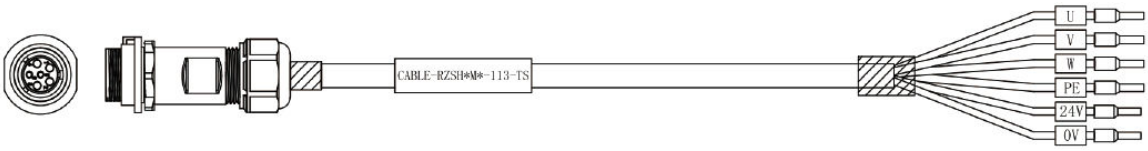
### 2.3.2.2 Cable with HH2 Plug for Frame 40/60/80

➢ **CABLE-RZH*M*-113-TS Motor Cable for Motor without Brake**




| Material | | Part No. | Quantity |
|---|---|---|---|
| Motor Cable Parts | Female Plug for Motor Cable | 11600548 | 1 |
| | Male Plug for Motor Cable | 11600549 | 1 |

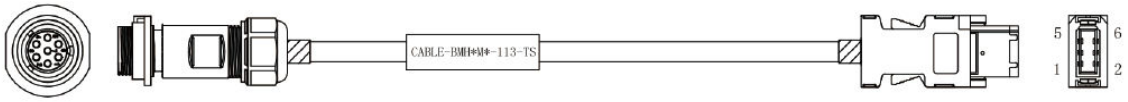
➢ **CABLE-TZSH*M*-113-TS Motor Cable for Motor with Brake**




| Material | Part No. | Quantity |
|---|---|---|

| | | | |
|---|---|---|---|
| Motor Cable Parts | Female Plug for Motor Cable | 11600546 | 1 |
| | Male Plug for Motor Cable | 11600547 | 1 |

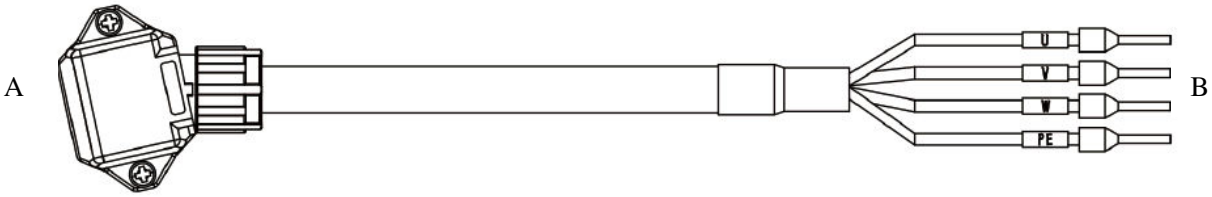
➢ **CABLE-BMH*M*-113-TS Encoder Cable**




| Material | | Part No. | Quantity |
|---|---|---|---|
| Encoder Cable Parts | Female Plug for Encoder Cable | 11600546 | 1 |
| | Male Plug for Encoder Cable | 11600547 | 1 |
| | Plug Connected to Drive | 11600383 | 1 |

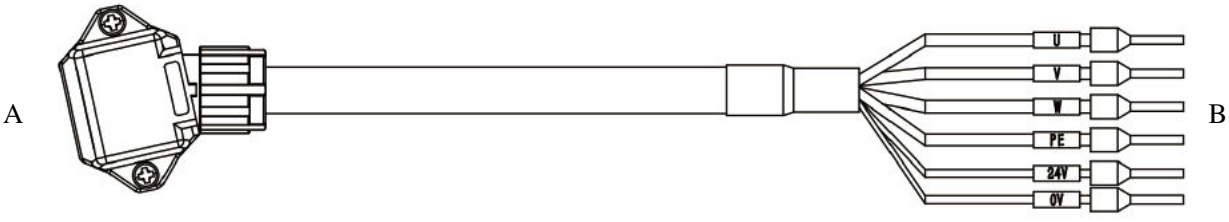
### 2.3.2.3 Cable with DC Plug for Frame 40/60/80

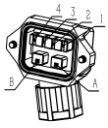
➢ **CABLE-RZH*M*-114-TS Motor Cable for Motor without Brake**



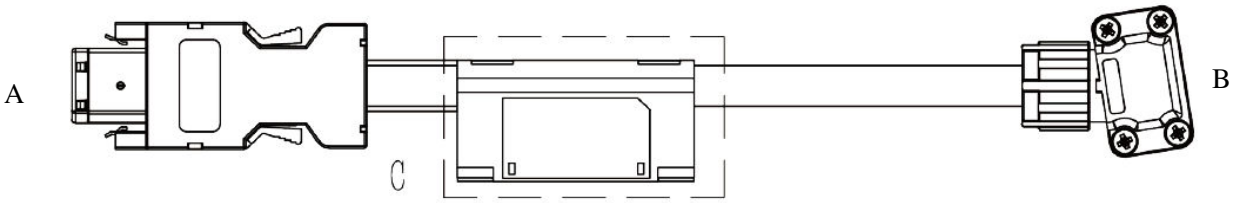

| Diagram | A-end | Color | B-end |
|---|---|---|---|
| | 1 | Blue | U |
| | 2 | Red | W |
| | 3 | Black | V |
| | 4 | Yellow/Green | PE |

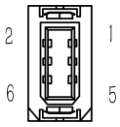
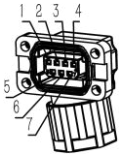
➢ **CABLE-RZH*M*-114-TS Motor Cable for Motor with Brake**




| Diagram | A-end | Color | B-end |
|---|---|---|---|
|  | 1 | Blue | U |
| | 2 | Red | W |
| | 3 | Black | V |
| | 4 | Yellow/Green | PE |
| | 5 | Black | 0V |
| | 6 | Red | 24V |

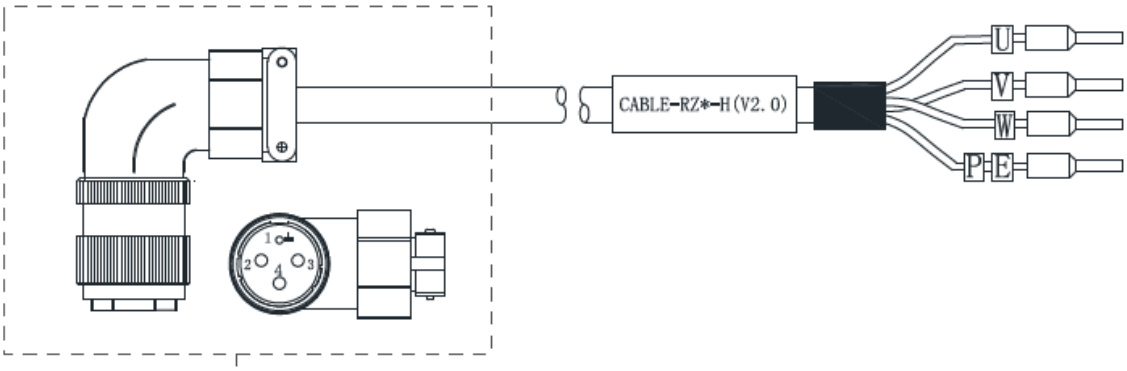
➢ **CABLE-BMAH*M*-124-TS Encoder Cable**




| Diagram | A-end | Definition | B-end | Diagram | C-end |
|---|---|---|---|---|---|
|  | 1 | PE | 1 |  | |
| | 2 | 5V | 2 | | |
| | 3 | 0V | 3 | | |
| | 4 | SD+ | 4 | | |
| | 5 | SD- | 5 | | |
| | 6 | BAT+ | 6 | | 1 |
| | 7 | BAT- | 7 | | 2 |

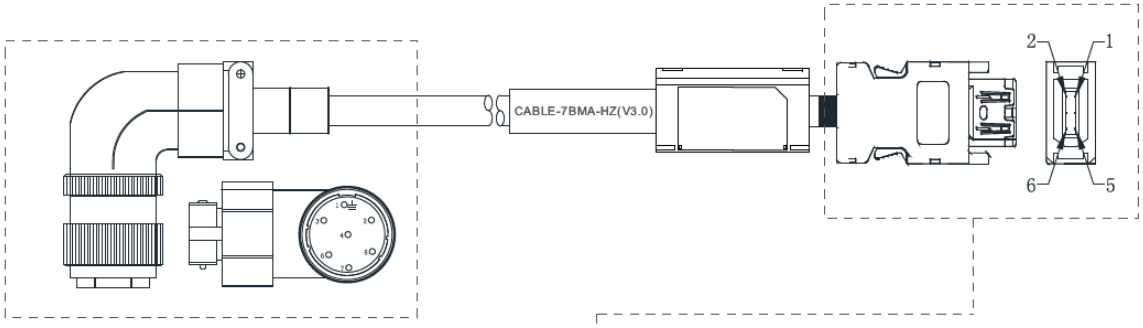
### 2.3.2.4 Cable with H Plug for Frame 130

➢ **CABLE-RZ*M*-H(V2.0) Motor Cable**



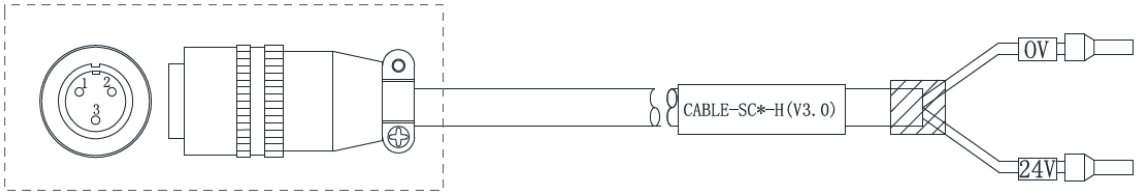

| Material | | Part No. | Quantity |
|---|---|---|---|
| Motor Cable Parts | Aviation Plug for Motor Cable | 11600072 | 1 |

➢ **CABLE-7BM*M*-HZ(V3.0) Encoder Cable**




| Material | | Part No. | Quantity |
|---|---|---|---|
| Encoder Cable Parts | Aviation Plug for Encoder Cable | 11600076 | 1 |
| | Plug Connected to Drive | 11600383 | 1 |

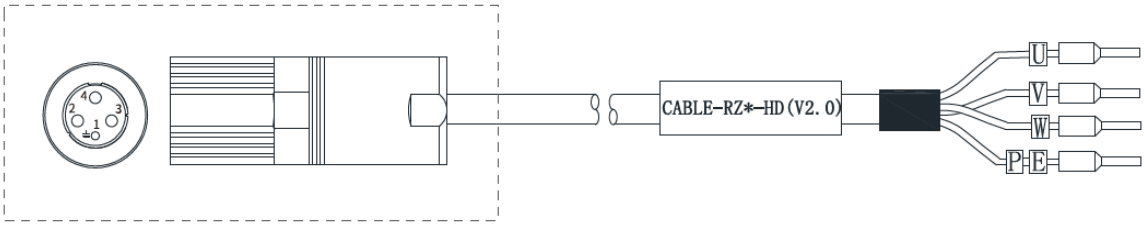
➢ **CABLE-SC*M*-H(V3.0) Brake Cable**




| Material | | Part No. | Quantity |
|---|---|---|---|
| Brake Cable Parts | Aviation Plug for Brake Cable | 11600070 | 1 |

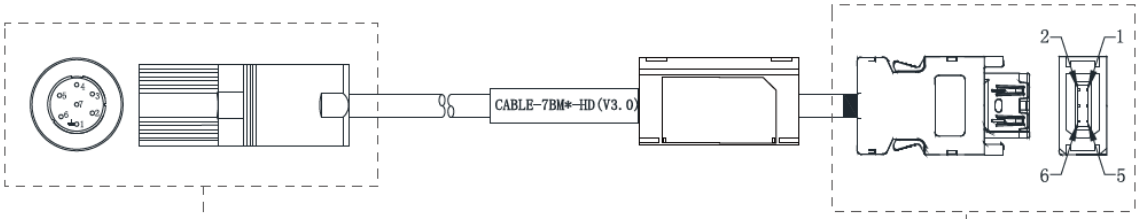
### 2.3.2.5 Cable with HD Plug for Frame 130

➢ **CABLE-RZ*M*-HD(V2.0) Motor Cable**




| Material | | Part No. | Quantity |
|---|---|---|---|
| Motor Cable Parts | Aviation Plug for Motor Cable | 11600077 | 1 |

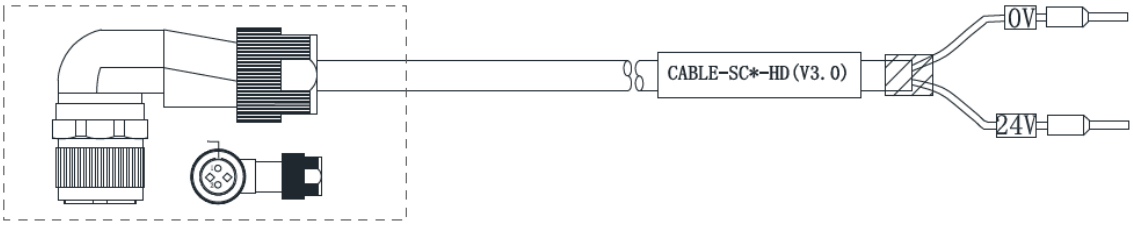
➢ **CABLE-7BM*M*-HD(V3.0) Encoder Cable**




| Material | Part No. | Quantity |
|---|---|---|

| | | | |
|---|---|---|---|
| Encoder Cable Parts | Aviation Plug for Encoder Cable | 11600079 | 1 |
| | Plug Connected to Drive | 11600383 | 1 |

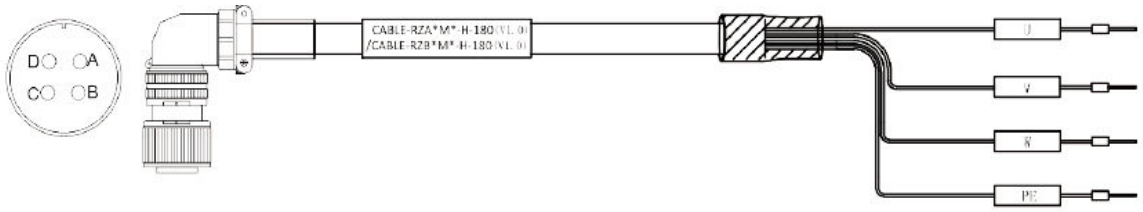
➢ **CABLE-SC*M*-HD(V3.0) Brake Cable**




| | Material | Part No. | Quantity |
|---|---|---|---|
| Brake Cable Parts | Aviation Plug for Brake Cable | 11600078 | 1 |

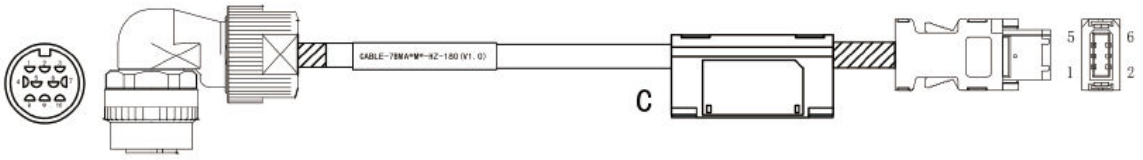
### 2.3.2.6 Cable with H Plug for Frame 180

➢ **CABLE-RZ*M*-H(V2.0) Motor Cable**



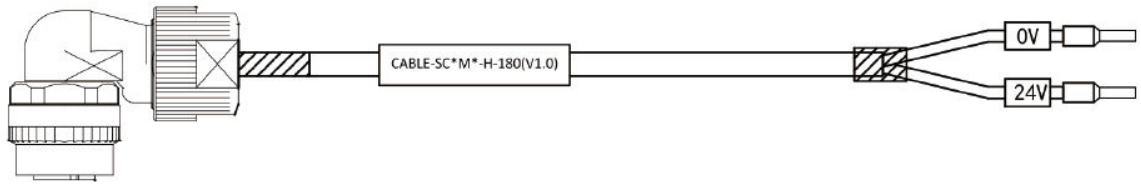

| | Material | Part No. | Quantity |
|---|---|---|---|
| Motor Cable Parts | Aviation Plug for Motor Cable | 11600980 | 1 |

➢ **CABLE-7BMA*M*-HZ-180(V1.0) Encoder Cable**




| | Material | Part No. | Quantity |
|---|---|---|---|
| Encoder Cable Parts | Aviation Plug for Encoder Cable | 11600979 | 1 |
| | Plug Connected to Drive | 11600383 | 1 |
| | Battery Box | 82600020 | 1 |

➢ **CABLE-SC*M*-H-180(V1.0) Brake Cable**




| Material | | Part No. | Quantity |
|---|---|---|---|
| Brake Cable Parts | Aviation Plug for Brake Cable | 11600978 | 1 |

# Chapter 3 Installation

## 3.1 Storage and Installation Condition

**Table 3.1 Environment of Servo Drive**

| Item | EL7 Series Drive |
|---|---|
| **Ambient Temperature** | 0℃~55℃ (free from freezing) |
| **Ambient Humility** | 20%~90%RH (free from condensation) |
| **Storage Temperature** | -20℃~80℃ (free from freezing) |
| **Storage Humility** | 20%~90%RH (free from condensation) |
| **Vibration** | Less than 4.9m/s$^2$ (0.5G) 10-60Hz (Non-continuous working) |
| **Altitude** | Lower than 1000m |
| **Impact** | Less than 19.6m/s$^2$ |
| **Protection Class** | IP20 |

**Table 3.2 Environment of Servo Motor**

| Item | EL7 Series Motor |
|---|---|
| **Ambient Temperature** | 0℃~40℃ (free from freezing) |
| **Ambient Humility** | 20%~90%RH (free from condensation) |
| **Storage Temperature** | -20℃~60℃ (free from freezing) |
| **Storage Humility** | 20%~90%RH (free from condensation) |
| **Vibration** | Less than 49m/s$^2$ (5G) |
| **Altitude** | Lower than 1000m |
| **Impact** | Less than 490m/s$^2$ (50G) |
| **Protection Class** | IP65 (ELM2S series up to IP67) |

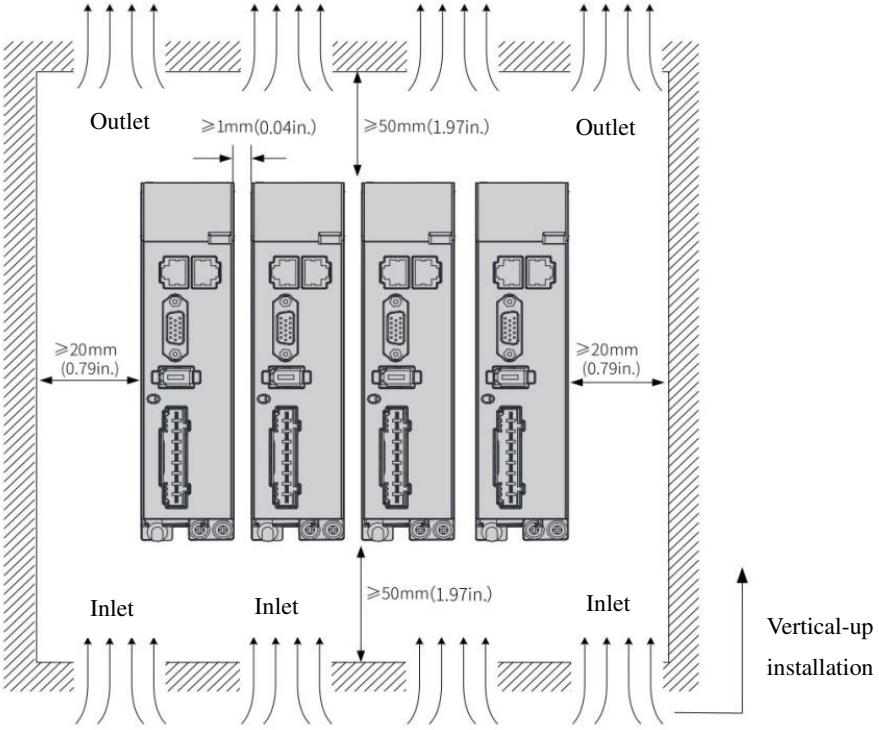
## 3.2 Servo Drive Installation

**Notice**

- Sufficient safeguarding grade is necessary for installation in control cabinet.
- Specified direction, intervals and good cooling condition are necessary for installation.
- Don't install them on inflammable substance or near it to prevent fire hazard.

Here is the installation diagram:

(1) Install in vertical position, and reserve enough space around the servo drive for ventilation.




(2) The user may install the product in the mode of bottom plate installation or panel installation, and the installation direction is perpendicular to the installation face. In order to ensure good heat dissipation conditions, at least 10MM of installation space should be set aside in the actual installation.

(3) When mounting drive compactly, consider installation tolerances and leave at least 1MM between each two drive. Use it below 75% of the actual load rate.

(4) Whenever lifting the product, two or more persons should hold it by metallic member, not by plastic member.

(5) We have been making the best effort to ensure the highest quality, however, application of exceptionally large external noise disturbance and static electricity, or failure in input power, wiring and components may result in unexpected action. It is highly recommended that you make a fail-safe design and secure the safety in the operative range.

(6) If stranded wires are used as the cable, bunch the conductors of the cable using rod terminals or round terminals. If stranded wires are used as they are, unexpected accidents such as an electric shock and short circuit or injury may result.

(7) There might be a chance of smoke generation due to the failure of these products. Pay an extra attention when you apply these products in a clean room environment.

(8) Be sure to install a no-fuse breaker in the power supply. In addition, be sure to ground the grounding terminal or grounding wire provided.

# 3.3 Servo Motor Installation

**Notice**

- Don't hold the product by the cable, motor shaft or encoder while transporting it.
- No knocking motor shaft or encoders, prevent motor by vibration or shock.
- The motor shaft can't bear the load beyond the limits.

- Motor shaft does not bear the axial load, radial load, otherwise you may damage the motor.
- Use a flexible with high stiffness designed exclusively for servo application in order to make a radial thrust caused by micro misalignment smaller than the permissible value.
- Installing must be steady, prevent drop from vibrating.

**How to Install**

You can mount the motor either horizontally or vertically as long as you observe the followings.

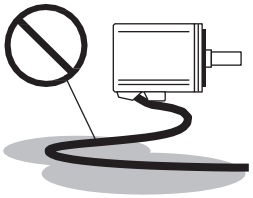
(1) Horizontal mounting

- Mount the motor with cable outlet facing downward for water/oil countermeasure.

(2) Vertical mounting

- Use the motor with oil seal (make-to-order in case of motor 750W or less) when mounting the motor with gear reducer to prevent the reducer oil/grease from entering to the motor.

**Oil/Water Protection**



(9) Don't submerge the motor cable to water or oil.

(10) Install the motor with the cable outlet facing downward.

(11) Avoid a place where the motor is always subjected to oil or water.

(12) Use the motor with an oil seal when used with the gear reducer, so that the oil may not enter to the motor through shaft

**Stress to Cables**

(1) Avoid a stress application to the cable outlet and connecting portion by bending or self- weight.

(2) Especially in an application where the motor itself travels, fix the junction cable into the bearer so that the stress by bending can be minimized.

(3) Take the cable bending radius as large as possible. (When you use our optional cable, Minimum R20mm)

**Permissible Load to Output Shaft**

(1) Design the mechanical system so that the applied radial load and/or thrust load to the motor shaft at installation and at normal operation can meet the permissible value specified to each model.

(2) Pay an extra attention when you use a rigid coupling. (Excess bending load may dam- age the shaft or deteriorate the bearing life.)

(3) Use a flexible coupling with high stiffness designed exclusively for servo application in order to make a radial thrust caused by micro misalignment smaller than the permissible value.

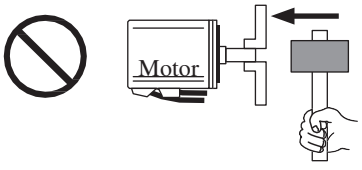
**Notes on Installation**

(1) Do not apply direct impact to the shaft by hammer while attaching/detaching a coupling to and from the motor shaft.

(2) (Or it may damage the encoder mounted on the other side of the shaft.)

(3) Make a full alignment. (Incomplete alignment may cause vibration and damage the bearing.)

(4) If the motor shaft is not electrically grounded, it may cause electrolytic corrosion to the bearing depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Check and verification by customer is required.



# Chapter 4 Wiring

**Warning**

- The workers of participation in wiring or checking must possess sufficient ability to do this job.
- The wiring and checking must be going with power off after five minutes.

**Caution**

- Ground the earth terminal of the motor and drive without fail.
- The wiring should be connected after servo drive and servo motor installed correctly.

## 4.1 Wiring

### 4.1.1 Wire Gauge

**(1) Power Supply Terminal TB**

- Diameter:

**Table 4.1 Power Wiring Specification**

| Drive | Wire Diameter ($mm^2$/AWG) | | | |
|---|---|---|---|---|
| | L1/L2/L3 | P+/BR | U/V/W | PE |
| EL7-*0400Z | 0.81/AWG18 | 2.1/AWG14 | 1.3/AWG16 | 2.1/AWG14 |
| EL7-*0750Z | 0.81/AWG18 | 2.1/AWG14 | 1.3/AWG16 | 2.1/AWG14 |
| EL7-*1000Z | 0.81/AWG18 | 2.1/AWG14 | 2.1/AWG14 | 2.1/AWG14 |
| EL7-*1500Z | 1.3/AWG16 | 2.6/AWG13 | 2.6/AWG13 | 2.6/AWG13 |
| EL7-*2000Z | 2.1/AWG14 | 2.6/AWG13 | 3.3/AWG12 | 2.6/AWG13 |

- Grounding: The grounding wire should be as thick as possible, drive servo motor the PE terminal point ground, ground resistance <100 Ω.
- Use noise filter to remove external noise from the power lines and reduce an effect of the noise generated by the servo drive.
- Install fuse (NFB) promptly to cut off the external power supply if drive error occurs.

**(2) The control signal CN1, feedback signal CN2**

- Cable diameter: Shielded cable (twisting shield cable would be better), the diameter ≥ 0.14$mm^2$ (AWG24-26), the shield should be connected to FG terminal.
- Cable length: Cable length should be as short as possible and control cable CN1 is no more than 3 meters, the CN2 cable length of the feedback signal is no more than 20 meters.
- Wiring: Ensure being away from the wiring of power line to prevent interference input.
- Install a surge absorbing element for the relevant inductive element (coil), DC coil should be in parallel connection with freewheeling diode reversely; AC coil should be in parallel connection with RC snubber circuit.

**(3) Regenerative resister**

- When the torque of the motor is opposite to the direction of rotation (common scenarios such as deceleration, vertical axis descent, etc.), energy will feedback from the load to the drive. At this time, the energy feedback is firstly received by the capacitor in the drive which makes the voltage of the capacitor rise. When voltage rises to a certain level, the excess energy needs to be consumedby the regenerative resistance.

The recommended regenerative resistor specifications for the EL7 series are as follows：

**Table 4.2 Regenerative Resistance Specification Sheet**

| Drive | Built-in Resister Value (Ω) | Built-in Resister Power (W) |
|---|---|---|
| **EL7-*0400Z** | 100 | 50 |
| **EL7-*0750Z** | 50 | 50 |
| **EL7-*1000Z** | 50 | 100 |
| **EL7-*1500Z** | 50 | 100 |
| **EL7-*2000Z** | 50 | 100 |

Methods for determining regenerative resistance specification:

- Firstly, use the built-in resistor of the drive to run for a long time to observe if it can meet the requirements, ensure that the drive temperature d33<60℃, the braking circuit does not alarm (Regeneration load factor d14<80), and the drive does not report over-voltage error.
- If the drive temperature is high, try to reduce the regenerative energy power, or addexternal resistor with same specification (While adding external resistor, built-in resistor should be removed).
- If the braking resistor burns out, try to reduce the regenerative energy power, or addexternal resistor with same specification or even higher specification (While adding external resistor, built-in resistor should be removed).
- If d14 value is too large or accumulates rapidly, it means the regenerative energy is too large, and built-in resistor cannot consume the generated energy, try to reduce the regenerative energy power, or add external resistor with higher specification.
- If drive reported over-voltage error, try to reduce the regenerative energy power, or add external resistor with smaller specification, or add parallel resistor.

**(4) Brake cable**

When connecting to motor with magnetic encoder (ELM1S series motors), it is necessary to pay attention to polarity of brake cable, otherwise it will cause the abnormal motor action such as alarm occurring, motor accuracy declining, abnormal motor vibration.

**Attention**

- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U.V.W).
- Never start nor stop the servo motor with this magnetic contactor.
- Cable must be fixed steadily; avoid closing to radiator and motor to prevent reducing the properties of heat insulation.

## 4.1.2 Position Control Mode

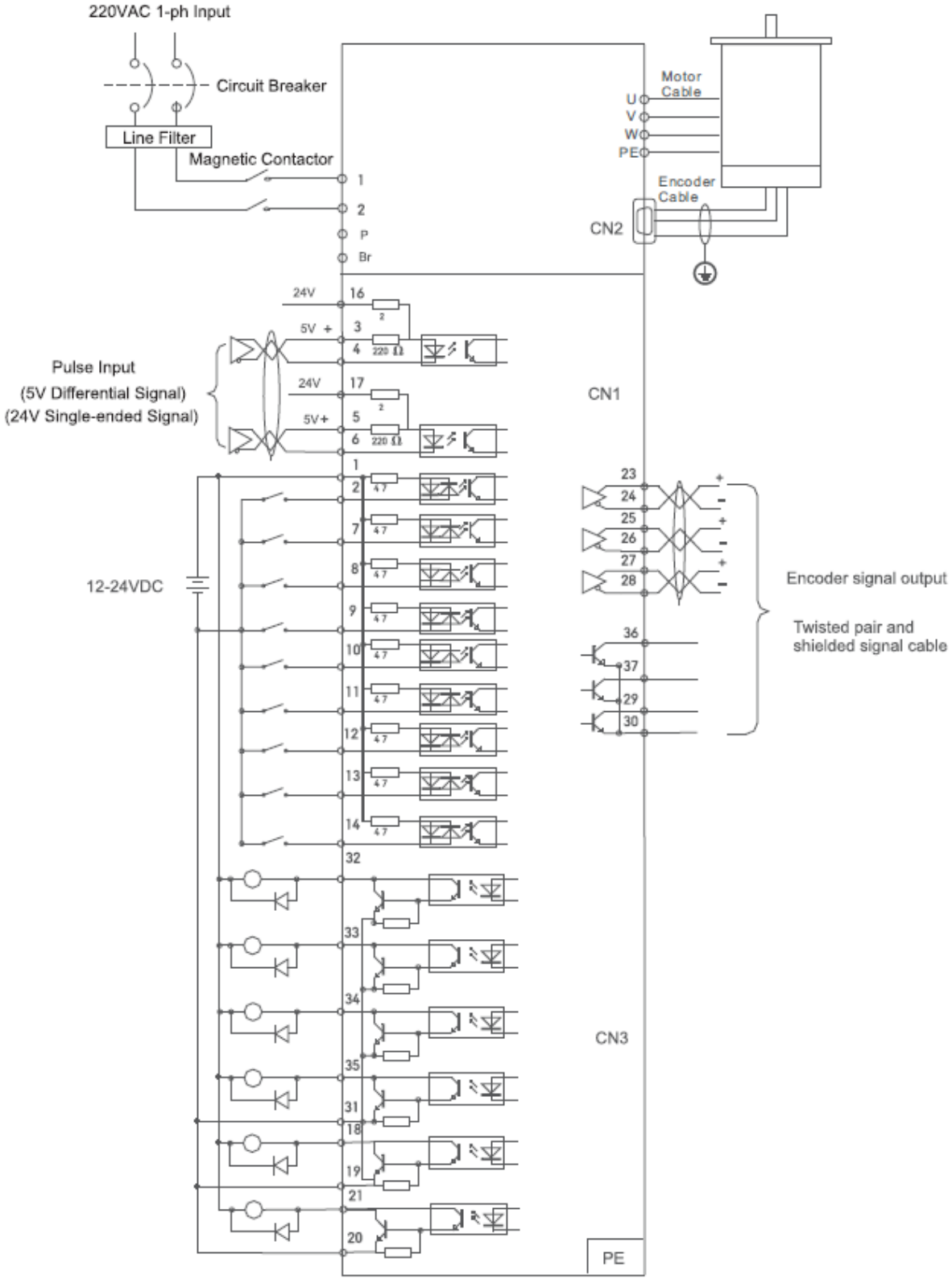



**Figure 4-1 Positional Control Mode Wiring**

**Note:** When the output power of drive you selected is higher than 1.5KW, we recommended using 3-phase power supply.

## 4.1.3 Torque /Velocity Control Mode

**Notice:** Analog input for Torque/Velocity mode is only available for EL7-RS***Z version

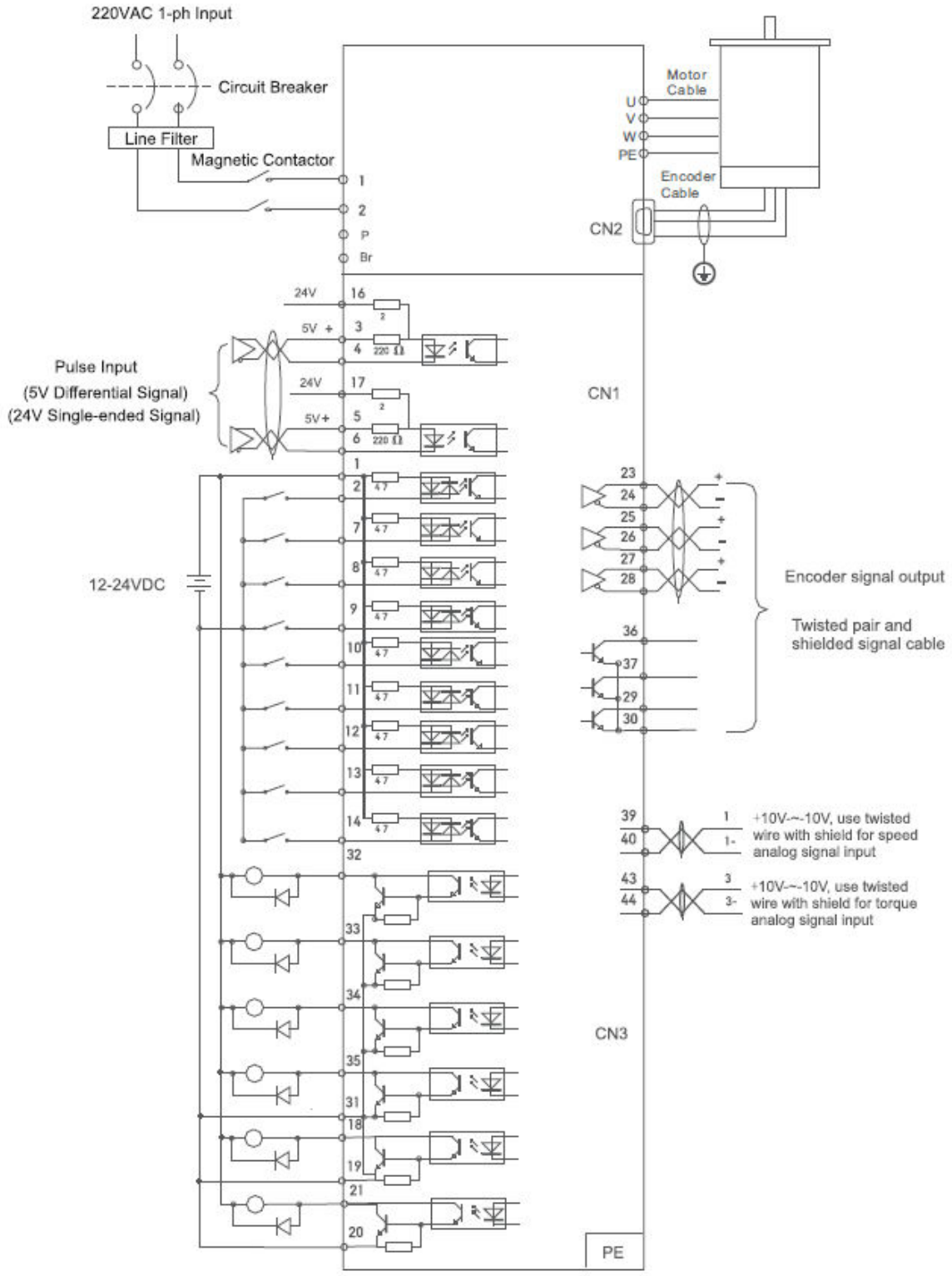



**Figure 4-2 Torque/Velocity Control Mode Wiring**

**Note:** When the output power of drive you selected is more than 1.5KW, we recommended using 3-phase power supply.

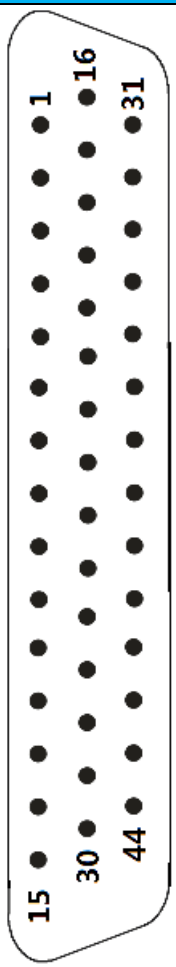
# 4.2 Drive Port Function

**Table 4.3 Drive Port Function**

| Port | Function |
|---|---|
| CN1 | Control Signal Port |
| CN2 | Encoder Input Port |
| CN3 | USB Communication Port |
| CN4 | RS232/ RS485 Communication Port (Only for EL7-RS***Z version) |
| CN5 | RS232/ RS485 Communication Port (Only for EL7-RS***Z version) |
| X1 | Power Port |

## 4.2.1 Control Signal Port-CN1

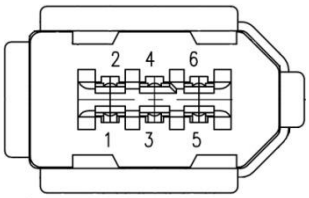
**Table 4.4 Signal Explanation of Control Signal Port-CN1**

| Port | Graphic | Pin | Signal | I/O | Name | Explanation |
|---|---|---|---|---|---|---|
| CN1 |  | 1 | COM_SI | Input | Digital input common terminal, Com+/Com-, 12VDC~24VDC | |
| | | 2 | SI1 | Input | Digital input 1 | Two-way digital input withcommon terminal<br>Configurable function<br>Recommended voltage: 12V ~ 24VDC |
| | | 7 | SI2 | Input | Digital input 2 | |
| | | 8 | SI3 | Input | Digital input 3 | |
| | | 9 | SI4 | Input | Digital input 4 | |
| | | 10 | SI5 | Input | Digital input 5 | |
| | | 11 | SI6 | Input | Digital input 6 | |
| | | 12 | SI7 | Input | Digital input 7 | |
| | | 13 | SI8 | Input | Digital input 8 | |
| | | 14 | SI9 | Input | Digital input 9 | |
| | | 31 | COM_SO | Output | Digital output common-terminal | Max voltage/current: 30V/50mA<br>Recommended voltage/current: 12V ~ 24VDC/ 10mA |
| | | 33 | SO1 + | Output | Digital output 1 | |
| | | 32 | SO2 + | Output | Digital output 2 | |
| | | 34 | SO3 + | Output | Digital output 3 | |
| | | 35 | SO4 + | Output | Digital output 4 | |
| | | 18 | SO5 + | Output | Differential Digital output 5 | Max voltage/current: 30V/50mA<br>Recommended voltage/ current: 12V ~ 24VDC/ 10mA |
| | | 19 | SO5- | Output | | |
| | | 20 | SO6- | Output | Differential Digital output 6 | |
| | | 21 | SO6 + | Output | | |
| | | 23 | A + | Output | Differential output terminal of motor encoder phase A | differential output<br>High voltage ≥ 2.5VDC<br>Low voltage ≤ 0.5VDC<br>Max current = ±20mA |
| | | 24 | A - | Output | | |
| | | 25 | B + | Output | Differential output | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 26 | B - | Output | terminal of motor encoder phase B | Only for NPN output |
| | | 27 | Z + | Output | Differential output terminal of motor encoder phase Z | |
| | | 28 | Z - | Output | | |
| | | 36 | OCA | Output | OC output terminal of motor encoder phase A | |
| | | 37 | OCB | Output | OC output terminal of motor encoder phase B | |
| | | 29 | OCZ | Output | OC output terminal of motor encoder phase Z | |
| | | 30 | GND | Output | OC output GND terminal of motor encoder | |
| | | 3 | PUL + | Input | Pulse input under position control mode<br>PUL+ and PUL-: 5V differential input PUL+_24 and PUL-: 24V differential input | |
| | | 4 | PUL - | Input | | |
| | | 16 | PUL + _24 | Input | | |
| | | 5 | DIR + | Input | Direction input under position control mode<br>DIR+ and DIR-: 5V differential input<br>DIR+_24 and DIR-: 24V differential input | |
| | | 6 | DIR - | Input | | |
| | | 17 | DIR + _24 | Input | | |
| | | 39 | AI1+ | Input | Differential analog input 1<br>Input voltage: -10VDC ~ +10VDC, input resistor: 20KΩ<br>Mainly for velocity mode (Analog input) | |
| | | 40 | AI1- | Input | | |
| | | 41 | AGND | Input | | |
| | | 43 | AI3 + | Input | Analog input 3, voltage input range: -10VDC~+10VDC, input resistor 20KΩ. for torque mode (Analog input) | |
| | | 44 | AI3 - | Input | | |
| | | 15.22.38.40.42 | NC | / | Not connect | |
| | | Shell | FG | / | Shield ground | |

## 4.2.2 Encoder Input Port-CN2

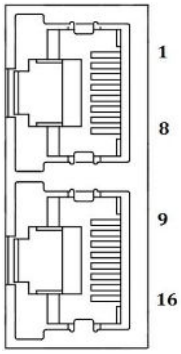
**Table 4.5 Signal Explanation of Encoder Input Port-CN2**

| Port | Graphic | Pin | Signal | Definition |
|---|---|---|---|---|
| CN2 |  | 1 | VCC5V | Encoder power 5V |
| | | 2 | GND | Encoder power GND |
| | | 3 | BAT+ | External battery + |
| | | 4 | BAT- | External battery - |
| | | 5 | SD+ | Series of encoders data + |
| | | 6 | SD- | Series of encoders data - |
| | | | PE | Shield ground |

## 4.2.3 RS232/ RS485 Communication Port-CN4/ CN5

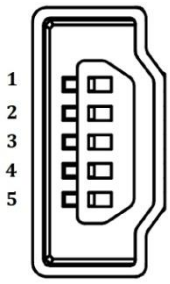
**Table 4.6 Signal Explanation of RS232/ RS485 Communication Port-CN4/ CN5**

| Port | Graphic | Pin | Signal | Definition |
|---|---|---|---|---|
| CN4 | | 1，9 | RDO+(RS485) | RS485 data + |
| CN5 | | 2，10 | RDO-(RS485) | RS485 data - |

| | | | | |
|---|---|---|---|---|
| |  | 3，11 | / | / |
| | | 4，12 | TXD(RS232) | RS232 sending end (reserved) |
| | | 5，13 | RXD(RS232) | RS232 receiving end (reserved) |
| | | 6，14 | VCC5V(RS232) | Power 5V + (reserved) |
| | | 7，15 | GND(RS232) | Power 5V GND (reserved) |
| | | 8，16 | / | / |
| | | | PE | Shield ground |

## 4.2.4 USB Communication Port-CN3

**Table 4.7 Signal Explanation of USB Communication Port-CN3**

| Port | Graphic | Pin | Signal | Definition |
|---|---|---|---|---|
| CN3 |  | 1 | VCC5V | Power 5V + |
| | | 2 | D+ | USB data + |
| | | 3 | D- | USB data - |
| | | 4 | / | / |
| | | 5 | GND | Power 5V GND |
| | | | USB_GND | Shield ground |

## 4.2.5 Power Port-X1

**Table 4.8 Main Power Input Port-X1**

| Port | Pin | Definition | Detail |
|---|---|---|---|
| X1 | L1 | Power phase L1 | For single phase 220V，+15～-15%，50/60Hz |
| | L2 | Power phase L2 | |
| Notes | (1) Isolation transformer can be used for power supply;<br>(2) Do Not access the 380VAC power supply, or it will cause serious damage to the drive;<br>(3) In the case of serious interference, it is recommended to use Noise filter for power supply;<br>(4) It is recommended to install a Non-fusible circuit breaker to cut off external power supply in time when the drive fails. | | |
| Port | Pin | Definition | Detail |
| X1 | P + | DC bus + terminal | (1) Drive Dc bus + terminal<br>(2) External regenerative resistor P terminal |
| | Br | External regenerative resistor terminal | External regenerative resistor terminal |
| Notes | When using external resistors, the values of resistance and power are selected as follows： | | |
| Port | Pin | Definition | Detail |
| X1 | U | U | 3 phase motor power input |
| | V | V | |
| | W | W | |
| | PE | PE | Frame ground |

| Notes | ① Connect the drive to the ground end (PE) of the motor and connect it to the earth |
|---|---|

# 4.3 I/O Interface Principles

## 4.3.1 Switch Input Interface

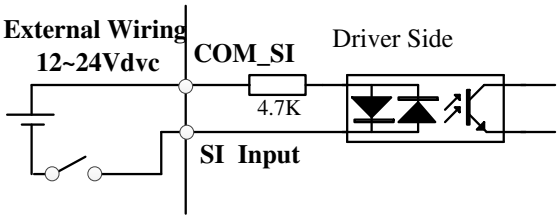



**Figure 4-3 Switch Input Interface**

1. The user provides power supply, DC 12-24V, current≥100mA.
2. **Notice:** if current polar connect reversely, servo drive doesn't run.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr4.00＊** | Name | Input selection SI1 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 303 | | |
| | Data Type | 16bit | Access | R/W | Address | 0401H | | |
| | Repower | o | | | | | | |
| **Pr4.01＊** | Name | Input selection SI2 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 | | |
| | Data Type | 16bit | Access | R/W | Address | 0403H | | |
| | Repower | o | | | | | | |
| **Pr4.02＊** | Name | Input selection SI3 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 | | |
| | Data Type | 16bit | Access | R/W | Address | 0405H | | |
| | Repower | o | | | | | | |
| **Pr4.03＊** | Name | Input selection SI4 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 | | |
| | Data Type | 16bit | Access | R/W | Address | 0207H | | |
| | Repower | o | | | | | | |
| **Pr4.04＊** | Name | Input selection SI5 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 | | |
| | Data Type | 16bit | Access | R/W | Address | 0409H | | |
| | Repower | o | | | | | | |
| **Pr4.05＊** | Name | Input selection SI6 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Data Type | 16bit | Access | R/W | Address | 040BH |
| | Repower | o | | | | |
| Pr4.06＊ | Name | Input selection SI7 | | | Mode | P S T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data Type | 16bit | Access | R/W | Address | 040DH |
| | Repower | o | | | | |
| Pr4.07＊ | Name | Input selection SI8 | | | Mode | P S T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data Type | 16bit | Access | R/W | Address | 040FH |
| | Repower | o | | | | |
| Pr4.08＊ | Name | Input selection SI9 | | | Mode | P S T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data Type | 16bit | Access | R/W | Address | 0411H |
| | Repower | o | | | | |

Set SI input function allocation.

This parameter use 16 binary system to set up the values,

For the function number, please refer to the following Figure.

| Signal Name | Symbol | Setup Value | |
|---|---|---|---|
| | | Normally Open | Normally Closed |
| Invalid | - | 00h | Do Not setup |
| Positive Direction Over-Travel Inhibition | POT | 01h | 81h |
| Negative Direction Over-Travel Inhibition | NOT | 02h | 82h |
| Servo-ON Input | SRV-ON | 03h | 83h |
| Alarm Clear Input | A-CLR | 04h | Do Not setup |
| Control Mode Switching Input | C-MODE | 05h | 85h |
| Gain Switching Input | GAIN | 06h | 86h |
| Deviation Counter Clear Input | CL | 07h | Do Not setup |
| Command Pulse Inhibition Input | INH | 08h | 88h |
| Electronic Gear Switching Input 1 | DIV1 | 0Ch | 8Ch |
| Electronic Gear Switching Input 2 | DIV2 | 0Dh | 8Dh |
| Selection 1 Input Of Internal Command Speed | INTSPD1 | 0Eh | 8Eh |
| Selection 2 Input Of Internal Command Speed | INTSPD2 | 0Fh | 8Fh |
| Selection 3 Input Of Internal Command Speed | INTSPD3 | 10h | 90h |
| Speed Zero Clamp Input | ZEROSPD | 11h | 91h |
| Speed Command Sign Input | VC-SIGN | 12h | 92h |
| Torque Command Sign Input | TC-SIGN | 13h | 93h |
| Forced Alarm Input | E-STOP | 14h | 94h |

Note:

- Normally open contact means when input signal is on and function is triggered.
- Normally closed contact means when input signal is off and function is triggered.
- Don’t setup to a value other than that specified in the table.

● Don't assign specific function to 2 or more signals. Duplicated assignment will cause Err21.0 I/F input multiple assignment error 1or Err21.1 I/F input multiple assignment error 2

**PR-Mode** related input setup as below:

| Input | | | |
|---|---|---|---|
| Signal Name | Symbol | Setup Value | |
| | | Normally Open | Normally Closed |
| Trigger Command | CTRG | 20h | A0h |
| Homing Signal | HOME | 21h | A1h |
| Forced Stop | STP | 22h | A2h |
| Forward Direction Jog | JOG+ | 23h | A3h |
| Opposite Direction Jog | JOG- | 24h | A4h |
| Positive Limit Switch | PL | 25h | A5h |
| Negative Limit Switch | NL | 26h | A6h |
| Homing Signal | ORG | 27h | A7h |
| Road Strength Address 0 | ADD0 | 28h | A8h |
| Road Strength Address 1 | ADD1 | 29h | A9h |
| Road Strength Address 2 | ADD2 | 2ah | Aah |
| Road Strength Address 3 | ADD3 | 2bh | Abh |
| Torque Switching | TC-SEL | 09h | 89h |

Note:

CTRG, HOME is edge triggered, but the valid level must be last more than 1ms.

I/O input digital filtering

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr5.15★ | Name | I/F reading filter | | | Mode | P | S | T |
| | Range | 0~255 | Unit | 0.1ms | Default | 0 | | |
| | Data Type | 16bit | Access | R/W | Address | 051FH | | |
| | Repower | o | | | | | | |
| I/O input digital filtering; higher setup will initiate control delay. | | | | | | | | |

## 4.3.2 Switch Output Interface

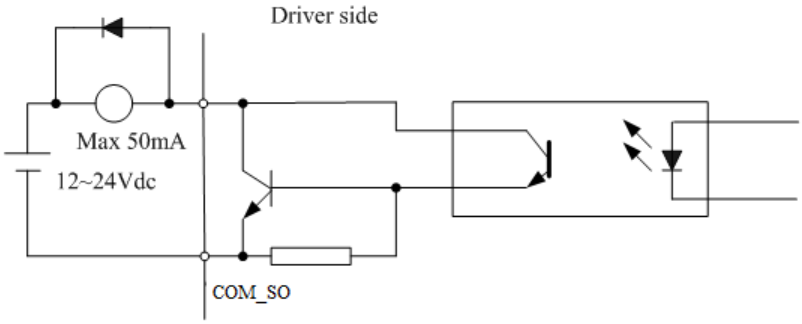



**Figure 4.4 Switch Output Interface**

(1) The user provides the external power supply. However, if current polarity connects reversely, servo drive is damaged.

(2) The output of the form is open-collector, the maximum voltage is 25V, and maximum current is 50mA. Therefore, the load of switch output signal must match the requirements. If you exceed the requirements or output directly connected with the power supply, the servo drive is damaged.

(3) If the load is inductive loads relays, etc., there must be anti-parallel freewheeling diode across the load. If the freewheeling diode is connected reversely, the servo drive is damaged.

(4) 32/33/34/35/31 Pin：Single-ended output;

18/19 Pin, 20/21 Pin：Differential output.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr4.10＊** | Name | Output selection SO1 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 101 | | |
| | Data Type | 16bit | Access | R/W | Address | 0415H | | |
| | Repower | o | | | | | | |
| **Pr4.11＊** | Name | Output selection SO2 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 202 | | |
| | Data Type | 16bit | Access | R/W | Address | 0417H | | |
| | Repower | o | | | | | | |
| **Pr4.12＊** | Name | Output selection SO3 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 404 | | |
| | Data Type | 16bit | Access | R/W | Address | 0419H | | |
| | Repower | o | | | | | | |
| **Pr4.13＊** | Name | Output selection SO4 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 303 | | |
| | Data Type | 16bit | Access | R/W | Address | 041BH | | |
| | Repower | o | | | | | | |
| **Pr4.14＊** | Name | Output selection SO5 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 101 | | |
| | Data Type | 16bit | Access | R/W | Address | 041DH | | |
| | Repower | o | | | | | | |
| **Pr4.15＊** | Name | Output selection SO6 | | | Mode | **P** | **S** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 303 | | |
| | Data Type | 16bit | Access | R/W | Address | 041FH | | |
| | Repower | o | | | | | | |

Assign functions to SO outputs.
This parameter use 16 binary system do setup
For the function number, please refer to the following Figure.

| Signal Name | Symbol | Setup Value |
|---|---|---|
| Invalid | - | 00h |
| Alarm Output | Alm | 01h |
| Servo-Ready Output | S-RDY | 02h |
| Eternal Brake Release Signal | BRK-OFF | 03h |
| Positioning Complete Output | INP | 04h |
| At-Speed Output | AT-SPPED | 05h |
| Zero-Speed Detection Output | ZSP | 07h |

| | | |
|---|---|---|
| Velocity Coincidence Output | V-COIN | 08h |
| Positional Command ON/OFF Output | P-CMD | 0Bh |
| Speed Command ON/OFF Output | V-CMD | 0Fh |

**PR-Mode** related output setup as below;

| Output | | | |
|---|---|---|---|
| Signal Name | Symbol | Set Value | |
| | | Normally Open | Normally Closed |
| Command Complete | CMD-OK | 20h | A0h |
| Road Strength Address | MC-OK | 21h | A1h |
| Homing Finish | HOME-OK | 22h | A2h |
| Torque Limit | TQL | 06h | 86h |

Note:
CMD-OK indicates PR command sent complete, but the motor may Not in-position.
MC-OK indicates command complete and the motor in-position.
*1 Pay attention to the front panel display is hexadecimal.

## 4.3.3 Pulse Input Interface

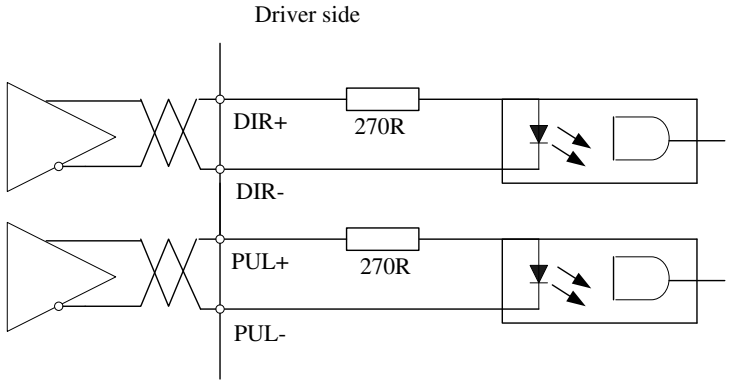
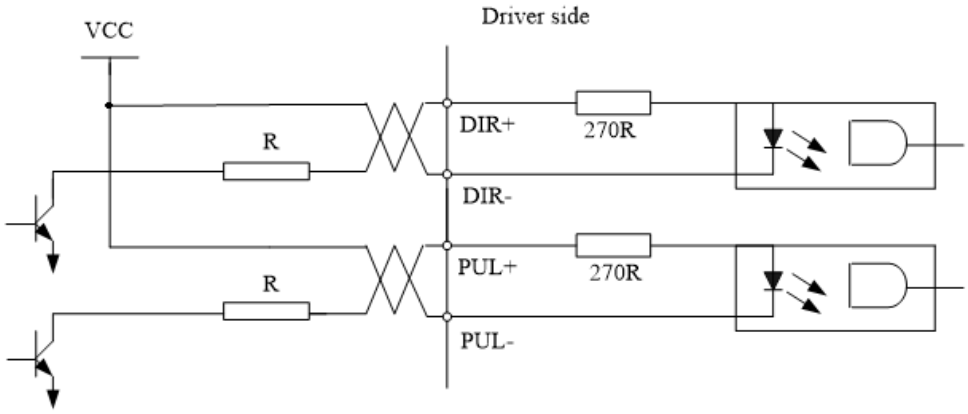



**Figure 4-6 Differential 5V Pulse Signal（Pin3/Pin4/Pin5/Pin6 of CN1 Terminal）**




Vcc =12V, R = 1K, 0.25W; Vcc =24V, R = 2K, 0.25W

**Figure 4-5 Pulse Input Interface Single Terminal Drive Mode**

(1) In order to transmit pulse data properly, we recommend using the differential drive mode.

(2) The differential drive mode, AM26LS31, MC3487 or similar RS422 line drive.

(3) Using of single-ended drive will cause reduction of the operation frequency. The value of the resistance R

depends on pulse input circuit and the external voltage, while drive current should be at the range of 10 - 15mA and the maximum voltage is No. more than 25V.

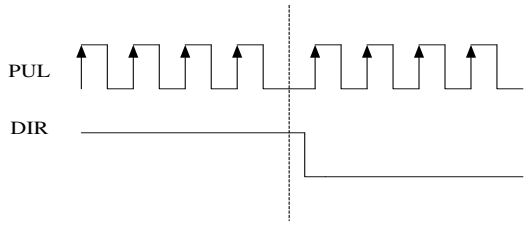
**Recommendation:**

VCC = 24V, R = 1.3 to 2KΩ;
VCC = 12V, R = 510 ~ 820Ω;
VCC = 5V, R = 82 ~ 120Ω.

(4) The users provide external power supply for single-ended pulse signal. However, the wrong connection of pulse polarity will cause servo drive damaged.

(5) The form of pulse input is the following form 4.9 below, while the arrow indicates the count.

**Table 4.9 Pulse Input Form**

| Pulse Command Form | CCW | CW | Parameter Setting Value |
|---|---|---|---|
| Pulse Symbol |  | | Pulse + direction |

The form of pulse input timing parameter is the following form 4.10 below. The 4 times pulse frequency ≤ 500kH if 2-phase input form is used.

**Table 4.10 Parameters of Pulse Input Time Sequence**

| Parameter | Differential Drive Input | Single-Ended Drive Input |
|---|---|---|
| $t_{ck}$ | ＞2μs | ＞5μs |
| $t_h$ | ＞1μs | ＞2.5μs |
| $t_l$ | ＞1μs | ＞2.5μs |
| $t_{rh}$ | ＜0.2μs | ＜0.3μs |
| $t_{rl}$ | ＜0.2μs | ＜0.3μs |
| $t_s$ | ＞1μs | ＞2.5μs |
| $t_{qck}$ | ＞8μs | ＞10μs |
| $t_{qh}$ | ＞4μs | ＞5μs |
| $t_{ql}$ | ＞4μs | ＞5μs |
| $t_{qrh}$ | ＜0.2μs | ＜0.3μs |
| $t_{qrl}$ | ＜0.2μs | ＜0.3μs |
| $t_{qs}$ | ＞1μs | ＞2.5μs |

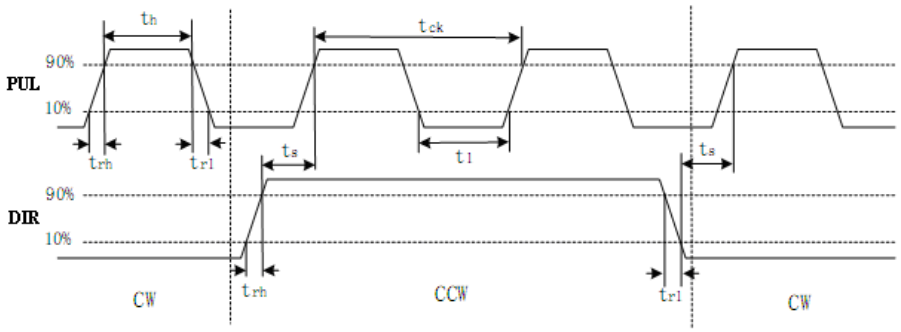
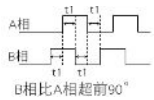
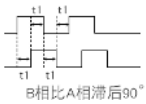
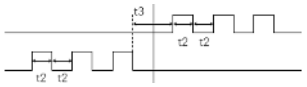
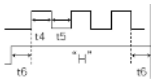
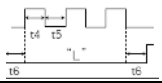
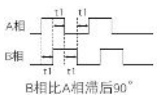
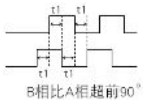
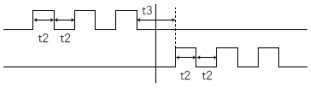
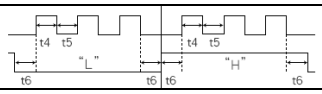



**Figure 4.6 Pulse + Direction Input Interface Timing (The Maximum of Pulse Frequency: 500KHZ)**

| Pr0.06* | Name | Command Pulse Rotational Direction Setup | Mode | P | | |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 |
| | Data Type | 16bit | Access | R/W | Address | 000DH |
| | Repower | o | | | | |
| Set command pulse input rotate direction, command pulse input type | | | | | | |
| **Pr0.07*** | Name | Command Pulse Input Mode Setup | | | Mode | **P** |
| | Range | 0~3 | Unit | — | Default | 1 |
| | Data Type | 16bit | Access | R/W | Address | 000FH |
| | Repower | o | | | | |

| Pr0.06 | Pr0.07 | Command Pulse Format | Signal | Positive Direction Command | Negative Direction Command |
|---|---|---|---|---|---|
| 0 | 0 or 2 | 90 degrees phase difference 2-phase pulse(phase A +phase B) | Pulse sign |  |  |
| | 1 | Positive direction pulse + negative direction pulse | Pulse sign |  | |
| | 3 | Pulse + sign | Pulse sign |  |  |
| 1 | 0 or 2 | 90 degrees phase difference 2 phase pulse(phase A +phase B) | Pulse sign |  |  |
| | 1 | Positive direction pulse + negative direction pulse | Pulse sign |  | |
| | 3 | Pulse + sign | Pulse sign |  | |

Command pulse input signal allow largest frequency and smallest time width

| PULS/SIGN Signal Input I/F | | Permissible Max. Input Frequency | Smallest Time Width | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | t1 | t2 | t3 | t4 | t5 | t6 |
| Pulse series interface | Long distance interface | 500kpps | 2 | 1 | 1 | 1 | 1 | 1 |
| | Open-collector output | 200kpps | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |

## 4.3.4 Analog Value Input Interface

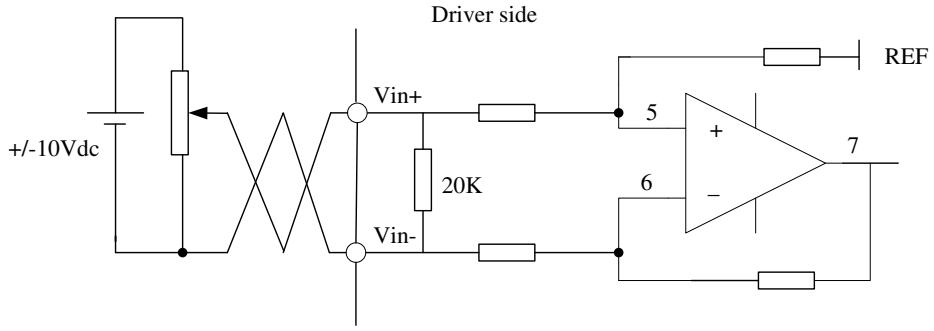



**Figure 4-7 Analog AI1 Input Interface**

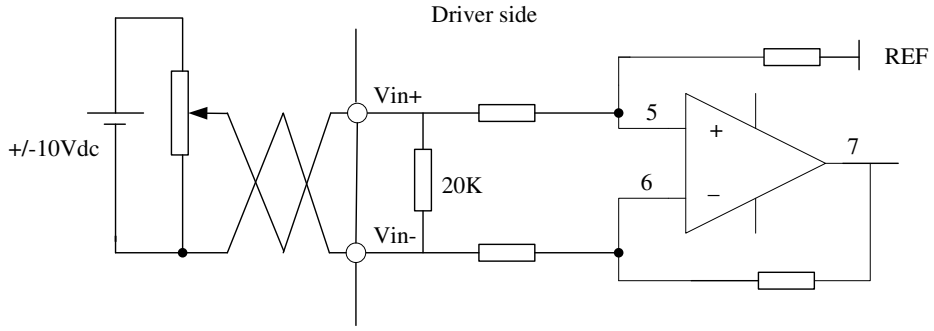



**Figure 4-8 Analog AI3 Input Interface**

# 4.4 Battery Installation

➢ **First Installation of the Battery**

After installing and connecting the back-up battery to the motor, and executing an absolute multi-turn encoder setup, it is recommended to perform ON/OFF action once a day after installing the battery for refreshing the battery.

A battery error might occur due to voltage delay of the battery if you fail you to carry out battery refreshment.

➢ **Replacement of the Battery**

It is necessary to replace the battery for absolute multi-turn encoder when battery alarm occurs. Replace while turning on the control power, data stored in the encoder might be lost when you replace the battery the control power of drive is off.

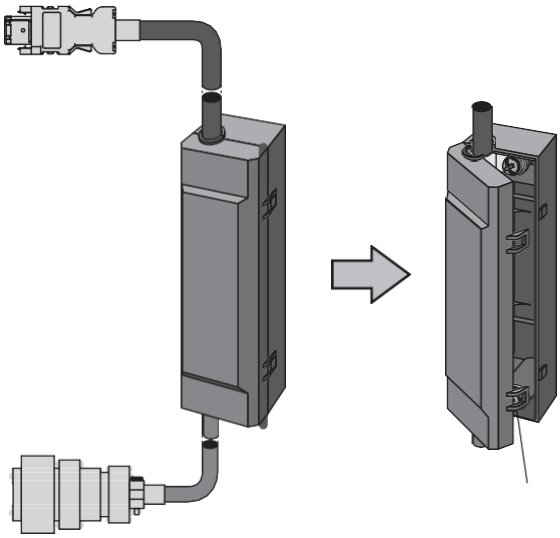
After replacing the battery, clear the battery alarm.

➢ **How to Replace the Battery**

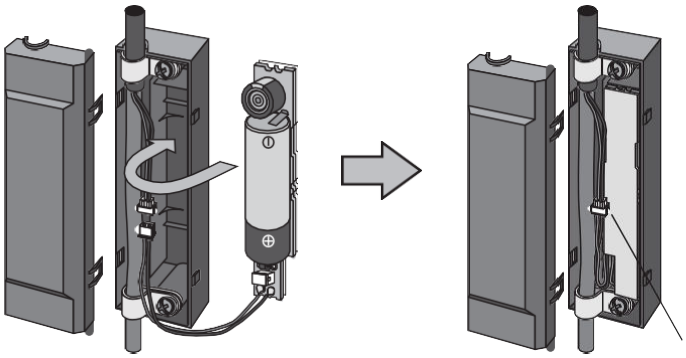
(1) Refresh the new battery, pull out connector.

Pull out after 5min connection

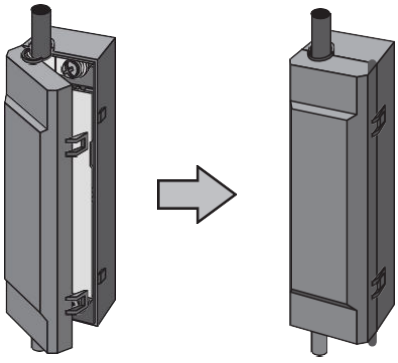
(2) Take off the cover of the battery box.



(3) Install the battery to the battery box.



(4) Close the cover of the battery box.



➢ **Life of the Battery**

Following the example shows the life calculation of the back-up battery.

| Item | Working situation 1 | Working situation 2 |
|---|---|---|
| **Working days (days)** | 313 | 52 |
| **T1 (h)** | 8 | 0 |
| **T2 (h)** | 0.1 | 0 |
| **T3 (h)** | 15.9 | 24 |

- **Working days in working situation 1:** Monday to Saturday in every week.
- **Working days in working situation 2:** Sunday in every week.
- **T1: time of normal working.**
- **T2: time of motor running while power off.**
- **T3: time of motor stopping while power off.**
- **Annual consumption capacity =**
  (8h*2uA+0.1h*80uA+15.9h*10uA)*313days+(0h*2uA+0h*80uA+24h*10uA) = 70mAh
- **Battery life =** battery capacity / annual consumption capacity = 2600mAh / 70mAh = 37.1years

# 4.5 Anti-Interference Solution

➢ **Circuit breaker**

The short-circuit protection circuit on the product is not for protection or branch circuit, the branch circuit should be protected in accordance with NEC and the applicable local regulations in your area.

➢ **Noise filter**

- Select a noise filter whose capacity is commensurate with the power source capacity (in consideration of load condition).
- For the detailed specifications of each noise filter, contact the manufacture.
- When two or more servo drives are used with a single noise filter at the common power source, consult with the noise filter manufacture.
- Do not run the input and output wiring on the same passage: noise resistance will drop.
- Isolate the input and output line from each other.

➢ **Surge absorber**

When performing withstand voltage test of machine and equipment, be sure to remove the surge absorber, otherwise it will be damaged.

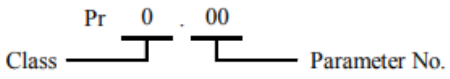
➢ **Grounding**

- To prevent electric shock, be sure to connect the ground terminal of the drive, and the ground terminal (PE) of the control panel.
- The ground terminal must not be shared with other equipment. Two ground terminals are provided.

# Chapter 5 Parameter

## 5.1 Parameter List

- A parameter is designated as follows:




- Definition of symbols under "Mode" – P: position control, S: velocity control, T: torque control, PR: PR control.
- 32bit data，high data before, low data after.

| Parameter Number | | Name | Default value | Effective | Mode | | | Communication | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Classify | NO. | | | | P | V | T | Data length | Access | Modbus Address |
| 【Class 0】 Basic Setting | 00 | MFC Function | 1 | Immediate | √ | — | — | 16bit | R/W | 0x0001 |
| | 01 | Control mode setup | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0003 |
| | 02 | Real-time auto-gain tuning | 2 | Immediate | √ | √ | √ | 16bit | R/W | 0x0005 |
| | 03 | Selection of machine stiffness at real-time auto-gain tuning | 70 | Immediate | √ | √ | √ | 16bit | R/W | 0x0007 |
| | 04 | Inertia ratio | 250 | Immediate | √ | √ | √ | 16bit | R/W | 0x0009 |
| | 06 | Command pulse rotational direction setup | 0 | Power-on again | √ | — | — | 16bit | R/W | 0x000D |
| | 07 | Command pulse input mode setup | 3 | Power-on again | √ | — | — | 16bit | R/W | 0x000F |
| | 08 | Command pulse per one motor revolution | 10000 | Power-on again | √ | — | — | 32bit | R/W | 0x0010 0x0011 |
| | 09 | 1st numerator of electronic gear | 1 | Power-on again | √ | — | — | 32bit | R/W | 0x0012 0x0013 |
| | 10 | Denominator of electronic gear | 1 | Power-on again | √ | — | — | 32bit | R/W | 0x0014 0x0015 |
| | 11 | Output pulse counts per one motor revolution | 2500 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0017 |
| | 12 | Reversal of pulse output logic | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0019 |
| | 13 | 1st Torque Limit | 300 | Immediate | √ | √ | √ | 16bit | R/W | 0x001B |
| | 14 | Position deviation excess setup | 200 | Immediate | √ | — | — | 16bit | R/W | 0x001D |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | Absolute encoder setup | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x001F |
| | 16 | External regenerative discharge resistor setup | 100 | Immediate | √ | √ | √ | 16bit | R/W | 0x0021 |
| | 17 | External regenerative discharge power value | 50 | Immediate | √ | √ | √ | 16bit | R/W | 0x0023 |
| | 22 | PR and P/V/T control mode switching | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x002D |
| | 25 | Auxiliary Function | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0033 |
| | 26 | Virtual IO | / | Immediate | √ | √ | √ | 16bit | R/W | 0x0035 |
| | 40 | Mapping parameter 1 | 0x0 | Immediate | √ | √ | √ | 32bit | R/W* | 0x0050<br>0x0051 |
| | 41 | Mapping parameter 2 | 0x0 | Immediate | √ | √ | √ | 32bit | R/W* | 0x0052<br>0x0053 |
| | 42 | Mapping parameter 3 | 0x0 | Immediate | √ | √ | √ | 32bit | R/W* | 0x0054<br>0x0055 |
| | 43 | Mapping parameter 4 | 0x0 | Immediate | √ | √ | √ | 32bit | R/W* | 0x0056<br>0x0057 |
| | 44 | Mapping parameter 5 | 0x0 | Immediate | √ | √ | √ | 32bit | R/W* | 0x0058<br>0x0059 |
| | 45 | Mapping parameter 6 | 0x0 | Immediate | √ | √ | √ | 32bit | R/W* | 0x005A<br>0x005b |
| | 46 | Mapping parameter 7 | 0x0 | Immediate | √ | √ | √ | 32bit | R/W* | 0x005C<br>0x005d |
| | 47 | Mapping parameter 8 | 0x0 | Immediate | √ | √ | √ | 32bit | R/W* | 0x005E<br>0x005F |
| | 50 | Mapping parameter 1 pointer | 0x00490049 | Immediate | √ | √ | √ | 32bit | R/W | 0x0064<br>0x0065 |
| | 51 | Mapping parameter 2 pointer | 0x00490049 | Immediate | √ | √ | √ | 32bit | R/W | 0x0066<br>0x0067 |
| | 52 | Mapping parameter 3 pointer | 0x00490049 | Immediate | √ | √ | √ | 32bit | R/W | 0x0068<br>0x0069 |
| | 53 | Mapping parameter 4 pointer | 0x00490049 | Immediate | √ | √ | √ | 32bit | R/W | 0x006A<br>0x006B |
| | 54 | Mapping parameter 5 pointer | 0x00490049 | Immediate | √ | √ | √ | 32bit | R/W | 0x006C<br>0x006D |
| | 55 | Mapping parameter 6 pointer | 0x00490049 | Immediate | √ | √ | √ | 32bit | R/W | 0x006E<br>0x007F |
| | 56 | Mapping parameter 7 pointer | 0x00490049 | Immediate | √ | √ | √ | 32bit | R/W | 0x0070<br>0x0071 |
| | 57 | Mapping parameter 8 pointer | 0x00490049 | Immediate | √ | √ | √ | 32bit | R/W | 0x0072<br>0x0073 |

| Parameter Number | Name | Default value | Effective | Mode | Communication |
|---|---|---|---|---|---|

| Classify | NO. | | | | P | V | T | Data length | Access | Modbus Address |
|---|---|---|---|---|---|---|---|---|---|---|
| 【Class 1】 Gain Adjust | 00 | 1st gain of position loop | 320 | Immediate | √ | — | — | 16bit | R/W | 0x0101 |
| | 01 | 1st gain of velocity loop | 180 | Immediate | √ | √ | √ | 16bit | R/W | 0x0103 |
| | 02 | 1st time constant of velocity loop integration | 310 | Immediate | √ | √ | √ | 16bit | R/W | 0x0105 |
| | 03 | 1st filter of velocity detection | 15 | Immediate | √ | √ | √ | 16bit | R/W | 0x0107 |
| | 04 | 1st time constant of torque filter | 126 | Immediate | √ | √ | √ | 16bit | R/W | 0x0109 |
| | 05 | 2nd gain of position loop | 380 | Immediate | √ | — | — | 16bit | R/W | 0x010B |
| | 06 | 2nd gain of velocity loop | 180 | Immediate | √ | √ | √ | 16bit | R/W | 0x010D |
| | 07 | 2nd time constant of velocity loop integration | 10000 | Immediate | √ | √ | √ | 16bit | R/W | 0x010F |
| | 08 | 2nd filter of velocity detection | 15 | Immediate | √ | √ | √ | 16bit | R/W | 0x0111 |
| | 09 | 2nd time constant of torque filter | 126 | Immediate | √ | √ | √ | 16bit | R/W | 0x0113 |
| | 10 | Velocity feed forward gain | 300 | Immediate | √ | — | — | 16bit | R/W | 0x0115 |
| | 11 | Velocity feed forward filter | 50 | Immediate | √ | — | — | 16bit | R/W | 0x0117 |
| | 12 | Torque feed forward gain | 0 | Immediate | √ | √ | — | 16bit | R/W | 0x0119 |
| | 13 | Torque feed forward filter | 0 | Immediate | √ | √ | — | 16bit | R/W | 0x011B |
| | 15 | Control switching mode | 0 | Immediate | √ | — | — | 16bit | R/W | 0x011F |
| | 17 | Control switching level | 50 | Immediate | √ | — | — | 16bit | R/W | 0x0123 |
| | 18 | Control switch hysteresis | 33 | Immediate | √ | — | — | 16bit | R/W | 0x0125 |
| | 19 | Gain switching time | 33 | Immediate | √ | — | — | 16bit | R/W | 0x0127 |
| | 35 | Positional command filter setup | 0 | Power-on again | √ | — | — | 16bit | R/W | 0x0147 |
| | 37 | Special Register | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x014B |

| Parameter Number | | Name | Default value | Effective | Mode | | | Communication | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Classify | NO. | | | | P | V | T | Data length | Access | Modbus Address |
| 【Class 2】 Vibration Restrain Function | 00 | Adaptive filter mode setup | 0 | Immediate | √ | √ | — | 16bit | R/W | 0x0201 |
| | 01 | 1st notch frequency | 2000 | Immediate | √ | √ | √ | 16bit | R/W | 0x0203 |
| | 02 | 1st notch width selection | 2 | Immediate | √ | √ | √ | 16bit | R/W | 0x0205 |
| | 03 | 1st notch depth selection | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0207 |
| | 04 | 2nd notch frequency | 2000 | Immediate | √ | √ | √ | 16bit | R/W | 0x0209 |
| | 05 | 2nd notch width selection | 2 | Immediate | √ | √ | √ | 16bit | R/W | 0x020B |
| | 06 | 2nd notch depth selection | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x020D |
| | 07 | 3rd notch frequency | 2000 | Immediate | √ | √ | √ | 16bit | R/W | 0x020F |
| | 08 | 3rd notch width selection | 2 | Immediate | √ | √ | √ | 16bit | R/W | 0x0211 |
| | 09 | 3rd notch depth selection | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0213 |
| | 14 | 1st damping frequency | 0 | Immediate | √ | — | — | 16bit | R/W | 0x021D |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 2nd damping frequency | 0 | Immediate | √ | — | — | 16bit | R/W | 0x0221 |
| | 22 | Positional command smooth filter | 0 | Power-on again | √ | — | — | 16bit | R/W | 0x022D |
| | 23 | Positional command fir filter | 0 | Power-on again | √ | — | — | 16bit | R/W | 0x022F |

| Parameter Number | | Name | Default value | Effective | Mode | | | Communication | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Classify | NO. | | | | P | V | T | Data length | Access | Modbus Address |
| 【Class 3】 Velocity, Torque Control | 00 | Velocity setup internal/external switching | 0 | Immediate | — | √ | — | 16bit | R/W | 0x0301 |
| | 01 | Speed command rotational direction selection | 0 | Immediate | — | √ | — | 16bit | R/W | 0x0303 |
| | 02 | Speed command input gain | 500 | Immediate | — | √ | √ | 16bit | R/W | 0x0305 |
| | 03 | Speed command reversal input | 0 | Immediate | — | √ | — | 16bit | R/W | 0x0307 |
| | 04 | 1st speed setup | 0 | Immediate | — | √ | — | 16bit | R/W | 0x0309 |
| | 05 | 2nd speed setup | 0 | Immediate | — | √ | — | 16bit | R/W | 0x030B |
| | 06 | 3rd speed setup | 0 | Immediate | — | √ | — | 16bit | R/W | 0x030D |
| | 07 | 4th speed setup | 0 | Immediate | — | √ | — | 16bit | R/W | 0x030F |
| | 08 | 5th speed setup | 0 | Immediate | — | √ | — | 16bit | R/W | 0x0311 |
| | 09 | 6th speed setup | 0 | Immediate | — | √ | — | 16bit | R/W | 0x0313 |
| | 10 | 7th speed setup | 0 | Immediate | — | √ | — | 16bit | R/W | 0x0315 |
| | 11 | 8th speed setup | 0 | Immediate | — | √ | — | 16bit | R/W | 0x0317 |
| | 12 | Time setup acceleration | 100 | Immediate | — | √ | — | 16bit | R/W | 0x0319 |
| | 13 | Time setup deceleration | 100 | Immediate | — | √ | — | 16bit | R/W | 0x031B |
| | 14 | Sigmoid acceleration/deceleration time setup | 0 | Power-on again | — | √ | — | 16bit | R/W | 0x031D |
| | 15 | Speed zero-clamp function selection | 0 | Immediate | — | √ | — | 16bit | R/W | 0x031F |
| | 16 | Speed zero-clamp level | 30 | Immediate | — | √ | — | 16bit | R/W | 0x0321 |
| | 17 | Torque command selection | 0 | Immediate | — | — | √ | 16bit | R/W | 0x0323 |
| | 18 | Torque command direction selection | 0 | Immediate | — | — | √ | 16bit | R/W | 0x0325 |
| | 19 | Torque command input gain | 30 | Immediate | — | — | √ | 16bit | R/W | 0x0327 |
| | 20 | Torque command input reversal | 0 | Immediate | — | — | √ | 16bit | R/W | 0x0329 |
| | 21 | Speed limit value 1 | 0 | Immediate | — | — | √ | 16bit | R/W | 0x032B |
| | 22 | 2nd torque limit | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x032D |
| | 23 | Speed zero-motor standstill delay time | 0 | Immediate | — | √ | — | 16bit | R/W | 0x032F |
| | 24 | Maximum speed of motor rotation | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0331 |
| | 28 | Synchrono.us parameter setting of gantry | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0339 |
| | 29 | Analog 1- clamp voltage | 0 | Immediate | — | — | √ | 16bit | R/W | 0x033B |
| | 30 | Analog 3- clamp voltage | 0 | Immediate | — | — | √ | 16bit | R/W | 0x033D |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | Velocity analog (only modbus setup) | 0 | Immediate | — | √ | √ | 16bit | R/W | 0x037D |
| | 63 | Torque analog (only modbus setup) | 0 | Immediate | — | — | √ | 16bit | R/W | 0x037F |

| Parameter Number | | Name | Default value | Effective | Mode | | | Communication | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Classify | NO. | | | | P | V | T | Data length | Access | Modbus Address |
| 【Class 4】 I/F Monitor Setting | 00 | Input selection SI1 | 3 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0401 |
| | 01 | Input selection SI2 | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0403 |
| | 02 | Input selection SI3 | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0405 |
| | 03 | Input selection SI4 | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0407 |
| | 04 | Input selection SI5 | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0409 |
| | 05 | Input selection SI6 | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x040B |
| | 06 | Input selection SI7 | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x040D |
| | 07 | Input selection SI8 | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x040F |
| | 08 | Input selection SI9 | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0411 |
| | 10 | Output selection SO1 | 1 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0415 |
| | 11 | Output selection SO2 | 2 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0417 |
| | 12 | Output selection SO3 | 4 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0419 |
| | 13 | Output selection SO4 | 3 | Power-on again | √ | √ | √ | 16bit | R/W | 0x041B |
| | 14 | Output selection SO5 | 1 | Power-on again | √ | √ | √ | 16bit | R/W | 0x041D |
| | 15 | Output selection SO6 | 3 | Power-on again | √ | √ | √ | 16bit | R/W | 0x041F |
| | 22 | Analog input 1(AI 1) offset setup | 0 | Immediate | — | √ | √ | 16bit | R/W | 0x042D |
| | 23 | Analog input 1(AI 1) filter | 0 | Immediate | — | √ | √ | 16bit | R/W | 0x042F |
| | 24 | Analog input 1(AI 1) over-voltage setup | 0 | Immediate | — | √ | √ | 16bit | R/W | 0x0431 |
| | 28 | Analog input 3(AI 3) offset setup | 0 | Immediate | — | √ | √ | 16bit | R/W | 0x0439 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 29 | Analog input 3(AI 3) filter | 0 | Immediate | — | √ | √ | 16bit | R/W | 0x43B |
| | 30 | Analog input 3(AI 3) over-voltage setup | 0 | Immediate | — | — | √ | 16bit | R/W | 0x043D |
| | 31 | Positioning complete range | 10 | Immediate | √ | — | — | 16bit | R/W | 0x043F |
| | 32 | Positioning complete output setup | 0 | Immediate | √ | — | — | 16bit | R/W | 0x0441 |
| | 33 | INP hold time | 0 | Immediate | √ | — | — | 16bit | R/W | 0x0443 |
| | 34 | Zero-speed | 50 | Immediate | √ | √ | √ | 16bit | R/W | 0x0445 |
| | 35 | Speed coincidence range | 50 | Immediate | | √ | — | 16bit | R/W | 0x0447 |
| | 36 | At-speed | 1000 | Immediate | | √ | — | 16bit | R/W | 0x0449 |
| | 37 | Mechanical brake action at stalling setup | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x044B |
| | 38 | Mechanical brake action at running setup | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x044D |
| | 39 | Brake action at running setup | 30 | Immediate | √ | √ | √ | 16bit | R/W | 0x044F |
| | 43 | E-stop function active | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0457 |

| Parameter Number | | Name | Default value | Effective | Mode | | | Communication | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Classify | NO. | | | | P | V | T | Data length | Access | Modbus Address |
| 【Class 5】 Extended Setup | 00 | 2nd numerator of electronic gear | 10000 | Power-on again | √ | — | — | 32bit | R/W | 0x0500 0x0501 |
| | 01 | 3rd numerator of electronic gear | 1 | Power-on again | √ | — | — | 32bit | R/W | 0x0502 0x0503 |
| | 02 | 4th numerator of electronic gear | 1 | Power-on again | √ | — | — | 32bit | R/W | 0x0504 0x0505 |
| | 04 | Drive inhibit input setup | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0509 |
| | 06 | Sequence at servo-off | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x050D |
| | 09 | Main power off detection time | 70 | Immediate | √ | √ | √ | 16bit | R/W | 0x0513 |
| | 10 | Dynamic braking mode | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0515 |
| | 11 | Torque setup for emergency stop | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0517 |
| | 12 | Over-load level setup | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0519 |
| | 13 | Over-speed level setup | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x051B |
| | 15 | I/f reading filter | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x051F |
| | 17 | Counter clear up input mode | 3 | Immediate | √ | — | — | 16bit | R/W | 0x0523 |
| | 20 | Position setup unit select | 2 | Immediate | √ | — | — | 16bit | R/W | 0x0529 |
| | 21 | Selection of torque limit | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x052B |
| | 22 | 2nd torque limit | 300 | Immediate | √ | √ | √ | 16bit | R/W | 0x052D |
| | 23 | Torque limit switching setup 1 | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x052F |
| | 24 | Torque limit switching setup 2 | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0531 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 28 | Led initial status | 1 | Immediate | √ | √ | √ | 16bit | R/W | 0x0539 |
| | 29 | Modbus mode selection | 21 | Immediate | √ | √ | √ | 16bit | R/W | 0x053B |
| | 30 | Modbus baud rate setup | 2 | Immediate | √ | √ | √ | 16bit | R/W | 0x053D |
| | 31 | Modbus slave axis address | 1 | Immediate | √ | √ | √ | 16bit | R/W | 0x053F |
| | 32 | Command pulse input maximum setup | 0 | Immediate | √ | — | — | 16bit | R/W | 0x0541 |
| | 35 | Front panel lock setup | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0547 |
| | 36 | Password for opening group 7 parameter | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0549 |

| Parameter Number | | Name | Default value | Effective | Mode | | | Communication | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Classify | NO. | | | | P | V | T | Data length | Access | Modbus Address |
| 【Class 6】 Special Setup | 01 | Encoder zero position compensation | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x0603 |
| | 03 | Jog trial run command torque | 0 | Immediate | √ | — | — | 16bit | R/W | 0x0607 |
| | 04 | Jog trial run command speed | 400 | Immediate | √ | — | — | 16bit | R/W | 0x0609 |
| | 05 | Position 3rd Gain Valid Time | 0 | Immediate | √ | — | — | 16bit | R/W | 0x060B |
| | 06 | Position 3rd Gain Scale Factor | 100 | Immediate | √ | — | — | 16bit | R/W | 0x060D |
| | 07 | Torque command additional value | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x060F |
| | 08 | Positive direction torque compensation value | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0611 |
| | 09 | Negative direction torque compensation value | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0613 |
| | 10 | Function extension | 0x0 | Power-on again | √ | — | — | 16bit | R/W | 0x0615 |
| | 11 | Current response setup | 100 | Immediate | √ | √ | √ | 16bit | R/W | 0x0617 |
| | 14 | Emergency stop time at alarm | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x061D |
| | 20 | Distance of trial running | 10 | Immediate | √ | — | — | 16bit | R/W | 0x0629 |
| | 21 | Waiting time of trial running | 100 | Immediate | √ | — | — | 16bit | R/W | 0x062B |
| | 22 | Cycling times of trial running | 5 | Immediate | √ | — | — | 16bit | R/W | 0x062D |
| | 25 | Acceleration of trial running | 200 | Immediate | √ | — | — | 16bit | R/W | 0x0633 |
| | 27 | Warning lock-up time | 0 | Immediate | √ | √ | — | 16bit | R/W | 0x0637 |
| | 28 | Observer gain | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0639 |
| | 29 | Observer filter | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x063B |
| | 56 | Torque threshold of motor blocking alarm | 300 | Immediate | √ | √ | √ | 16bit | R/W | 0x0661 |
| | 57 | Motor blocking alarm delay time | 0 | Immediate | √ | √ | √ | 16bit | R/W | 0x0663 |
| | 63 | Absolute multi-turn position upper bound | 0 | Power-on again | √ | √ | √ | 16bit | R/W | 0x067F |

| Parameter Number | | Name | Default value | Effective | Mode | | | Communication | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Classify | NO. | | | | P | V | T | Data length | Access | Modbus Address |
| 【Class B】 Status Information | 00 | Software version 1（DSP） | | Immediate | √ | √ | √ | 16bit | R | 0x0B00 |
| | 01 | Software version 2（CPLD） | | Immediate | √ | √ | √ | 16bit | R | 0x0B01 |
| | 02 | Software version 3（other） | | Immediate | √ | √ | √ | 16bit | R | 0x0B02 |
| | 03 | Error code | | Immediate | √ | √ | √ | 16bit | R | 0x0B03 |
| | 04 | Factor of No.-motor running | | Immediate | √ | √ | √ | 16bit | R | 0x0B04 |
| | 05 | Drive operating state | | Immediate | √ | √ | √ | 16bit | R | 0x0B05 |
| | 06 | Actual velocity (unfiltered) | | Immediate | √ | √ | √ | 16bit | R | 0x0B06 |
| | 07 | Actual torque feedback | | Immediate | √ | √ | √ | 16bit | R | 0x0B07 |
| | 08 | Actual current feedback | | Immediate | √ | √ | √ | 16bit | R | 0x0B08 |
| | 09 | Actual velocity(After filtering)） | | Immediate | √ | √ | √ | 16bit | R | 0x0B09 |
| | 10 | DC bus voltage | | Immediate | √ | √ | √ | 16bit | R | 0x0B0A |
| | 11 | Drive temperature | | Immediate | √ | √ | √ | 16bit | R | 0x0B0B |
| | 12 | Analog input1 | | Immediate | √ | √ | √ | 16bit | R | 0x0B0C |
| | 13 | Analog input2 | | Immediate | √ | √ | √ | 16bit | R | 0x0B0D |
| | 14 | Analog input3 | | Immediate | √ | √ | √ | 16bit | R | 0x0B0E |
| | 15 | Over-load ratio | | Immediate | √ | √ | √ | 16bit | R | 0x0B0F |
| | 16 | Regeneration load ratio | | Immediate | √ | √ | √ | 16bit | R | 0x0B10 |
| | 17 | Digital input signal status | | Immediate | √ | √ | √ | 16bit | R | 0x0B11 |
| | 18 | Digital output signal status | | Immediate | √ | √ | √ | 16bit | R | 0x0B12 |
| | 20 | Motor position feedback（Command unit） | | Immediate | √ | √ | √ | 32bit | R | 0x0B14<br>0x0B15 |
| | 21 | Command pulse sum（Command unit） | | Immediate | √ | - | - | 32bit | R | 0x0B16<br>0x0B17 |
| | 22 | Positional deviation（Command unit） | | Immediate | √ | √ | √ | 32bit | R | 0x0B18<br>0x0B19 |
| | 23 | Position command（Encoder unit） | | Immediate | √ | √ | √ | 32bit | R | 0x0B1A<br>0x0B1B |
| | 24 | Motor position（encoder unit） | | Immediate | √ | - | - | 32bit | R | 0x0B1C<br>0x0B1D |
| | 25 | Positional deviation (encoder unit) | | Immediate | √ | √ | √ | 32bit | R | 0x0B1E<br>0x0B1F |
| | 26 | Position feedback in rotation mode(encoder unit) | | Immediate | √ | - | - | 32bit | R | 0x0B20<br>0x0B21 |

# 5.2 Parameter Function

Here is the explanation of parameters, you can check them or modify the value using software Motion Studio or the front panel of servo drive.

**Contact tech@leadshine.com if you need more technical service.**

## 5.2.1【Class 0】Basic Setting

| Pr0.00 | Name | Mode loop gain | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0-2000 | Unit | 0.1Hz | Default | 1 | | |
| | Data length | 16bit | Access | R/W | Address | 0x0001 | | |
| | Effective | Immediate | | | | | | |

Set up the bandwidth of MFC , it is similar to the response bandwidth

| Setup value | Meaning |
|---|---|
| 0 | Disable the function. |
| 1 | Enable the function, set the bandwidth automatically, recommended for most application. |
| 2-10 | Forbidden and reserved. |
| 11-20000 | Set the bandwidth manually , 1.1Hz – 2000Hz |

MFC is used to enhance the performance of dynamic tracing for input command, make positioning faster, cut down the tracking error, and run more smooth and steady. It is very useful for multi-axis synchroNo.us movement and interpolation, the performance will be better.

**The main way to use this function :**

a. Choose the right control mode : Pr0.01 = 0
b. Set up Pr0.02=1 for interpolation movement
c. Set up the inertia of ratio : Pr0.04
d. Set up the rigidity : Pr0.03
e. Set up the Pr0.00 :
   1) If No. multi-axis synchroNo.us movement , set Pr0.00 as 1 or more than 10 ;
   2) If multi-axis synchroNo.us movement needed, set Pr0.00 as the same for all the axes.
   3) If Pr0.00 is more than 10, start with 100, or 150, 200, 250….

**Caution:**

1. Set up the right control mode, the right inertia of ratio and rigidity firstly.
2. Don't change the value of Pr0.00 when the motor is running , otherwise vibration occurs

Set up a small value from the beginning if using it in manual mode , smaller value means running more smooth and steady , while bigger one means faster positioning

| Pr0.01* | Name | Control mode setup | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x0003 | | |
| | Effective | Power-on again | | | | | | |

Set using control mode：

| Setup Value | Content | |
|---|---|---|
| | 1st Mode | 2nd Mode |
| 0 | Position | - |
| 1 | Velocity | - |

When you set up the combination mode of 3.4.5, you can select either the 1st or the 2nd with control mode switching input(C-MODE).
When C-MODE is on, the 1st mode will

| | | | | |
|---|---|---|---|---|
| | 2 | Torque | - | be selected.<br>When C-MODE is off, the 2nd mode will be selected. |
| | 3 | Position | Velocity | |
| | 4 | Position | Torque | |
| | 5 | Velocity | Torque | |
| | 6 | PR-Mode | | |
| | 7~10 | Reserved | | |

| Pr0.02 | Name | Real-time auto-gain tuning | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x0005 | | |
| | Effective | Immediate | | | | | | |

You can set up the action mode of the real-time auto-gain tuning:

| Setup Value | Mode | Varying Degree of Load Inertia In Motion |
|---|---|---|
| 0 | invalid | Real-time auto-gain tuning function is disabled. |
| 1 | standard | Basic mode. Do Not use unbalanced load, friction compensation or gain switching. It is usually for interpolation movement. |
| 2 | positioning | Main application is positioning. it is recommended to use this mode on equipment without unbalanced horizontal axis, ball screw driving equipment with low friction, etc. it is usually for point-to point movement . |

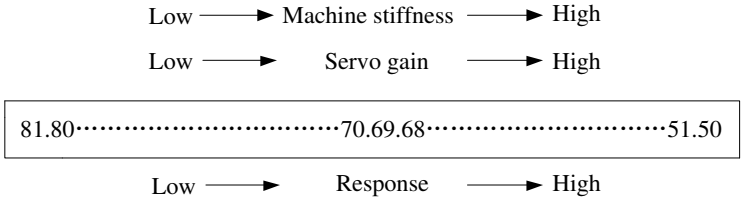
**Caution:** If Pr0.02=1 or 2 , you can't modify the values of Pr1.01 – Pr1.13, the values of them depend on the real-time auto-gain tuning ,all of them are set by the drive itself

For **Standard** mode (Pr0.02=1), it is usually for interpolation movement. It is unavailable to modify the value of Pr1.00- 1.14, just need to change the value of Pr0.03, and then all values of Pr1.00-1.14 will be changed accordingly.

For **Positioning** mode (Pr0.02=2), it is usually for point to point movement. It is unavailable to modify the value of Pr1.00- 1.14, just change the value of Pr0.03 ,then all values of Pr1.00-1.14 will be changed

| Pr0.03 | Name | Selection of machine stiffness at real- time auto-gain tuning | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50 -81 | Unit | — | Default | 70 | | |
| | Data length | 16bit | Access | R/W | Address | 0x0007 | | |
| | Effective | Immediate | | | | | | |

You can set up response while the real-time auto-gain tuning is valid.




**Notice:** Lower the setup value, higher the velocity response and servo stiffness will be obtained. However, when decreasing the value, check the resulting operation to avoid oscillation or vibration. Control gain is updated while the motor is stopped. If the motor can't be stopped due to excessively

low gain or continuous application of one-way direction command, any change made to Pr0.03 is Not used for update. If the changed stiffness setting is made valid after the motor stopped, abnormal sound or oscillation will be generated. To prevent this problem, stop the motor after changing the stiffness setting and check that the changed setting is enabled.

| Pr0.04 | Name | Inertia ratio | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | % | Default | 250 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0009 | | |
| | Effective | Immediate | | | | | | |

You can set up the ratio of the load inertia against the rotor (of the motor) inertia.

**Pr0.04=( load inertia/rotate inertia)×100%**

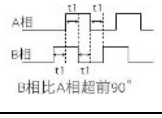
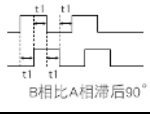
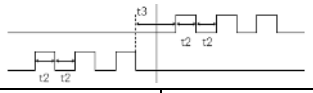
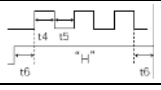
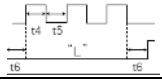
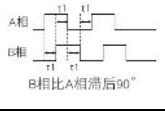
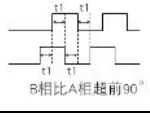
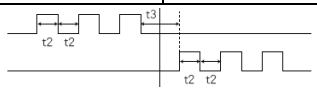
Notice:

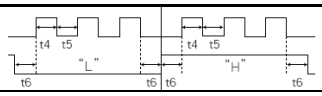
If the inertia ratio is correctly set, the setup unit of Pr1.01 and Pr1.06 becomes (Hz). When the inertia ratio of Pr0.04 is larger than the actual value, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr0.04 is smaller than the actual value, the setup unit of the velocity loop gain becomes smaller.

| Pr0.06* | Name | Command pulse rotational direction setup | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 000D | | |
| | Effective | Power-on again | | | | | | |

Set command pulse input rotate direction, command pulse input type

| Pr0.07* | Name | Command Pulse Input Mode Setup | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | — | Default | 1 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 000F | | |
| | Effective | Power-on again | | | | | | |

| Pr0.06 | Pr0.07 | Command pulse format | Signal | Positive direction command | Negative direction command |
|---|---|---|---|---|---|
| 0 | 0 or 2 | 90 degrees phase difference 2-phase pulse(phase A +phase B) | Pulse sign |  |  |
| | 1 | Positive direction pulse + negative direction pulse | Pulse sign |  | |
| | 3 | Pulse + sign | Pulse sign |  |  |
| 1 | 0 or 2 | 90 degrees phase difference 2 phase pulse(phase A +phase B) | Pulse sign |  |  |
| | 1 | Positive direction pulse + negative direction pulse | Pulse sign |  | |

| | | | | |
|---|---|---|---|---|
| | 3 | Pulse + sign | Pulse sign |  |

Command pulse input signal allow largest frequency and smallest time width

| Puls/sign signal input I/F | | Permissible max. Input frequency | Smallest time width | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | t1 | t2 | t3 | t4 | t5 | t6 |
| Pulse series interface | Long distance interface | 500kpps | 2 | 1 | 1 | 1 | 1 | 1 |
| | Open-collector output | 200kpps | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |

| Pr0.08 | Name | Command pulse counts per one motor revolution | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0-8388608 | Unit | P | Default | 0 | | |
| | Data length | 32bit | Access | R/W | Address | 0x 0010<br>0x 0011 | | |
| | Effective | Power-on again | | | | | | |

Set the command pulse that causes single turn of the motor shaft.
1) If Pr008≠0 , the actual motor rotation turns = pulse number / Pr008
2) If Pr008 = 0 , Pr0.09 1st numerator of electronic gear and Pr0.10 denominator of electronic gear become valid.

| Pr0.09 | Name | 1st numerator of electronic gear | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~1073741824 | Unit | — | Default | 1 | | |
| | Data length | 32bit | Access | R/W | Address | 0x 0012<br>0x 0013 | | |
| | Effective | Power-on again | | | | | | |

Set the numerator of division/multiplication operation made according to the command pulse input.

| Pr0.10 | Name | 1st denominator of electronic gear | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~1073741824 | Unit | — | Default | 1 | | |
| | Data length | 32bit | Access | R/W | Address | 0x 0014<br>0x 0015 | | |
| | Effective | Power-on again | | | | | | |

Set the denominator of division/multiplication operation made according to the command pulse input.

| Pr0.09 | Pr0.10 | Command division/multiplication operation |
|---|---|---|
| 1-10737 41824 | 1-10737 41824 | Command pulse input → 【Pr0.09 set value】 / 【Pr0.10 set value】 → position command |

1. Settings：
   1)The drive input command pulse number is X
   2)The pulse number of encoder after frequency division and frequency doubling is Y
   3)The number of pulses per revolution of the motor encoder is Z
   4)Number of turns of motor is W
2. Calculations：

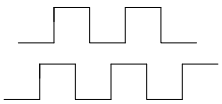
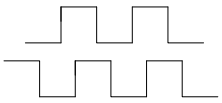
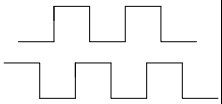
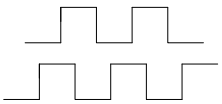
1)Y=X* Pr0.09 / Pr0.10
2)17-bit encoder: Z=2^17 = 131072
23-bit encoder: Z=2^23 = 8388608

| Pr0.11＊ | Name | Output pulse counts per one motor revolution | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~2500 | Unit | P/r | Default | 2500 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0017 | | |
| | Effective | Power-on again | | | | | | |
| | For example, if this parameter is set to 1000, it means that the frequency division output signal of the encoder outputs 4000 pulses per turn. | | | | | | | |

| Pr0.12＊ | Name | Reversal of pulse output logic | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0019 | | |
| | Effective | Power-on again | | | | | | |

You can set up the phase B logic and the output source of the pulse output. With this parameter, you can reverse the phase relation between the phase A pulse and phase B pulse by reversing the phase B logic.

**< reversal of pulse output logic >**

| Pr0.12 | phase A Logic | CCW direction rotation | CW direction rotation |
|---|---|---|---|
| 0 | Standard | Phase A<br>  <br>Phase B | Phase A<br>  <br>Phase B |
| 1 | Reverse | phase A<br>  <br>Phase B | Phase A<br>  <br>Phase B |

| Pr0.13 | Name | 1st torque limit | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 300 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 001B | | |
| | Effective | Immediate | | | | | | |
| | You can set up the limit value of the motor output torque, as motor rate current %, the value can't exceed the maximum of output current. | | | | | | | |

| Pr0.14 | Name | Position deviation excess setup | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | 0.1rev | Default | 200 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 001D | | |
| | Effective | Immediate | | | | | | |
| | Set excess range of positional deviation by the command unit(default).Setting the value too small will cause Err18.0 (position deviation excess detection) | | | | | | | |

| Pr0.15 | Name | Absolute encoder setup | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~15 | Unit | | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 001F | | |
| | Effective | Power-on again | | | | | | |

How to use:

**0: Incremental position mode**:
The encoder is used as a incremental encoder, and the position retentive at power failure is Not supported.

**1: Absolute position linear mode**:
The encoder is used as an absolute encoder, and the position retentive at power failure is supported.
It is applicable to the scenario where the travel range of device load is fixed and the encoder multi-turn data dose Not overflow.

**2: Absolute position rotation mode**:
The encoder is used as an absolute encoder, and the position retentive at power failure is supported.
It is mainly applicable to the scenario where the load travel range is Not limited and the number of motor single-direction revolution is less than 0~(Pr6.63+1)

**5: Clean multi-turn alarm**, and open multi-turn absolute function.
It will become 1 when Normal clearance, if it's still 5 after 3seconds, please deal with according to 153 alarm processing.

**9: Clear multi-turn position and reset multi-turn alar**m, open multi-turn absolute function.
It will become 1 when Normal clearance, if it's still 9 after 3seconds, please deal with according to 153 alarm processing. Please remember to do mechanical homing.

**Notes:** Set to 9 after homing process finished and servo disabled, valid after Effective.

| Pr0.16 | Name | External regenerative resistance | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 10~50 | Unit | Ω | Default | 100 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0021 | | |
| | Effective | Immediate | | | | | | |
| | Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current. | | | | | | | |

| Pr0.17 | Name | External regenerative resistor power value | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | W | Default | 20 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0023 | | |
| | Effective | Immediate | | | | | | |
| | Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current. | | | | | | | |

| Pr0.22 | Name | PR and P/S/T control mode switching | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | - | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x002D | | |
| | Effective | Immediate | | | | | | |

When you set up the Pr0.01 of 6, you can set the 2nd mode with Pr0.22.
You can select either the 1st or the 2nd with control mode switching input(C-MODE).
When C-MODE is on, the 1st mode (PR) will be selected.
When C-MODE is off, the 2nd mode will be selected.

| Pr0.01 | Pr0.22 | Control Mode |
|---|---|---|
| 6 | 【0】 | PR / Position Mode |
| | 1 | PR/ Velocity Mode |
| | 2 | PR/ Torque Mode |

| Pr0.25 | Name | Auxiliary function | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~0xFFFF | Unit | | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0033 | | |
| | Effective | Immediate | | | | | | |

| Value | Auxiliary function |
|---|---|
| 0x1111 | Reset current alarm |
| 0x1122 | Reset history alarm |
| 0x2211 | Save parameter |
| 0x2222 | Reset to factory setting except motor parameters |
| 0x2233 | Reset to factory setting |
| 0x4001 | JOG_P（50ms time period） |
| 0x4002 | JOG_N（50ms time period） |
| 0x6666 | Soft reset |

| Pr0.26 (Modbus) | Name | Virtual IO | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~0xFFFF | Unit | - | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x0035 | | |
| | Effective | Immediate | | | | | | |

| Bit | Input |
|---|---|
| 0 | SI1 |
| 1 | SI2 |
| 2 | SI3 |
| 3 | SI4 |
| 4 | SI5 |
| 5 | SI6 |
| 6 | SI7 |
| 7 | SI8 |
| 8 | SI9 |

Note:
Only for Modbus communication：
Virtual IO and physical IO are exclusive OR. The current IO state will be inverted.

| Pr0.40 (Modbus) | Name | Mapping parameter 1 | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | 0 | | |
| | Data length | 32bit | Access | | Address | H： 0x0050 | | |
| | Effective | Immediate | | | | L： 0x0051 | | |

| | |
|---|---|
| | It is mainly provided to the user to quickly read and write decentralized parameter addresses.<br>You can set Pr0.50 to the mapping parameter which you want to read and write. When you read and write Pr0.40 data, it is equivalent to reading and writing the parameters specified by Pr0.50.<br>The parameter setting method is described in Pr0.57<br>Note:<br>The parameter Range, Unit, Access, etc. of Pr0.40 are determined by the parameter specified by Pr0.50. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr0.41 (Modbus)** | Name | Mapping parameter 2 | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | 0 | | |
| | Data length | 32bit | Access | | Address | H: 0x0052 | | |
| | Effective | Immediate | | | | L: 0x0053 | | |
| | The parameter description refers to Pr0.40, and the parameter setting method refers to Pr0.57.<br>Note:<br>The parameter Range, Unit, Access, etc. of Pr0.41 are determined by the parameter specified in Pr0.51. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr0.42 (Modbus)** | Name | Mapping parameter 3 | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | 0 | | |
| | Data length | 32bit | Access | | Address | H: 0x0054 | | |
| | Effective | Immediate | | | | L: 0x0055 | | |
| | The parameter description refers to Pr0.40, and the parameter setting method refers to Pr0.57.<br>Note:<br>The parameter Range, Unit, Access, etc. of Pr0.42 are determined by the parameter specified in Pr0.52 | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr0.43 (Modbus)** | Name | Mapping parameter 4 | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | 0 | | |
| | Data length | 32bit | Access | | Address | H: 0x0056 | | |
| | Effective | Immediate | | | | L: 0x0057 | | |
| | The parameter description refers to Pr0.40, and the parameter setting method refers to Pr0.57.<br>Note:<br>The parameter Range, Unit, Access, etc. of Pr0.43 are determined by the parameter specified in Pr0.52. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr0.44 (Modbus)** | Name | Mapping parameter 5 | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | 0 | | |
| | Data length | 32bit | Access | | Address | H: 0x0058 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | L: 0x0059 |
| | The parameter description refers to Pr0.40, and the parameter setting method refers to Pr0.57.<br>Note:<br>The parameter Range, Unit, Access, etc. of Pr0.44 are determined by the parameter specified in Pr0.54. | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pr0.45 (Modbus)** | Name | Mapping parameter 6 | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | 0 | | |
| | Data length | 32bit | Access | | Address | H: 0x005A | | |
| | Effective | Immediate | | | | L: 0x005B | | |
| | The parameter description refers to Pr0.40, and the parameter setting method refers to Pr0.57.<br>Note:<br>The parameter Range, Unit, Access, etc. of Pr0.45 are determined by the parameter specified in Pr0.55. | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pr0.46 (Modbus)** | Name | Mapping parameter 7 | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | 0 | | |
| | Data length | 32bit | Access | | Address | H: 0x005C | | |
| | Effective | Immediate | | | | L: 0x005D | | |
| | The parameter description refers to Pr0.40, and the parameter setting method refers to Pr0.57.<br>Note:<br>The parameter Range, Unit, Access, etc. of Pr0.46 are determined by the parameter specified in Pr0.56. | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pr0.47 (Modbus)** | Name | Mapping parameter 8 | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | 0 | | |
| | Data length | 32bit | Access | | Address | H: 0x005E | | |
| | Effective | Immediate | | | | L: 0x005F | | |
| | The parameter description refers to Pr0.40, and the parameter setting method refers to Pr0.57.<br>Note:<br>The parameter Range, Unit, Access, etc. of Pr0.47 are determined by the parameter specified in Pr0.57. | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pr0.50 (Modbus)** | Name | Mapping parameter 1 pointer | | | Mode | **P** | **V** | **T** |
| | Range | 0~0xFFFFFFFF | Unit | | Default | 0x00490049 | | |
| | Data length | 32bit | Access | R/W | Address | H: 0x0064 | | |
| | Effective | Immediate | | | | L: 0x0065 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr0.51** | Name | Mapping parameter 2 pointer | | Mode | **P** | **V** | **T** |

| | | | | | | |
|---|---|---|---|---|---|---|
| (Modbus) | Range | 0~0xFFFFFFFF | Unit | | Default | 0x00490049 |
| | Data length | 32bit | Access | R/W | Address | H： 0x0066 |
| | Effective | Immediate | | | | L： 0x0067 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr0.52 (Modbus) | Name | Mapping parameter 3 pointer | | | Mode | P | V | T |
| | Range | 0~0xFFFFFFFF | Unit | | Default | 0x00490049 | | |
| | Data length | 32bit | Access | R/W | Address | H： 0x0068 | | |
| | Effective | Immediate | | | | L： 0x0069 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr0.53 (Modbus) | Name | Mapping parameter 4 pointer | | | Mode | P | V | T |
| | Range | 0~0xFFFFFFFF | Unit | | Default | 0x00490049 | | |
| | Data length | 32bit | Access | R/W | Address | H: 0x006A | | |
| | Effective | Immediate | | | | L: 0x006B | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr0.54 (Modbus) | Name | Mapping parameter 5 pointer | | | Mode | P | V | T |
| | Range | 0~0xFFFFFFFF | Unit | | Default | 0x00490049 | | |
| | Data length | 32bit | Access | R/W | Address | H: 0x006C | | |
| | Effective | Immediate | | | | L: 0x006D | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr0.55 (Modbus) | Name | Mapping parameter 6 pointer | | | Mode | P | V | T |
| | Range | 0~0xFFFFFFFF | Unit | | Default | 0x00490049 | | |
| | Data length | 32bit | Access | R/W | Address | H: 0x006E | | |
| | Effective | Immediate | | | | L: 0x006F | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr0.56 (Modbus) | Name | Mapping parameter 7 pointer | | | Mode | P | V | T |
| | Range | 0~0xFFFFFFFF | Unit | | Default | 0x00490049 | | |
| | Data length | 32bit | Access | R/W | Address | H: 0x0070 | | |
| | Effective | Immediate | | | | L: 0x0071 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr0.57 (Modbus) | Name | Mapping parameter 8 pointer | | | Mode | P | V | T |
| | Range | 0~0xFFFFFFFF | Unit | | Default | 0x00490049 | | |
| | Data length | 32bit | Access | R/W | Address | H: 0x0072 | | |
| | Effective | Immediate | | | | L: 0x0073 | | |

Set the parameter as 0xABCDWXYZ.

Then the high bit (PH) of the parameter and the low bit (PL) of the parameter are set in the following format: (PH) 0xABCD and (PL) 0xWXYZ.

| PH bit | Content | PL bit | Content |
|---|---|---|---|
| CD | Parameter NO. – Value (Decimal) | YZ | Parameter NO. – Value (Decimal) |
| B | Parameter Class - Value (Hexadecimal) | X | Parameter Class - Value (Hexadecimal) |
| A | No effect | W | No effect |

**An example is as follows.**

The Data length of Mapping parameter 1 - Pr0.40 is 32bit, so Pr0.40 can be mapped to two 16bit parameters or one 32bit parameter.

The content of Pr0.50 is as follows:
(mapping parameter 1 pointer: Pr0.50; value of mapping parameter 1: Pr0.40)
The high bit (PH) of Pr0.40 corresponds to the high bit of Pr0.50.
The low bit (PL) of Pr0.40 corresponds to the low bit of Pr0.50.

1. When the high bit value of Pr0.50 is not equal to the low bit value of Pr0.50 (PH ≠ PL), it means that Pr0.40 is mapped to two 16bit mapping parameters.
If you set Pr0.50=0x06200101; that is, PH=0x0620,PL=0x0101; write 0x0005 0064 to Pr0.40; then it will write 0x0005 to parameter Pr6.20, and 0x0064 to parameter Pr1.01.
2. When the high bit value of Pr0.50 is equal to the low bit value of Pr0.50 (PH=PL), it means that Pr0.40 is mapped to one 32bit mapping parameter.
If you set Pr0.50=0x01150115; that is, PH=0x0115, PL=0x0115; write 0x00000001 to Pr0.40; then it will write 0x00000001 to parameter Pr1.15.

## 5.2.2【Class 1】Gain Adjust

| Pr1.00 | Name | 1st gain of position loop | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~30000 | Unit | 0.1/s | Default | 320 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0101 | | |
| | Effective | Immediate | | | | | | |
| | You can determine the response of the positional control system.<br>Higher the gain of position loop you set, faster the positioning time you can obtain.<br>Note that too high setup may cause oscillation. | | | | | | | |

| Pr1.01 | Name | 1st gain of velocity loop | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | 0.1Hz | Default | 180 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0103 | | |
| | Effective | Immediate | | | | | | |
| | You can determine the response of the velocity loop.<br>In order to increase the response of overall servo system by setting high position loop gain, you need higher setup of this velocity loop gain as well. However, too high setup may cause oscillation. | | | | | | | |

| Pr1.02 | Name | 1st time constant of velocity loop integration | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 310 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0105 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |
| | You can set up the integration time constant of velocity loop, Smaller the setup, faster you can dog-in deviation at stall to 0.The integration will be maintained by setting to"9999".The integration effect will be lost by setting to"10000". | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr1.03** | Name | 1st filter of velocity detection | | | Mode | **P V T** |
| | Range | 50~81 | Unit | — | Default | 15 |
| | Data length | 16bit | Access | R/W | Address | 0x 0107 |
| | Effective | Immediate | | | | |

You can set up the time constant of the low pass filter (LPF) after the speed detection, in 32 steps (0 to 31).Higher the setup, larger the time constant you can obtain so that you can decrease the motor Noise, however, response becomes slow.

You can set the filter parameters through the loop gain, referring to the following table:

| **Set Value** | **Speed Detection Filter Cut-off Frequency(Hz)** | **Set Value** | **Speed Detection Filter Cut-off Frequency(Hz)** |
|---|---|---|---|
| 81 | 2500 | 65 | 750 |
| 80 | 2250 | 64 | 700 |
| 79 | 2100 | 63 | 650 |
| 78 | 2000 | 62 | 600 |
| 77 | 1800 | 61 | 550 |
| 76 | 1600 | 60 | 500 |
| 75 | 1500 | 59 | 450 |
| 74 | 1400 | 58 | 400 |
| 73 | 1300 | 57 | 350 |
| 72 | 1200 | 56 | 300 |
| 71 | 1100 | 55 | 250 |
| 70 | 1000 | 54 | 200 |
| 69 | 950 | 53 | 175 |
| 68 | 900 | 52 | 150 |
| 67 | 850 | 51 | 125 |
| 66 | 800 | 50 | 100 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr1.04** | Name | 1st time constant of torque filter | | | Mode | **P V T** |
| | Range | 0~2500 | Unit | 0.01ms | Default | 126 |
| | Data length | 16bit | Access | R/W | Address | 0x 0109 |
| | Effective | Immediate | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr1.05** | Name | 2nd gain of position loop | | | Mode | **P** |
| | Range | 0~30000 | Unit | 0.1/s | Default | 380 |
| | Data length | 16bit | Access | R/W | Address | 0x 010B |
| | Effective | Immediate | | | | |

| Pr1.06 | Name | 2nd gain of velocity loop | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | 0.1Hz | Default | 180 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 010D | | |
| | Effective | Immediate | | | | | | |

| Pr1.07 | Name | 2nd time constant of velocity loop integration | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 10000 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 010F | | |
| | Effective | Immediate | | | | | | |

| Pr1.08 | Name | 2nd filter of velocity detection | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~31 | Unit | — | Default | 15 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0111 | | |
| | Effective | Immediate | | | | | | |

| Pr1.09 | Name | 2nd time constant of torque filter | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2500 | Unit | 0.01ms | Default | 126 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0113 | | |
| | Effective | Immediate | | | | | | |
| | Position loop, velocity loop, velocity detection filter, torque command filter have their 2 pairs of gain or time constant (1st and 2nd). | | | | | | | |

| Pr1.10 | Name | Velocity feed forward gain | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | 0.10% | Default | 300 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0115 | | |
| | Effective | Immediate | | | | | | |
| | Multiply the velocity control command calculated according to the internal positional command by the ratio of this parameter and adds the result to the speed command resulting from the positional control process. | | | | | | | |

| Pr1.11 | Name | Velocity feed forward filter | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~6400 | Unit | 0.01ms | Default | 50 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0117 | | |
| | Effective | Immediate | | | | | | |
| | Set the time constant of 1st delay filter which affects the input of speed feed forward.<br>**(usage example of velocity feed forward)**<br>The velocity feed forward will become effective as the velocity feed forward gain is | | | | | | | |

gradually increased with the speed feed forward filter set at approx.50 (0.5ms). The positional deviation during operation at a constant speed is reduced as shown in the equation below in proportion to the value of velocity feed forward gain.

Position deviation [ unit of command]=command speed [ unit of command /s]/position loop gain[1/s]×(100-speed feed forward gain[%]/100

| Pr1.12 | Name | Torque feed forward gain | | | Mode | P V | |
|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | 0.1% | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 0119 | |
| | Effective | Immediate | | | | | |

- Multiply the torque control command calculated according to the velocity control command by the ratio of this parameter and adds the result to the torque command resulting from the velocity control process.
- To use torque feed forward, correctly set ratio of inertia. Set the inertia ratio that can be calculated from the machine specification to Pr0.04 inertia ratio.
- Positional deviation at a constant acceleration/deceleration can be minimized close to 0 by increasing the torque forward gain .this means that positional deviation can be maintained at near 0 over entire operation range while driving in trapezoidal speed pattern under ideal condition where disturbance torque is Not active.

| Pr1.13 | Name | Torque feed forward filter | | | Mode | P V | |
|---|---|---|---|---|---|---|---|
| | Range | 0~6400 | Unit | 0.01ms | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 011B | |
| | Effective | Immediate | | | | | |

Set up the time constant of 1st delay filter which affects the input of torque feed forward.

zero positional deviation is impossible in actual situation because of disturbance torque. as with

the velocity feed forward, large torque feed forward filter time constant decreases the operating Noise but increases positional deviation at acceleration change point.

| Pr1.15 | Name | Mode of position control switching | | | Mode | P | |
|---|---|---|---|---|---|---|---|
| | Range | 0~10 | Unit | — | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 011F | |
| | Effective | Immediate | | | | | |

| Setup Value | Switching Condition | Gain Switching Condition |
|---|---|---|
| 0 | Fixed to 1st gain | Fixed to the 1st gain (Pr1.00-Pr1.04) |
| 1 | Fixed to 2nd gain | Fixed to the 2nd gain (Pr1.05-Pr1.09) |
| 2 | with gain switching input | ● 1st gain when the gain switching input is open.<br>● 2nd gain when the gain switching input is connected to com- .<br>✧ If No. input signal is allocated to the gain switching input, the 1st gain is fixed. |
| 3 | Torque command is large | ● Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis)[%]previously with the 1st gain.<br>● Return to the 1st gain when the absolute value of the torque |

| | | |
|---|---|---|
| | | command was kept below (level + hysteresis) [%] previously during delay time with the 2nd gain. |
| 4-9 | reserved | reserved |
| 10 | Have position command +actual speed | ● Valid for position control.<br>● Shift to the 2nd gain when the positional command was Not 0 previously with the 1st gain.<br>● Return to the 1st gain when the positional command was kept at 0 during the delay time and the absolute value of actual speed was kept below (level - hysteresis) (r/min) previously with the 2nd gain. |

| **Pr1.17** | Name | Level of position control switching | | | Mode | **P** | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | Mode specific | Default | 50 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0123 | | |
| | Effective | Immediate | | | | | | |
| | Unit of setting varies with switching mode.<br>Switching condition: Position: encoder pulse number; speed: r/min; torque: %.<br>Notice: set the level equal to or higher than the hysteresis. | | | | | | | |

| **Pr1.18** | Name | Hysteresis at position control switching | | | Mode | **P** | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | Mode specific | Default | 33 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0125 | | |
| | Effective | Immediate | | | | | | |
| | Combining Pr1.17(control switching level)setup<br>Notice: when level< hysteresis, the hysteresis is internally adjusted so that it is equal to level. | | | | | | | |

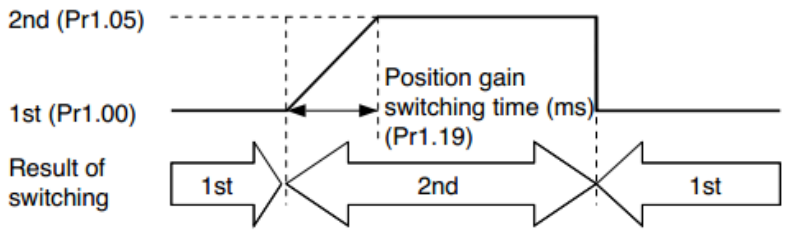
| **Pr1.19** | Name | Position gain switching time | | | Mode | **P** | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 33 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0127 | | |
| | Effective | Immediate | | | | | | |

For position controlling: if the difference between 1st gain and 2nd gain is large, the increasing rate of position loop gain can be limited by this parameter.

**<Position gain switching time>**

Notice: when using position control, position loop gain rapidly changes, causing torque change and vibration. By adjusting Pr1.19 position gain switching time, increasing rate of the position loop gain can be decreased and variation level can be reduced.

Example: 1st (pr1.00) <-> 2nd (Pr1.05)




| Pr1.35* | Name | Positional command filter setup | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~200 | Unit | 0.05us | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0147 | | |
| | Effective | Immediate | | | | | | |
| | Do filtering for positional command pulse, eliminate the interference of the narrow pulse, over-large setup will influence the input of high frequency positional command pulse, and make more time-delayed. | | | | | | | |

| Pr1.37 | Name | Special register | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~0xFFFF | Unit | - | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 2137 | | |
| | Effective | Immediate | | | | | | |
| | Under binary, these bits in register are used for some function operation.<br>Bit2=1, shield the speed out of control alarm (1A1)<br>Bit4=1, shield the over-load alarm 100,101<br>Bit6=1, shield the excessive vibration alarm 190<br>Bit7=1, shield the braking resistor over-load alarm 120<br>Bit9=1, shield the lacking of phase alarm0dl (other bits are forbidden to use, default 0)<br><br>For example : Pr137 = 4 can be used to shield alarm code 1A1<br>Pr137 = 64 can be used to shield alarm code 190<br>Pr137 =68 can be used to shield both 1A1 and 190. | | | | | | | |

## 5.2.3【Class 2】Vibration Suppression

| Pr2.00 | Name | Adaptive filter mode setup | | | Mode | P | V | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0201 | | |
| | Effective | Immediate | | | | | | |

Set up the resonance frequency to be estimated by the adaptive filter and the special the operation after estimation.

| Setup Value | Details | |
|---|---|---|
| 0 | Adaptive filter: invalid | Parameters related to the 3rd and 4th Notch filter hold the current value. |
| 1 | Adaptive filter,1 filter is valid, one time | One adaptive filter is valid, parameters related to the 3rd Notch filter will be updated based on adaptive performance. After updated, Pr2.00 returns to 0, stop self-adaptation. |
| 2 | Adaptive filter, 1 filter is valid, It will be valid all the time | One adaptive filter is valid, parameters related to the 3rd Notch filter will be updated all the time based on adaptive performance. |
| 3-4 | Not use | Forbid Non-professional to use |

| Pr2.01 | Name | 1st notch frequency | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0203 | | |
| | Effective | Immediate | | | | | | |

Set the center frequency of the 1st Notch filter

Notice: the Notch filter function will be invalid by setting up this parameter to “2000”.

| Pr2.02 | Name | 1st notch width selection | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | — | Default | 2 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0205 | | |
| | Effective | Immediate | | | | | | |

Set the width of Notch at the center frequency of the 1st Notch filter.

Notice: Higher the setup, larger the Notch width you can obtain. Use with default setup in Normal operation.

| Pr2.03 | Name | 1st notch depth selection | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0207 | | |
| | Effective | Immediate | | | | | | |

Set the depth of Notch at the center frequency of the 1st Notch filter.

Notice: Higher the setup, shallower the Notch depth and smaller the phase delay you can obtain.

| Pr2.04 | Name | 2nd notch frequency | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0209 | | |
| | Effective | Immediate | | | | | | |

Set the center frequency of the 2nd Notch filter

Notice: the Notch filter function will be invalid by setting up this parameter to “2000”.

| Pr2.05 | Name | 2nd notch width selection | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | — | Default | 2 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 020B | | |
| | Effective | Immediate | | | | | | |

Set the width of Notch at the center frequency of the 2nd Notch filter.
Notice: Higher the setup, larger the Notch width you can obtain. Use with default setup in Normal operation.

| Pr2.06 | Name | 2nd notch depth selection | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 020D | | |
| | Effective | Immediate | | | | | | |

Set the depth of Notch at the center frequency of the 2nd Notch filter.
Notice: Higher the setup, shallower the Notch depth and smaller the phase delay you can obtain.

| Pr2.07 | Name | 3rd notch frequency | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 020F | | |
| | Effective | Immediate | | | | | | |

Set the center frequency of the 3rd Notch filter
Notice: the Notch filter function will be invalid by setting up this parameter to “2000”.

| Pr2.08 | Name | 3rd notch width selection | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | — | Default | 2 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0211 | | |
| | Effective | Immediate | | | | | | |

Set the width of Notch at the center frequency of the 3rd Notch filter.
Notice: Higher the setup, larger the Notch width you can obtain. Use with default setup in Normal operation.

| Pr2.09 | Name | 3rd notch depth selection | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0213 | | |
| | Effective | Immediate | | | | | | |

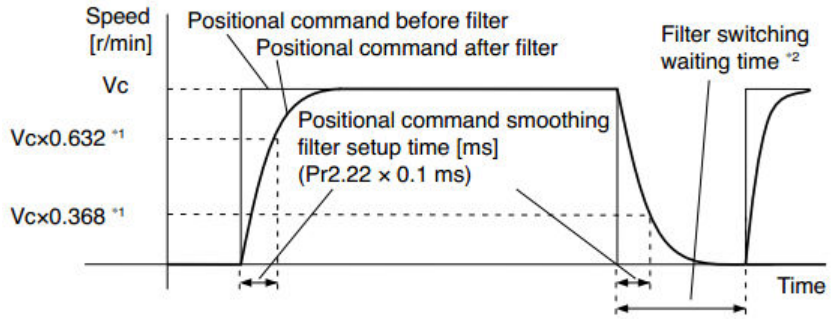
Set the depth of Notch at the center frequency of the 3rd Notch filter.
Notice: Higher the setup, shallower the Notch depth and smaller the phase delay you can obtain.

| Pr2.14* | Name | 1st damping frequency | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | 0.1HZ | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 021D | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |
| 0: close<br>Setup damping frequency, to suppress vibration at the load edge. | | | | | | |
| **Pr2.16*** | Name | 2nd damping frequency | | | Mode | **P** |
| | Range | 10~2000 | Unit | 0.1HZ | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0221 |
| | Effective | Immediate | | | | |
| 0: close<br>Setup damping frequency, to suppress vibration at the load edge | | | | | | |

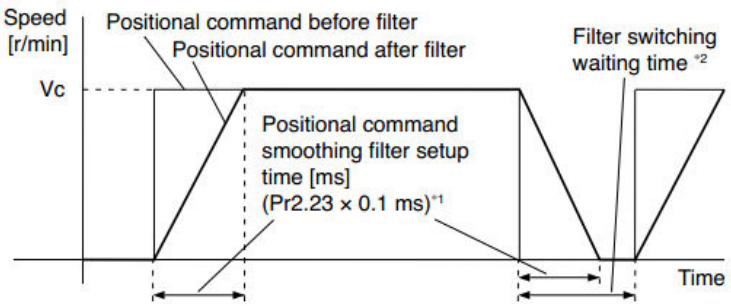
| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr2.22** | Name | Positional command smoothing filter | | | Mode | **P** |
| | Range | 0~32767 | Unit | 0.1ms | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 022D |
| | Effective | Power-on again | | | | |

- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied ,set up the time constant of the 1st delay filter as shown in the figure below




| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr2.23** | Name | Positional command FIR filter | | | Mode | **P** |
| | Range | 0~10000 | Unit | 0.1ms | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 022F |
| | Effective | Power-on again | | | | |

- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied, set up the Vc arrival time as shown in the figure below.




## 5.2.4【Class 3】Velocity/ Torque Control

| Pr3.00 | Name | Speed setup, Internal /External switching | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0301 |
| | Effective | Immediate | | | | |

This drive is equipped with internal speed setup function so that you can control the speed with contact inputs only.

| Setup Value | Speed Setup Method |
|---|---|
| 0 | Analog speed command(SPR) |
| 1 | Internal speed command 1st to 4th speed(Pr3.04-Pr3.07) |
| 2 | Internal speed command 1st to 3rd speed (Pr3.04-Pr3.06), Analog speed command(SPR) |
| 3 | Internal speed command 1st to 8th speed (Pr3.04-Pr3.11) |

**<relationship between Pr3.00 Internal/External switching speed setup and the internal command speed selection 1-3 and speed command to be selected>**

| Setup Value | 1st Selection Of Internal Command Speed (Intspd1) | 2nd Selection Of Internal Command Speed (Intspd2) | 3rd Selection Of Internal Command Speed (Intspd3) | Selection Of Speed 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 | | Analog speed command |
| 3 | The same as [Pr3.00=1] | | OFF | 1st to 4th speed |
| | OFF | OFF | ON | 5th speed |
| | ON | OFF | ON | 6th speed |
| | OFF | ON | ON | 7th speed |

| | | | | | |
|---|---|---|---|---|---|
| | | ON | ON | ON | 8th speed |

| Pr3.01 | Name | Speed command rotational direction selection | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0303 |
| | Effective | Immediate | | | | |

Select the Positive /Negative direction specifying method

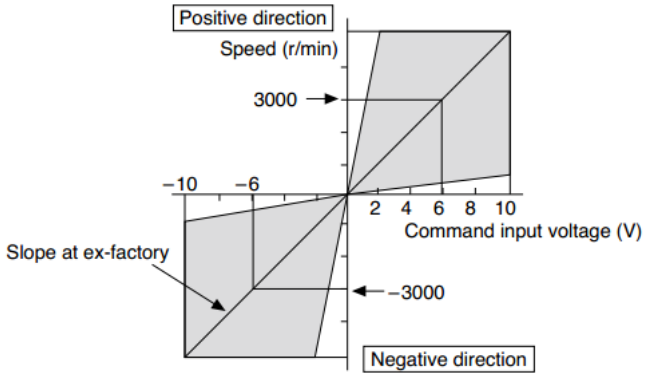
| Setup Value | Velocity Value | Velocity Command Signal(VC-SIGN) | Velocity Command Direction |
|---|---|---|---|
| 0 | + | No. effect | Positive direction |
| | - | No. effect | Negative direction |
| 1 | Sign Not effect | OFF | Positive direction |
| | Sign Not effect | ON | Negative direction |

| Pr3.02 | Name | Input gain of speed command | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | (r/min)/V | Default | 500 |
| | Data length | 16bit | Access | R/W | Address | 0x 0305 |
| | Effective | Immediate | | | | |

Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.
You can set up “slope” of relation between the command input voltage and motor speed, with Pr3.02. Default is set to Pr3.02=500(r/min)/V, hence input of 6V becomes 3000r/min.

Notice:

1. Do Not apply more than ±10V to the speed command input(SPR).
2. When you compose a position loop outside of the drive while you use the drive in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
3. Pay an extra attention to oscillation caused by larger setup of Pr3.02




| Pr3.03 | Name | Reversal of speed command input | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 1 |
| | Data length | 16bit | Access | R/W | Address | 0x 0307 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |

Specify the polarity of the voltage applied to the analog speed command (SPR).

| Setup Value | Motor Rotating Direction | |
|---|---|---|
| 0 | Standard | [+ voltage]→ [+ direction] \ [- voltage]→ [-direction] |
| 1 | Reversed | [+ voltage]→ [- direction] \ [- voltage]→ [+direction] |

**Caution:** When you compose the servo drive system with this drive set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup do Not match.

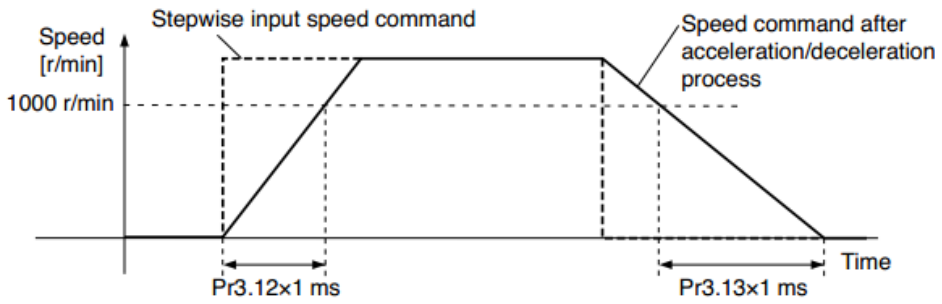
| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr3.04** | Name | 1st speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x0309 |
| | Effective | Immediate | | | | |
| **Pr3.05** | Name | 2nd speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 030B |
| | Effective | Immediate | | | | |
| **Pr3.06** | Name | 3rd speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 030D |
| | Effective | Immediate | | | | |
| **Pr3.07** | Name | 4th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 030F |
| | Effective | Immediate | | | | |
| **Pr3.08** | Name | 5th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 0311 |
| | Effective | Immediate | | | | |
| **Pr3.09** | Name | 6th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 0313 |
| | Effective | Immediate | | | | |
| **Pr3.10** | Name | 7th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 0315 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |
| Pr3.11 | Name | 8th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0317 |
| | Effective | Immediate | | | | |
| | Set up internal command speeds, 1st to 8th | | | | | |

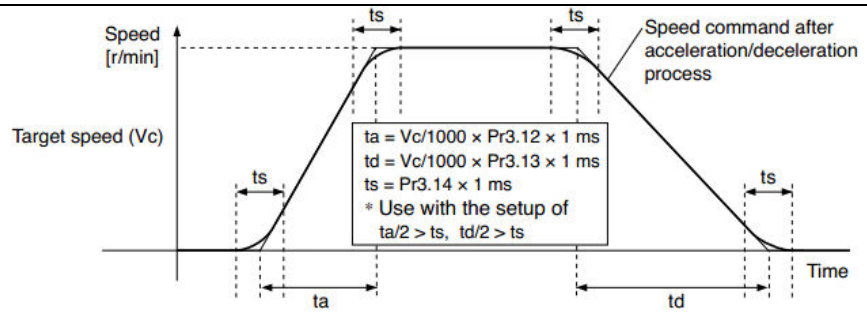
| | | | | | | |
|---|---|---|---|---|---|---|
| Pr3.12 | Name | Time setup acceleration | | | Mode | V |
| | Range | 0~10000 | Unit | Ms/ (1000r/min) | Default | 100 |
| | Data length | 16bit | Access | R/W | Address | 0x 0319 |
| | Effective | Immediate | | | | |
| Pr3.13 | Name | Time setup deceleration | | | Mode | V |
| | Range | 0~10000 | Unit | Ms/ (1000r/min) | Default | 100 |
| | Data length | 16bit | Access | R/W | Address | 0x 031B |
| | Effective | Immediate | | | | |

Set up acceleration/deceleration processing time in response to the speed command input.
Set the time required for the speed command(stepwise input)to reach 1000r/min to Pr3.12
Acceleration time setup. Also set the time required for the speed command to reach from 1000r/min to 0 r/min, to Pr3.13 deceleration time setup.
Assuming that the target value of the speed command is Vc(r/min), the time required for acceleration/deceleration can be computed from the formula shown below.

Acceleration time (ms)=Vc/1000 *Pr3.12 *1ms
Deceleration time (ms)=Vc/1000 *Pr3.13 *1ms




| | | | | | | |
|---|---|---|---|---|---|---|
| Pr3.14 | Name | Sigmoid acceleration /deceleration time setup | | | Mode | V |
| | Range | 0~1000 | Unit | ms | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 031D |
| | Effective | Power-on again | | | | |




Set S-curve time for acceleration/deceleration process when the speed command is applied. According to Pr3.12 Acceleration time setup and Pr3.13 Deceleration time setup, set up sigmoid time with time width centering the inflection point of acceleration/deceleration.

| Pr3.15 | Name | Speed zero-clamp function selection | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | 0.1HZ | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 031F |
| | Effective | Immediate | | | | |

1. If Pr3.15=0, the function of zero clamp is forbidden. It means the motor rotates with actual velocity which is controlled by the analog voltage input 1 even if the velocity is less than 10 rpm. The motor runs No. matter what the value of Pr3.16 is. The actual velocity is controlled by external the analog voltage input.
2. If Pr3.15=1 and the input signal of Zero Speed is available in the same time, the function of zero clamp works. It means motor will stop rotating in servo-on condition No. matter what the velocity of motor is, and motor stop rotating No. matter what the value of Pr3.16 is.
3. If Pr3.15=2 , the function of zero clamp belongs to the value of Pr3.16. If the actual velocity is less than the value of Pr3.16, the motor will stop rotating in servo-on condition.

| Pr3.16 | Name | Speed zero-clamp level | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 30 |
| | Data length | 16bit | Access | R/W | Address | 0x 0321 |
| | Effective | Immediate | | | | |

When analog speed command value less than speed zero-clamp level setup, actual speed will set to 0.

| Pr3.17 | Name | Selection of torque command | | | Mode | T |
|---|---|---|---|---|---|---|
| | Range | 0/1/2 | Unit | | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0323 |
| | Effective | Immediate | | | | |

| Setup value | Torque command input | Velocity limit input |
|---|---|---|
| 0 | Analog input 3 | Parameter value (P3.21) |
| 1 | Analog input 3 | Analog input 1 for Speed limit |

| | | | | |
|---|---|---|---|---|
| | 2 | Parameter value (P3.22) | Parameter value (P3.21) | |
| | 3 | Analog input 3 | Speed limit 0 | |

| Pr3.18 | Name | Torque command direction selection | | | Mode | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0325 | | |
| | Effective | Immediate | | | | | | |

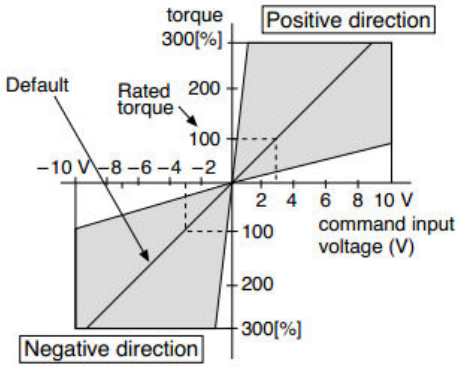
Select the direction positive/negative direction of torque command

| Setup Value | Details |
|---|---|
| 0 | Specify the direction with the sign of torque command<br>Torque command input[+] → positive direction, [-] → negative direction |
| 1 | Specify the direction with torque command sign(TC-SIGN).<br>OFF: positive direction ON: negative direction |

| Pr3.19 | Name | Torque command input gain | | | Mode | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 10~100 | Unit | 0.1V/100% | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0327 | | |
| | Effective | Immediate | | | | | | |

Based on the voltage (V) applied to the analog torque command (TRQR),set up the conversion gain to torque command(%)

- Unit of the setup value is 0.1V/100%] and set up input voltage necessary to produce the rated torque.
- Default setup of 30 represents 3V/100%




| Pr3.20 | Name | Torque command input reversal | | | Mode | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0329 | | |
| | Effective | Immediate | | | | | | |

Set up the polarity of the voltage applied to the analog torque command (TRQR).

| Setup Value | Direction Of Motor Output Torque | |
|---|---|---|
| 0 | Non-reversal | [+ voltage]→ [+ direction] [- voltage]→ [-direction] |
| 1 | reversal | [+ voltage]→ [- direction] [- voltage]→ [+direction] |

| Pr3.21 | Name | Speed limit value 1 | | | Mode | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 032B | | |
| | Effective | Immediate | | | | | | |

Set up the speed limit used for torque control.
During the torque controlling, the speed set by the speed limit cannot be exceeded.

| Pr3.22 | Name | Torque command | | | Mode | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~300 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 032D | | |
| | Effective | Immediate | | | | | | |

Set up torque limit value in torque mode control.

| Pr3.23 | Name | Speed zero-motor standstill delay time | | | Mode | | V | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2000 | Unit | ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x032F | | |
| | Effective | Immediate | | | | | | |

Set the “Speed Zero-Motor Standstill delay time Pr3.23” in velocity control mode, it is the time between the speed reaching below the Speed Zero-Clamp level and the motor standstill.
It mainly prevents the motor from rotating slowly When the zero speed clamp is in effect.
When Pr3.23 set to 0, the function is invalid.
When Pr3.23 set to 1~2000, the motor speed reaches below the Pr3.16 Speed zero-clamp level, and then the motor is stationary after the set time.

| Pr3.24＊ | Name | Motor rotate maximum speed limit | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 3000 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0331 | | |
| | Effective | Immediate | | | | | | |

Set up motor running max rotate speed, but can’t be exceeded motor allowed max rotate speed.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr3.29 | Name | Analog 1 clamp voltage | | | Mode | | | T |
| | Range | 0~20000 | Unit | mv | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x033B | | |
| | Effective | Immediate | | | | | | |
| | Set the clamp voltage of analog 1, it is effective only when Pr3.17 is set to 1.<br>For example:<br>Pr3.17=1, when the analog 1 (AI1) is equal or lesser than the Pr3.29 set value, the motor speed is set to 0 directly. | | | | | | | |
| Pr3.30 | Name | Analog 3 clamp voltage | | | Mode | | | T |
| | Range | 0~20000 | Unit | mv | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x033D | | |
| | Effective | Immediate | | | | | | |
| | Set the clamp voltage of analog 3, it is effective only when Pr3.17 is set to 0 or1.<br>For example:<br>Pr3.17=1, when the analog 3 (AI1) is equal or lesser than the Pr3.30 set value, the motor speed is set to 0 directly. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr3.62 | Name | Velocity analog | | | Mode | | V | T |
| | Range | -32767~32768 | Unit | mv | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x037D | | |
| | Effective | Immediate | | | | | | |
| | Set the Velocity Analog via Modbus connection, it is effective only when Pr3.17 is set to 3. | | | | | | | |
| Pr3.63 | Name | Torque analog | | | Mode | | | T |
| | Range | -32767~32768 | Unit | mv | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x037F | | |
| | Effective | Immediate | | | | | | |
| | Set the Torque Analog via Modbus connection, it is effective only when Pr3.17 is set to 3. | | | | | | | |

## 5.2.5【Class 4】I/F Monitor Setting

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr4.00＊ | Name | Input selection SI1 | | | Mode | P | V | T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 3 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0401H | | |
| | Effective | Power-on again | | | | | | |
| Pr4.01＊ | Name | Input selection SI2 | | | Mode | P | V | T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0403 | | |
| | Effective | Power-on again | | | | | | |
| Pr4.02＊ | Name | Input selection SI3 | | | Mode | P | V | T |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0405 |
| | Effective | O | | | | |
| Pr4.03* | Name | Input selection SI4 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0207 |
| | Effective | Power-on again | | | | |
| Pr4.04* | Name | Input selection SI5 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0409 |
| | Effective | Power-on again | | | | |
| Pr4.05* | Name | Input selection SI6 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 040B |
| | Effective | Power-on again | | | | |
| Pr4.06* | Name | Input selection SI7 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 040D |
| | Effective | Power-on again | | | | |
| Pr4.07* | Name | Input selection SI8 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 040F |
| | Effective | Power-on again | | | | |
| Pr4.08* | Name | Input selection SI9 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0411 |
| | Effective | Power-on again | | | | |

Set digital SI input function allocation.

This parameter use 16 binary system to set up the values,

For the function number, please refer to the following Figure.

| Signal Name | Symbol | Setup Value | |
|---|---|---|---|
| | | Normally Open | Normally Closed |
| Invalid | - | 00h | Do not setup |
| Positive direction over-travel inhibition | POT | 01h | 81h |
| Negative direction over-travel inhibition | NOT | 02h | 82h |
| Servo-ON input | SRV-ON | 03h | 83h |
| Alarm clear input | A-CLR | 04h | Do not setup |

| | | | |
|---|---|---|---|
| Control mode switching input | C-MODE | 05h | 85h |
| Gain switching input | GAIN | 06h | 86h |
| Deviation counter clear input | CL | 07h | Do not setup |
| Command pulse inhibition input | INH | 08h | 88h |
| Torque switching | TC-SEL | 09h | 89h |
| Electronic gear switching input 1 | DIV1 | 0Ch | 8Ch |
| Selection 1 input of internal command speed | INTSPD1 | 0Eh | 8Eh |
| Selection 2 input of internal command speed | INTSPD2 | 0Fh | 8Fh |
| Selection 3 input of internal command speed | INTSPD3 | 10h | 90h |
| Speed zero clamp input | ZEROSPD | 11h | 91h |
| Speed command sign input | VC-SIGN | 12h | 92h |
| Torque command sign input | TC-SIGN | 13h | 93h |
| Forced alarm input | E-STOP | 14h | 94h |

Note:

- Normally open contact means when input signal is on and function is triggered.
- Normally closed contact means when input signal is off and function is triggered.
- Don't setup to a value other than that specified in the table.
- Don't assign specific function to 2 or more signals. Duplicated assignment will cause Err21.0 I/F input multiple assignment error 1or Err21.1 I/F input multiple assignment error 2

**PR-Mode** related input setup as below:

| **Input** | | | |
|---|---|---|---|
| **Signal Name** | **Symbol** | **Setup Value** | |
| | | **Normally Open** | **Normally Closed** |
| Trigger command | CTRG | 20h | A0h |
| Homing signal | HOME | 21h | A1h |
| Forced stop | STP | 22h | A2h |
| Forward direction JOG | JOG+ | 23h | A3h |
| Opposite direction JOG | JOG- | 24h | A4h |
| Positive limit switch | PL | 25h | A5h |
| Negative limit switch | NL | 26h | A6h |
| Homing switch signal | ORG | 27h | A7h |
| Road strength address 0 | ADD0 | 28h | A8h |
| Road strength address 1 | ADD1 | 29h | A9h |
| Road strength address 2 | ADD2 | 2ah | Aah |
| Road strength address 3 | ADD3 | 2bh | Abh |

Note:

CTRG, HOME is edge triggered; the active duration must more than 1ms.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr4.10*** | Name | Output selection SO1 | | | Mode | **P** | **V** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 101 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0415 | | |
| | Effective | Power-on again | | | | | | |
| **Pr4.11*** | Name | Output selection SO2 | | | Mode | **P** | **V** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 202 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0417 | | |
| | Effective | Power-on again | | | | | | |
| **Pr4.12*** | Name | Output selection SO3 | | | Mode | **P** | **V** | **T** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 404 | | |
| | Data length | 16bit | Access | R/W | Address | 0419H | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Power-on again | | | | |
| Pr4.13* | Name | Output selection SO4 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 303 |
| | Data length | 16bit | Access | R/W | Address | 0x 041B |
| | Effective | Power-on again | | | | |
| Pr4.14* | Name | Output selection SO5 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 101 |
| | Data length | 16bit | Access | R/W | Address | 0x 041D |
| | Effective | Power-on again | | | | |
| Pr4.15* | Name | Output selection SO6 | | | Mode | P V T |
| | Range | 0~00FFFFFFh | Unit | — | Default | 303 |
| | Data length | 16bit | Access | R/W | Address | 0x 041F |
| | Effective | Power-on again | | | | |

Set digital SO output functions allocation.
This parameter use 16 binary system do setup
For the function number, please refer to the following Figure.

| Signal Name | Symbol | Setup Value |
|---|---|---|
| Invalid | - | 00h |
| Alarm output | Alm | 01h |
| Servo-Ready output | S-RDY | 02h |
| External brake release signal | BRK-OFF | 03h |
| Positioning complete output | INP | 04h |
| At-speed output | AT-SPPED | 05h |
| Zero-speed detection output | ZSP | 07h |
| Velocity coincidence output | V-COIN | 08h |
| Positional command ON/OFF output | P-CMD | 0Bh |
| Speed command ON/OFF output | V-CMD | 0Fh |

**PR-Mode** related output setup as below;

| Output | | | |
|---|---|---|---|
| Signal Name | Symbol | Setup Value | |
| | | Normally Open | Normally Closed |
| Command complete | CMD-OK | 20h | A0h |
| Road strength address | MC-OK | 21h | A1h |
| Homing finish | HOME-OK | 22h | A2h |
| Torque limit | TQL | 06h | 86h |

Note:
CMD-OK indicates PR command sent complete, but the motor may Not in-position.
MC-OK indicates command complete and the motor in-position.
*Pay attention to the front panel display is hexadecimal.

| | | | | | | |
|---|---|---|---|---|---|---|
| Pr4.22 | Name | Analog input 1 (AI1) offset setup | | | Mode | V |
| | Range | -5578~5578 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 042D |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |
| Set up the offset correction value applied to the voltage fed to the analog input 1. | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr4.23** | Name | Analog input 1 (AI1) filter | | | Mode | **V** |
| | Range | 0~6400 | Unit | 0.01ms | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 042F |
| | Effective | Immediate | | | | |
| Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 1. | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr4.24** | Name | Analog input 1 (AI1) over -voltage setup | | | Mode | **V** |
| | Range | 0~100 | Unit | 0.1v | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0431 |
| | Effective | Immediate | | | | |
| Set up the excessive level of the input voltage of analog input 1 by using the voltage associated with offset | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr4.28** | Name | Analog input 3 (AI3) offset setup | | | Mode | **T** |
| | Range | -342~342 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0439 |
| | Effective | Immediate | | | | |
| Set up the offset correction value applied to the voltage fed to the analog input 3. | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr4.29** | Name | Analog input 3 (AI3) filter | | | Mode | **T** |
| | Range | 0~6400 | Unit | 0.01ms | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 043B |
| | Effective | Immediate | | | | |
| Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 3. | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr4.30** | Name | Analog input 3 (AI3) overvoltage setup | | | Mode | **T** |
| | Range | 0~100 | Unit | 0.1v | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 043D |
| | Effective | Immediate | | | | |
| Set up the excessive level of the input voltage of analog input 3 by using the voltage associated with offset. | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Pr4.31** | Name | Positioning complete range | Mode | **P** | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.0001rev | Default | 10 |
| | Data length | 16bit | Access | R/W | Address | 0x 043F |
| | Effective | Immediate | | | | |
| | Set up the timing of positional deviation at which the positioning complete signal (INP1) is output. | | | | | |

| Pr4.32 | Name | Positioning complete output setup | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | command unit | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0441 | | |
| | Effective | Immediate | | | | | | |

Select the condition to output the positioning complete signal (INP1).

| Setup Value | Action Of Positioning Complete Signal |
|---|---|
| 0 | The signal will turn on when the positional deviation is smaller than Pr4.31 [positioning complete range]. |
| 1 | The signal will turn on when there is No. position command and position deviation is smaller than Pr4.31 [positioning complete range]. |
| 2 | The signal will turn on when there is No. position command, the zero-speed detection signal is ON and the positional deviation is smaller than Pr4.31 [positioning complete range]. |
| 3 | The signal will turn on when there is No. position command and the positional deviation is smaller than Pr4.31 [positioning complete range].Then holds “ON” states until the next position command is entered. Subsequently, ON state is maintained until Pr4.33 INP hold time has elapsed. After the hold time, INP output will be turned ON/OFF according to the coming positional command or condition of the positional deviation. |

| Pr4.33 | Name | INP hold time | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~30000 | Unit | 1ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0443 | | |
| | Effective | Immediate | | | | | | |

Set up the hold time when Pr 4.32 positioning complete output setup=3

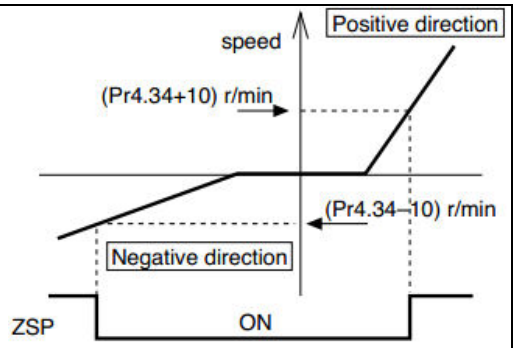
| Setup Value | State Of Positioning Complete Signal |
|---|---|
| 0 | The hold time is maintained definitely, keeping ON state until next positional command is received. |
| 1-30000 | ON state is maintained for setup time (ms) but switched to OFF state as the positional command is received during hold time. |

| Pr4.34 | Name | Zero-speed | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 10~20000 | Unit | r/min | Default | 50 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0445 | | |
| | Effective | Immediate | | | | | | |

You can set up the timing to feed out the Zero-speed detection output signal (ZSP or TCL) in rotate speed (r/min).

The zero-speed detection signal(ZSP) will be fed out when the motor speed falls below the setup of this parameter, Pr4.34

- The setup of pr4.34 is valid for both positive and negative direction regardless of the motor rotating direction.
- There is hysteresis of 10[r/min]



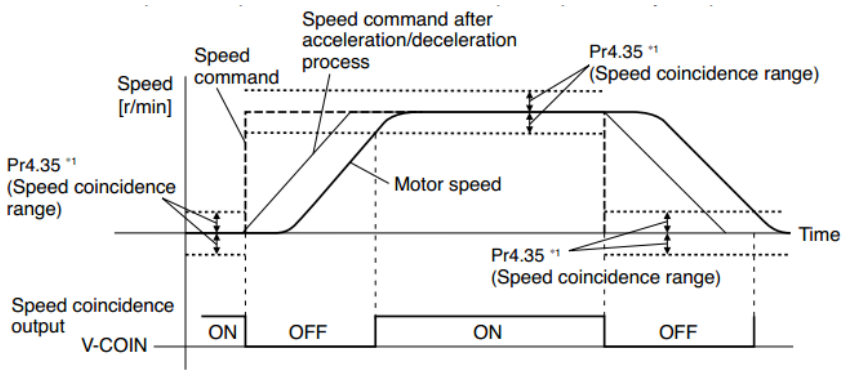

| Pr4.35 | Name | Speed coincidence range | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 50 |
| | Data length | 16bit | Access | R/W | Address | 0x 0447 |
| | Effective | Immediate | | | | |

Set the speed coincidence (V-COIN) output detection timing.
Output the speed coincidence (V-COIN) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter.

Because the speed coincidence detection is associated with 10 r/min hysteresis, actual detection range is as shown below.

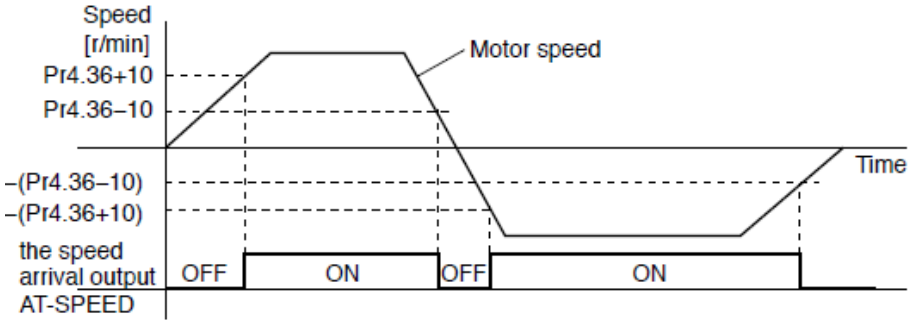
Speed coincidence output OFF -> ON timing (Pr4.35 -10) r/min

Speed coincidence output ON -> OFF timing (Pr4.35 +10) r/min




| Pr4.36 | Name | At-speed(Speed arrival) | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 1000 |
| | Data length | 16bit | Access | R/W | Address | 0x 0449 |
| | Effective | Immediate | | | | |

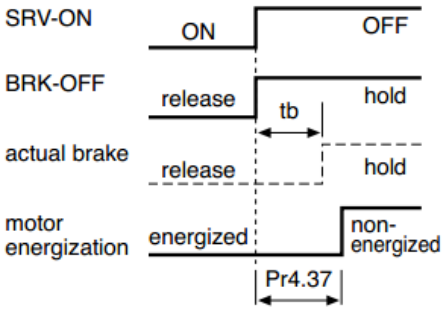
Set the detection timing of the speed arrival output (AT-SPEED).
When the motor speed exceeds this setup value, the speed arrive output (AT-SPEED) is output.
Detection is associated with 10r/min hysteresis.




| Pr4.37 | Name | Mechanical brake action at stalling setup | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 1ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 044B | | |
| | Effective | Immediate | | | | | | |

Motor brake delay time setup, mainly used to prevent servo on “galloping “phenomenon.
Set up the time from when the brake release signal(BRK-OFF) turns off to when the motor is de-energized (servo-free),when the motor turns to servo-off while the motor is at stall

- Set up to prevent a micro-travel/drop of the motor (work) due to the action delay time (tb) of the brake.
- Ni After setting up Pr4.37>=tb, then compose the sequence so as the drive turns to servo-off after the brake is actually activated.

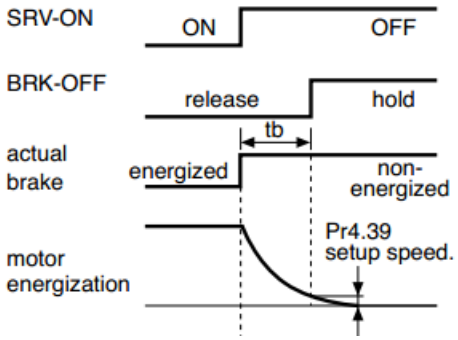



| Pr4.38 | Name | Mechanical brake action at running setup | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 1ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 044D | | |
| | Effective | Immediate | | | | | | |

Mechanical brake start delay time setup, mainly used to prevent servo off "galloping phenomenon"

Set up time from when detecting the off of servo-on input signal(SRV-ON)is to when external brake release signal(BRK-OFF)turns off, while the motor turns to servo off during the motor in motion

- Set up to prevent the brake deterioration due to the motor running.
- At servo-OFF during the motor is running , tb of the right fig will be a shorter one of either Pr4.38 setup time, or time lapse till the motor speed falls below Pr4.39 setup speed




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr4.39** | Name | Brake release speed setup | | | Mode | **P** | **V** | **T** |
| | Range | 30~3000 | Unit | 1ms | Default | 30 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 044F | | |
| | Effective | Immediate | | | | | | |
| | When servo off, rotate speed less than this setup vale, and mechanical brake start delay time arrive, motor lost power. | | | | | | | |

## 5.2.6【Class 5】Extended Setup

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.00** | Name | 2nd Command pulse counts per one motor revolution | | | Mode | **P** | | |
| | Range | 0-8388608 | Unit | P | Default | 0 | | |
| | Data length | 32bit | Access | R/W | Address | 0x 0500<br>0x 0501 | | |
| | Effective | Power-on again | | | | | | |
| | Set the command pulse that causes single turn of the motor shaft. Select Pr0.08 1st or Pr5.00 2nd by IO signal.<br>1) If Pr5.00≠0 , the actual turns = pulse number / Pr5.00<br>2) If Pr5.00 = 0, Pr5.01 2nd numerator of electronic gear and Pr5.02 2nd Denominator of electronic Gear become valid. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.01** | Name | 2nd numerator of electronic gear | | | Mode | **P** | | |
| | Range | 1~1073741824 | Unit | — | Default | 1 | | |
| | Data length | 32bit | Access | R/W | Address | 0x 0502<br>0x 0503 | | |
| | Effective | Power-on again | | | | | | |
| | Set the numerator of division/multiplication operation made according to the command pulse input | | | | | | | |
| **Pr5.02** | Name | 2nd denominator of electronic gear | | | Mode | **P** | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Range | 1~1073741824 | Unit | — | Default | 1 |
| | Data length | 32bit | Access | R/W | Address | 0x 0504<br>0x 0505 |
| | Effective | Power-on again | | | | |
| | Set the denominator of division/multiplication operation made according to the command pulse input.<br>Instructions refer to Pr0.09 and Pr0.10 and select by IO signal | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.04** | Name | Over-travel inhibit input setup | | | Mode | **P** | **V** | **T** |
| | Range | 0/1/2 | Unit | 1ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0509 | | |
| | Effective | Immediate | | | | | | |
| | 0: positive and negative limit effective, No. alarm output;<br>1: positive and negative limit effective invalid;<br>2: positive and negative limit effective, alarm output; | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.06** | Name | Sequence at servo-off | | | Mode | **P** | **V** | **T** |
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 050D | | |
| | Effective | Immediate | | | | | | |

Specify the status during deceleration and after stop, after servo-off.

| Setup Value | During Deceleration | After Stop |
|---|---|---|
| 0 | emergency | Free-run |
| 1 | Free-run | Free-run |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.08** | Name | LV trip selection at main power OFF | | | Mode | **P** | **V** | **T** |
| | Range | 0~1 | Unit | — | Default | 1 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0511 | | |
| | Effective | Immediate | | | | | | |

You can select whether or Not to activate Err0d.0 (main power under-voltage protection) function while the main shutoff continues for the setup of Pr5.09 (The main power-OFF detection time).

| Setup Value | Action of Main Power Low Voltage Protection |
|---|---|
| 0 | When the main power is shut off during Servo-On, Err0d.0 will Not be triggered and the drive turns to Servo-OFF. The drive returns to Servo-On again after the main power resumption. |
| 1 | When the main power is shut off during Servo-On, the drive will trip due to Err0d.0 |

**Caution:** Err0d.0 (main power under-voltage protection) is trigged when setup of Pr5.09 is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff, regardless of the Pr5.08 setup.

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr5.09*** | Name | The main power-OFF detection time | Mode | **P** | **V** | **T** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Range | 70~2000 | Unit | 1ms | Default | 70 |
| | Data length | 16bit | Access | R/W | Address | 0x 0513 |
| | Effective | Power-on again | | | | |
| | You can set up the time to detect the shutoff while the main power is kept shut off continuously. The main power off detection is invalid when you set up this to 2000. | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.10** | Name | Dynamic braking mode | | | Mode | **P** | **V** | **T** |
| | Range | 0~2 | Unit | | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0515 | | |
| | Effective | Power-on again | | | | | | |
| | 0：Dynamic braking is valid in both Normal and abnormal conditions.<br>1：Dynamic braking is valid in Normal condition, invalid in abnormal condition. (used to prevent abnormal conditions, high speed and large inertia to burn up the dynamic braking)<br>2：Dynamic braking is invalid in both Normal and abnormal conditions. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.11＊** | Name | Torque setup for emergency stop | | | Mode | **P** | **V** | **T** |
| | Range | 0~500 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0517 | | |
| | Effective | Immediate | | | | | | |
| | Set up the torque limit at emergency stop<br>When setup value is 0, the torque limit for Normal operation is applied. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.12** | Name | Over-load level setup | | | Mode | **P** | **V** | **T** |
| | Range | 0~115 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0519 | | |
| | Effective | Immediate | | | | | | |
| | You can set up over-load level. The overload level becomes 115% by setting up this value to 0.<br>Use this with 0 setup in Normal operation, set up other value only when you need to low this over-load level.<br>The setup value of this parameter is limited by 115% of the motor rating. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.13** | Name | Over-speed level setup | | | Mode | **P** | **V** | **T** |
| | Range | 0~10000 | Unit | r/min | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 051B | | |
| | Effective | Immediate | | | | | | |
| | If the motor speed exceeds this setup value, Err1A.0 [over-speed protect] occurs.<br>The over-speed level becomes 1.2 times of the motor max, speed by setting up this to 0. | | | | | | | |

| Pr5.15＊ | Name | I/F reading filter | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~255 | Unit | 0.1ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 051F | | |
| | Effective | Power-on again | | | | | | |
| I/O input digital filtering; higher setup will initiate control delay. | | | | | | | | |

| Pr5.17 | Name | Counter clear input mode | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | — | Default | 3 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0523 | | |
| | Effective | Immediate | | | | | | |

Set up the clearing conditions of the counter clear input signal

| Setup Value | Clear Condition |
|---|---|
| 0/2/4 | Invalid |
| 1 | Always clear |
| 3 | Only clear one time |

| Pr5.20 | Name | Position setup unit select | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 2 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0529 | | |
| | Effective | Immediate | | | | | | |

Specify the unit to determine the range of positioning complete and excessive positional deviation

| Setup Value | Unit |
|---|---|
| 0 | Encoder unit |
| 1 | Command unit |
| 2 | 10000pulse/rotation |

| Pr5.21 | Name | Selection of torque limit | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~5 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 052B | | |
| | Effective | Immediate | | | | | | |

Set up the torque limiting method

| Setup Value | | Limiting Value |
|---|---|---|
| 0 | | Pr0.13 |
| 1 | | Pr5.22 |
| 2 | TL-SEL off | Pr0.13 |
| | TL-SEL on | Pr5.22 |
| 5 | | Pr0.13 Positive torque limit<br>Pr5.22 Negative torque limit |

| Pr5.22 | Name | 2nd torque limit | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 300 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Data length | 16bit | Access | R/W | Address | 0x 052D |
| | Effective | Immediate | | | | |
| | Set up the 2nd limit value of the motor torque output<br>The value of the parameter is limited to the maximum torque of the applicable motor. | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.23** | Name | Positive torque reached | | | Mode | **P** | **V** | **T** |
| | Range | 0~300 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 052F | | |
| | Effective | Immediate | | | | | | |
| | ● Default setting is 0，if the torque feedback is greater than 95% of the rated torque, output TCL signal.<br>● If the torque feedback is greater than the user setting value, output TCL signal. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.24** | Name | Negative torque reached | | | Mode | **P** | **V** | **T** |
| | Range | 0~300 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0531 | | |
| | Effective | Immediate | | | | | | |
| | ● Default setting is 0，if the torque feedback is greater than 95% of the rated torque, output TCL signal.<br>● If the torque feedback is greater than the user setting value, output TCL signal. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.28*** | Name | LED initial status | | | Mode | **P** | **V** | **T** |
| | Range | 0~35 | Unit | — | Default | 1 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0539 | | |
| | Effective | Immediate | | | | | | |

You can select the type of data to be displayed on the front panel LED (7-segment) at the initial status after power-on.

| Setup Value | Content | Setup Value | Content | Setup Value | Content |
|---|---|---|---|---|---|
| 0 | Positional command deviation | 10 | I/O signal status | 27 | Voltage across PN [V] |
| 1 | Motor speed | 11 | Analog input value | 28 | Software version |
| 2 | Positional command speed | 12 | Error factor and reference of history | 29 | Drive serial number |
| 3 | Velocity control command | 16 | Inertia ratio | 30 | Motor serial number |
| 4 | Torque command | 17 | Factor of No.-motor running | 31 | Accumulated operation time |
| 5 | Feedback pulse sum | 23 | Communication axis address | 33 | Temperature information |
| 6 | Command pulse sum | 24 | Encoder positional deviation [encoder unit] | 36 | Safety condition monitor |
| 9 | Control mode | | | | |

| Pr5.29＊ | Name | Mode setup of Modbus communication | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~255 | Unit | — | Default | 5 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 053B | | |
| | Effective | Immediate | | | | | | |

| Value | Data Bit | Parity-Check | Stop Bit |
|---|---|---|---|
| 0 | 8 | Even Parity | 2 |
| 1 | 8 | Odd Parity | 2 |
| 2 | 8 | Even Parity | 1 |
| 3 | 8 | Odd Parity | 1 |
| 4 | 8 | None | 1 |
| 5 | 8 | None | 2 |

| Pr5.30＊ | Name | Baud rate setup of Modbus communication | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~6 | Unit | — | Default | 2 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 053D | | |
| | Effective | Immediate | | | | | | |

Set up the communication baud rate of RS485.

| Setup Value | Baud Rate | Setup Value | Baud Rate |
|---|---|---|---|
| 0 | 2400bps | 4 | 38400bps |
| 1 | 4800bps | 5 | 57600bps |
| 2 | 9600bps | 6 | 115200bps |
| 3 | 19200bps | | |

| Pr5.31* | Name | Modbus slave axis ID | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~127 | Unit | — | Default | 1 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 053F | | |
| | Effective | Immediate | | | | | | |

During communication with the host (e.g. PC) to control multiple shafts, the shaft being accessed by the host should be identified.

Note: when using RS232/RS485, the maximum valid value is 31.

| Pr5.32 | Name | Command pulse input maximum setup | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~4000 | Unit | KHZ | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0541 | | |
| | Effective | Immediate | | | | | | |

Set the maximum number of pulses to be used as command pulse input, if the number of the input pulse exceeds the setup value ,ERR1B0 command pulse input frequency error protection occurs

| Pr5.35* | Name | Front panel lock setup | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0547 | | |
| | Effective | Immediate | | | | | | |

Lock the operation on the front panel.

| Setup Value | Content |
|---|---|
| 0 | No. limit on the front panel operation |
| 1 | Lock the operation on the front panel |

| Pr5.36 | Name | 7th setting parameters open | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0, 102 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0549 | | |
| | Effective | Immediate | | | | | | |

7th setting parameters open.

| Setup Value | Content |
|---|---|
| 0 | |
| 102 | Open 7th setting parameters modification authority. |

## 5.2.7【Class 6】Special Setup

| Pr6.03 | Name | JOG trial run command torque | | | Mode | | | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~100 | Unit | % | Default | 0 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Data length | 16bit | Access | R/W | Address | 0x 0607 |
| | Effective | Immediate | | | | |
| You can set up the command speed used for JOG trial run (torque control). | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr6.04** | Name | JOG trial run command speed | | | Mode | **P** | **V** | **T** |
| | Range | 0~10000 | Unit | r/min | Default | 300 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0609 | | |
| | Effective | Immediate | | | | | | |
| You can set up the command speed used for JOG trial run (velocity control). | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr6.05** | Name | Position 3rd gain valid time | | | Mode | **P** | | |
| | Range | 0~1000 | Unit | 0.1ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 060B | | |
| | Effective | Immediate | | | | | | |
| Set up the time at which 3rd gain becomes valid.<br>When Not using this parameter, set Pr6.05=0, Pr6.06=100<br>This is valid for only position control/full-closed control. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr6.06** | Name | Position 3rd gain multiplication | | | Mode | **P** | | |
| | Range | 0~1000 | Unit | 100% | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 060D | | |
| | Effective | Immediate | | | | | | |
| Set up the 3rd gain by multiplying factor of the 1st gain<br>3rd gain= 1st gain * Pr6.06/100. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr6.07** | Name | Torque command additional value | | | Mode | **P** | **V** | **T** |
| | Range | -100~100 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 060F | | |
| | Effective | Immediate | | | | | | |
| **Pr6.08** | Name | Positive torque compensation value | | | Mode | **P** | **V** | **T** |
| | Range | -100~100 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0611 | | |
| | Effective | Immediate | | | | | | |
| **Pr6.09** | Name | Negative torque compensation value | | | Mode | **P** | **V** | **T** |
| | Range | -100~100 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0613 | | |
| | Effective | Immediate | | | | | | |
| These three parameters may apply feed forward torque superposition directly to torque | | | | | | | | |

| |
|---|
| command. |

| Pr6.10 | Name | Function extension | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0x0~0xFFFF | Unit | — | Default | 0x0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x0615 | | |
| | Effective | Power-on again | | | | | | |

Pr6.10 is only valid in position control mode and Pr0.07=3.

| Value | Bit set | Function |
|---|---|---|
| 0x0 | bit1=0，bit2=0 | Pulse and direction input polarity do not change |
| 0x2 | bit1=1，bit2=0 | Pulse input polarity is reversed |
| 0x4 | bit1=0，bit2=1 | Direction input polarity is reversed |
| 0x6 | bit1=1，bit2=1 | Pulse and direction input polarity are reversed |

Note:

Only bit1 and bit2 are supported for setting, please do not change other bits.

| Pr6.11 | Name | Current response setup | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 50~100 | Unit | % | Default | 100 | | |
| | Data length | 16bit | Access | R/W | Address | 0x0617 | | |
| | Effective | Immediate | | | | | | |

Set the value ratio of the drive current loop parameters.

| Pr6.14 | Name | Emergency stop time at alarm | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3000 | Unit | ms | Default | 200 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 061D | | |
| | Effective | Immediate | | | | | | |

Set up the time allowed to complete emergency stop in an alarm condition, exceeding this time puts this system in alarm state.

| Pr6.20 | Name | Trial run distance | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1200 | Unit | 0.1rev | Default | 10 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0629 | | |
| | Effective | Immediate | | | | | | |

The distance of running each time in JOG run(position control)

| Pr6.21 | Name | Trial run waiting time | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~30000 | Unit | Ms | Default | 100 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 062B | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |
| The waiting time after running each time in JOG run(position control) | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr6.22** | Name | Trial run cycle times | | | Mode | **P** |
| | Range | 0~32767 | Unit | — | Default | 5 |
| | Data length | 16bit | Access | R/W | Address | 0x 062D |
| | Effective | Immediate | | | | |
| The cycling times of JOG run(position control) | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr6.25** | Name | Acceleration of trial running | | | Mode | **P** **V** |
| | Range | 0~32767 | Unit | ms | Default | 100 |
| | Data length | 16bit | Access | R/W | Address | 0x 0633 |
| | Effective | Immediate | | | | |
| Acceleration time from 0rpm~1000rpm of trial running | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr6.27** | Name | Warning latching time setup | | | Mode | **P** **V** |
| | Range | 0~10 | Unit | ms | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x0637 |
| | Effective | Immediate | | | | |
| 0: Standard model<br>1: Mode 1, under study | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr6.28** | Name | Observer gain | | | Mode | **P** **V** |
| | Range | 0~32767 | Unit | % | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x0639 |
| | Effective | Immediate | | | | |
| 0: Default gain 1: Off<br>x: Unit: %, manual, dependent on motor, load and encoder | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr6.29** | Name | Observer filter | | | Mode | **P** **V** |
| | Range | 0~32767 | Unit | us | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x063B |
| | Effective | Immediate | | | | |
| 0: Default gain 1: Off<br>x: Unit: %, manual, dependent on motor, load and encoder | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr6.56** | Name | Motor blocking alarm torque threshold | | | Mode | **P** **V** |
| | Range | 0~300 | Unit | % | Default | 300 |
| | Data length | 16bit | Access | R/W | Address | 0x0661 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |

Value=0: Motor blocking alarm function off.

Value≠0: Function on. Set the motor blocking alarm torque threshold (Motor speed is equal or lesser than 20 rpm)

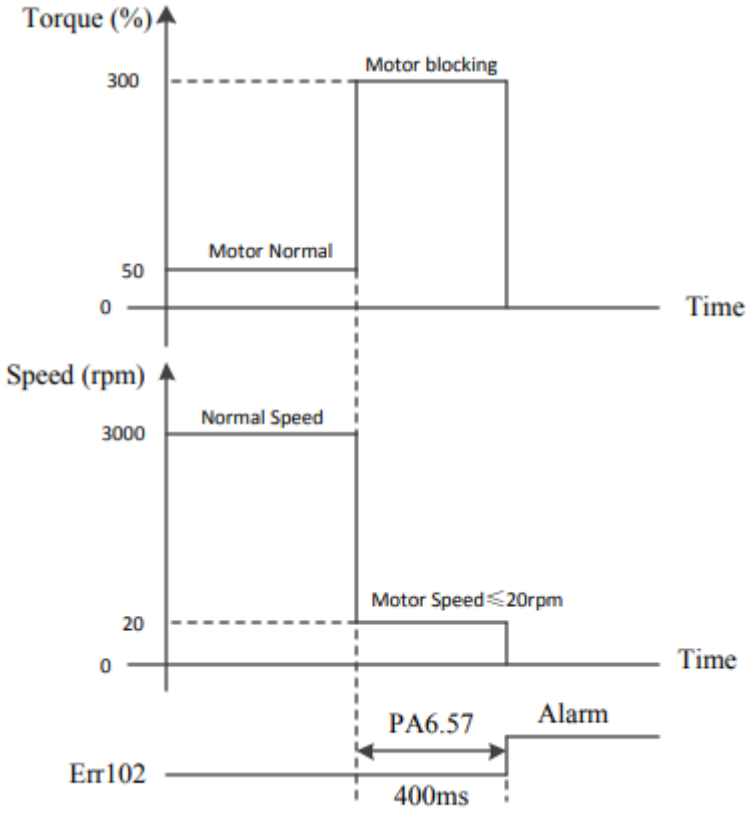
If the motor reaches this torque threshold when motor speed is greater than 20rpm, it will not trigger the motor blocking alarm Er102.

| Pr6.57 | Name | Motor blocking alarm delay time | | | Mode | P | V | |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~10000 | Unit | ms | Default | 400 | | |
| | Data length | 16bit | Access | R/W | Address | 0x0663 | | |
| | Effective | Immediate | | | | | | |

Pr6.57 is effective if Pr6.56≠0.

For example:

Pr6.56=300, Pr6.57=400; motor blocking speed threshold default is 20rpm




-If the Pr0.13 torque limit is lesser than the blocking torque threshold, the overload alarm Er100 will occur when the motor load is too large.

-If the speed is greater than 20rpm when blocking, it will not trigger the motor blocking alarm Er102, but will trigger the alarm Er100.

| Pr6.63 | Name | Absolute multi-turn position upper bound | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~32766 | Unit | Rotation | Default | 0 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Data length | 16bit | Access | R/W | Address | 0x 067F |
| | Effective | Power-on again | | | | |
| | **While Pr0.15=2: Absolute position rotation mode**:<br>The encoder is used as an absolute encoder, and the position retentive at power failure is supported..<br>It is mainly applicable to the scenario where the load travel range is Not limited and the number of motor single-direction revolution is less than 0~(Pr6.63+1) | | | | | |

## 5.2.8【Class B】Status Information

Note: This parameters class is only for RS485 communication.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PrB.00** | Name | Software version 1（DSP） | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B00 | | |
| | Display Software version 1（DSP） | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PrB.01** | Name | Software version 2（CPLD） | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B01 | | |
| | Display Software version 2（CPLD） | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PrB.02** | Name | Software version 3（other） | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B02 | | |
| | Display Software version 3 | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PrB.03** | Name | Error code | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B03 | | |
| | Display Error code | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PrB.04** | Name | Factor of No.-motor running | | | Mode | **P** | **V** | **T** |
| | Range | | Unit | | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B04 | | |
| | Factor of No.-motor running | | | | | | | |

| PrB.05 | Name | Drive operating state | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B05 | | |

| Bit | Function | Details |
|---|---|---|
| 0 | RDY | Servo ready |
| 1 | RUN | Servo run |
| 2 | ERR | Servo error |
| 3 | HOME_OK | Homing process finished |
| 4 | INP | Positioning complete |
| 5 | AT-SPEED | At-speed |
| 6~15 | | Reserve |

| PrB.06 | Name | Actual velocity (unfiltered) | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | RPM | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B06 | | |
| Actual velocity (unfiltered) | | | | | | | | |

| PrB.07 | Name | Actual torque feedback | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | % | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B07 | | |
| Actual torque feedback（Percentage of the rated torque） | | | | | | | | |

| PrB.08 | Name | Actual current feedback | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | 0.01A | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B08 | | |
| Actual current feedback | | | | | | | | |

| PrB.09 | Name | Actual velocity(After filtering) | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | RPM | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B09 | | |
| Actual velocity(After filtering) | | | | | | | | |

| PrB.10 | Name | DC bus voltage | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | V | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B0A | | |
| DC bus voltage | | | | | | | | |

| PrB.11 | Name | Drive temperature | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | ℃ | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B0B | | |
| | Drive temperature | | | | | | | |

| PrB.12 | Name | Analog input1 | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | 0.01V | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B0C | | |
| | Analog input1 | | | | | | | |

| PrB.13 | Name | Analog input 2 | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | 0.01V | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B0D | | |
| | Analog input2 | | | | | | | |

| PrB.14 | Name | Analog input 3 | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | 0.01V | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B0E | | |
| | Analog input3 | | | | | | | |

| PrB.15 | Name | Over-load ratio | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | % | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B0F | | |
| | Over-load ratio（%） | | | | | | | |

| PrB.16 | Name | Regeneration load ratio | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | % | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B10 | | |
| | Regeneration load ratio（%） | | | | | | | |

| PrB.17 | Name | Digital input signal status | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B11 | | |

Digital input signal status：

| Bit | SI Input |
|---|---|

| | |
|---|---|
| 0 | SI1 |
| 1 | SI2 |
| 2 | SI3 |
| … | … |
| 8 | SI9 |

Bitn=1, indicates SI (n+1) is at high level; Bitn=0, indicates SI (n+1) is at low level.

| PrB.18 | Name | Digital output signal status | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | | | |
| | Data length | 16bit | Access | R | Address | 0x 0B11 | | |

Digital output signal status：

| Bit | SO Output |
|---|---|
| 0 | SO1 |
| 1 | SO2 |
| 2 | SO3 |
| … | … |
| 5 | SO6 |

Bitn=1, indicates SO (n+1) is at high level; Bitn=0, indicates SO (n+1) is at low level.

| PrB.20 | Name | Motor position feedback (command unit) | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | P | Default | | | |
| | Data length | 32bit | Access | R | Address | 0x 0B14<br>0x 0B15 | | |

Motor position feedback（Command unit）.

If the drive receives 8388608 pulse, and the drive's instruction unit is 10000pulse/ r, the encoder unit is 8388608 pulse/r, then the drive motor position feedback pulse number is 10000P

| PrB.21 | Name | Command pulse sum（command unit） | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | P | Default | | | |
| | Data length | 32bit | Access | R | Address | 0x 0B16<br>0x 0B17 | | |

Command pulse sum（Command unit）

| PrB.22 | Name | Positional deviation（command unit） | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | P | Default | | | |
| | Data length | 32bit | Access | R | Address | 0x 0B18<br>0x 0B19 | | |

Positional deviation（Command unit）,refer to PrB.23 for details.

| PrB.23 | Name | Position command（encoder unit） | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | | | |
| | Data length | 32bit | Access | R | Address | 0x 0B1A<br>0x 0B1B | | |
| | Position command（Encoder unit）<br>If the drive's instruction unit is 10000pulse/ r, the encoder unit is 8388608 pulse/r, then the drive receive 10000pulse, the position command pulse number is 8388608 pulse | | | | | | | |

| PrB.24 | Name | Motor position（encoder unit） | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | | | |
| | Data length | 32bit | Access | R | Address | 0x 0B1C<br>0x 0B1D | | |
| | Motor position（encoder unit） | | | | | | | |

| PrB.25 | Name | Positional deviation(encoder unit) | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | | | |
| | Data length | 32bit | Access | R | Address | 0x 0B1E<br>0x 0B1F | | |
| | Positional deviation(encoder unit) | | | | | | | |

| PrB.26 | Name | Position feedback in rotation mode(encoder unit) | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | | Unit | | Default | | | |
| | Data length | 32bit | Access | R | Address | 0x 0B20H<br>0x 0B21 | | |
| | Position feedback in rotation mode(encoder unit)，refer to PrB.23 for details. | | | | | | | |

# Chapter 6 Alarm and Processing

## 6.1 Alarm List

Protection function is activated when an error occurs, the drive will stop the rotation of servo motor, and the front panel will automatically display the corresponding fault error code. The history of the error can be viewed on data monitoring mode. Error logging submenu displays like: "d12er".

**Table 6.1 Error Code List**

| Error Code | | Content | Attribute | | |
|---|---|---|---|---|---|
| Main | Sub | | Save | Emergency Stop | Available to Clear |
| 09 | 0~F | FPGA communication error | ● | | |
| 0A | 0~1 | Current detection circuit error | ● | | |
| | 2．4 | Analog input circuit error | ● | | |
| | 3 | Power line（U/V/W）not connected | ● | | |
| | 5 | DC bus circuit error | ● | | |
| | 6 | Temperature detection circuit error | ● | | |
| 0b | 0 | Control power under-voltage | ● | | |
| 0c | 0 | DC bus over-voltage | ● | | ● |
| 0d | 0 | DC bus under-voltage | ● | | ● |
| | 2 | Power line（U/V/W）not connected | | | ● |
| 0E | 0 | Over-current | ● | | |
| | 1 | over-current of intelligent power module (IPM) | ● | | |
| 0F | 0 | Drive over-heat | ● | ● | |
| 10 | 0 | Motor over-load | ● | | ● |
| | 1 | Drive over-load | ● | | ● |
| 12 | 0 | Resistor discharged circuit overload | ● | ● | |
| | 1 | Brake error | ● | | |
| 15 | 0 | Encoder wiring error | ● | | |
| | 1 | Encoder data error | ● | | |
| | 2 | Encoder initial position error | ● | | |
| | 3 | Encoder battery low-voltage error | ● | | ● |
| 17 | 0 | Encoder data error | ● | ● | |
| | 1 | Motor parameter error | | | |
| 18 | 0 | Too large position pulse deviation | ● | ● | ● |
| | 1 | Too large velocity deviation | ● | ● | ● |
| 19 | 0 | Vibration is too large | ● | ● | ● |
| 1A | 0 | Over-speed 1 | ● | ● | ● |
| | 1 | Speed out of control | ● | | ● |
| 21 | 0 | I/F input interface allocation error | ● | | ● |
| | 1 | I/F input interface function set error | ● | | ● |
| | 2 | I/F output interface function set error | ● | | ● |
| 24 | 0 | CRC verification error when EEPROM | | | |

| | | | | | |
|---|---|---|---|---|---|
| | | parameter saved | | | |
| 26 | 0 | Positive/negative over-range input valid | ● | ● | ● |
| 57 | 0 | Compulsory alarm input valid | ● | ● | |

**Save**: Save the error history record.

**Emergency stop**: drive will stop immediately when alarm occurs.

**Available to clear**: Alarm is available to be removed through SI input/panel/configuration software.

**Table 6.2 Relation between Alarm Code and 603Fh**

| Alarm Code | 1001h Object | 603Fh Object | ETG Code | Alarm Specification |
|---|---|---|---|---|
| Er 0A0 | 0x04 | 0x3150 | | Current detection circuit error of phase A |
| Er 0A1 | 0x04 | 0x3151 | | Current detection circuit error of phase B |
| Er 0A3 | 0x04 | 0x3153 | | U/V/W wire disconnection error |
| Er 0C0 | 0x04 | 0x3211 | | Over-voltage of DC bus |
| Er 0d0 | 0x04 | 0x3221 | | Under-voltage of DC bus |
| Er 0d2 | 0x04 | 0x3222 | | Lack of supply power |
| Er 0E0 | 0x02 | 0x2211 | | Over-current |
| Er 0E1 | 0x02 | 0x2212 | | Over-current of IPM |
| Er 0f0 | 0x08 | 0x4210 | | Over-heat of drive |
| Er 100 | 0x02 | 0x8310 | | Over-load |
| Er 101 | 0x02 | 0x8311 | | Over-load |
| Er 120 | 0x80 | 0x7701 | | Discharge overload |
| Er 150 | 0x80 | 0x7321 | | Encoder disconnection |
| Er 151 | 0x80 | 0x7322 | | Encoder communication error |
| Er 152 | 0x80 | 0x7323 | | Initial position error of encoder |
| Er 153/<br>Er 154 | 0x80 | 0x7325 | | Low-voltage error of battery of absolute encoder<br>Parameter error of encoder mode |
| Er 155 | 0x80 | 0x7326 | | Data exceeding of absolute multi-turn encoder |
| Er 156 | 0x80 | 0x7327 | | Over-heat of encoder |
| Er 157 | 0x80 | 0x7328 | | Encoder count error |
| Er 170 | 0x80 | 0x7324 | | Encoder data error |
| Er 180 | 0x20 | 0x 8611 | | Position overproof |
| Er 190 | 0x20 | 0x 8401 | | Alarm of excessive vibration |
| Er 1A0 | 0x20 | 0x 8402 | | Over-speed |
| Er 1a1 | 0x20 | 0x 8403 | | Speed out of control |
| Er 1b0 | 0x20 | 0x 8612 | | Over-frequency of position command |
| Er 1b1 | 0x20 | 0x 8503 | | Electronic gear ratio error |
| Er 210 | 0x80 | 0x6321 | | Repeat error of input I/O parameters |
| Er 211 | 0x80 | 0x6322 | | Over-range of input I/O parameters |
| Er 212 | 0x80 | 0x6323 | | Over-range of output I/O parameters |
| Er 240 | 0x80 | 0x5530 | | Saving error of parameters |
| Er 241 | 0x80 | 0x5531 | | EEPROM hardware error |
| Er 242 | 0x80 | 0x5532 | | Saving error of alarm history |

| | | | | |
|---|---|---|---|---|
| Er 243 | 0x80 | 0x5533 | | Saving error of manufacturer parameters |
| Er 244 | 0x80 | 0x5534 | | Saving error of communication parameters |
| Er 245 | 0x80 | 0x5535 | | Saving error of 402 parameters |
| Er 246 | 0x80 | 0x5536 | | Saving error of power off data |
| Er 260 | 0x80 | 0x7329 | | Limit alarm, valid while selecting alarm on limit function |
| Er 570 | 0x80 | 0x5441 | | IO emergency stop |
| Er 5f0 | 0x80 | 0x7122 | | Wrong motor model |
| Er 73A | 0x10 | 0x873A | | Over-loss of SM2 |
| Er 73b | 0x10 | 0x873B | | Over-loss of Sync0 |
| Er 73c | 0x10 | 0x873C | | Excessive DC error |
| Er 801 | 0x10 | 0x8201 | 0x0001 | Unknown communication error |
| Er 802 | 0x80 | 0x5510 | 0x0002 | Inadequate RAM |
| Er 803 | 0x80 | 0x5511 | | RAM cross the border |
| Er 805 | 0x80 | 0x6202 | | Fail to upgrade FOE firmware |
| Er 806 | 0x80 | 0x6201 | | Mismatching between saved ESI files and drive firmware |
| Er 811 | 0x10 | 0xA001 | 0x0011 | Invalid ESM status transfer |
| Er 812 | 0x10 | 0xA002 | 0x0012 | Unknown ESM transfer request |
| Er 813 | 0x10 | 0x8213 | 0x0013 | Not support BOOT |
| Er 814 | 0x80 | 0x6203 | | Invalid firmware |
| Er 815 | 0x10 | 0x8215 | 0x0015 | Invalid configuration on BOOT mode |
| Er 816 | 0x10 | 0x8216 | 0x0016 | Invalid Preop configuration |
| Er 817 | 0x10 | 0x8217 | | Invalid SM configuration |
| Er 818 | 0x10 | 0x8211 | | Invalid input data |
| Er 819 | 0x10 | 0x8212 | | Invalid output data |
| Er 81A | 0x10 | 0xFF02 | 0x871A | Sync loss error |
| Er 81b | 0x10 | 0x821B | 0x001B | SM watchdog timeout |
| Er 81C | 0x10 | 0x821C | 0x001C | Invalid SM type |
| Er 81d | 0x10 | 0x821D | 0x001D | Invalid output configuration |
| Er 81E | 0x10 | 0x821E | 0x001E | Invalid input configuration |
| Er 81f | 0x10 | 0x821F | | Invalid watchdog configuration |
| Er 821 | 0x10 | 0xA003 | 0x0021 | Slave station waiting for initial-operational request |
| Er 822 | 0x10 | 0xA004 | 0x0022 | Slave station waiting for pre-operational request |
| Er 823 | 0x10 | 0xA005 | 0x0023 | Slave station waiting for safe-operational request |
| Er 824 | 0x10 | 0x8224 | 0x0024 | Invalid TPDO mapping |
| Er 825 | 0x10 | 0x8225 | 0x0025 | Invalid RPDO mapping |
| Er 827 | 0x10 | 0x8227 | | Not support free-move mode |
| Er 828 | 0x10 | 0x8228 | | Not support synchronous mode |

| | | | | |
|---|---|---|---|---|
| Er 82b | 0x10 | 0x8210 | 0x002B | Configuration not same |
| Er 82C | 0x10 | 0x872C | 0x002C | Synchronous error |
| Er 82d | 0x10 | 0x872D | 0x002D | No synchronous error (pre-op to safe-op not receive synchronous command from master station) |
| Er 82E | 0x10 | 0x872E | 0x002E | Synchronous cycle too small |
| Er 830 | 0x10 | 0x8730 | 0x0030 | Invalid DC configuration |
| Er 832 | 0x10 | 0x8732 | 0x0032 | DC PLL error |
| Er 833 | 0x10 | 0x8733 | | Synchronous error between DC to IO |
| Er 834 | 0x10 | 0x8734 | | DC Synchronous over-time |
| Er 835 | 0x10 | 0x8735 | | Invalid DC cycle |
| Er 836 | 0x10 | 0x8736 | 0x0036 | Invalid sync0 cycle |
| Er 850 | 0x80 | 0x5550 | 0x0050 | No access to ESC EEPROM |
| Er 851 | 0x80 | 0x5551 | 0x0051 | Saving error of ESI files |
| Er 852 | 0x80 | 0x5552 | 0x0052 | Fail to build link |
| Er 860 | 0x80 | 0xFF01 | | Over-loss of ECAT frame loss per unit time |
| Er 870 | 0x80 | 0x5201 | | Not support drive enable while operating |

# 6.2 Alarm Processing Method

When appear error, please clear error reason, renew power on

| **Error code** | Main | Extra | **Display:**"Er 090"--"Er 09F" | |
|---|---|---|---|---|
| | 09 | 0~F | **Content:** FPGA communication error | |
| Cause | | | Confirmation | Solution |
| L1,L2 terminal under-voltage | | | Check L1,L2 terminal voltage | Make sure voltage of L1,L2 terminal in proper range; |
| Drive internal fault | | | / | Replace the drive with a new one; |

| **Error code** | Main | Extra | **Display:**"Er 0A0"--"Er 0A1" | |
|---|---|---|---|---|
| | 0A | 0~1 | **Content:** Current detection circuit error | |
| Cause | | | Confirmation | Solution |
| Wiring error of motor output U,V,W terminal | | | Check wiring of motor output U,V,W terminal | Make sure motor U,V,W terminal wiring correctly;<br>Make sure voltage of L1,L2,L3 terminal in proper range;<br>Replace the drive with a new one;<br>Tune cable and power cable work at same time, pluck out tune cable; |
| Main voltage L1,L2,L3 terminal voltage whether over-low | | | Check main voltage L1,L2,L3 terminal voltage | |
| Drive inner fault | | | / | |

| **Error code** | Main | Extra | **Display:** "Er 0A2", "Er 0A4" | |
|---|---|---|---|---|
| | 0A | 2, 4 | **Content:** Analog input circuit error | |
| Cause | | | Confirmation | Solution |

| | | |
|---|---|---|
| Analog input Wiring error | Check wiring of analog input | Make sure analog input wiring correctly;<br>Replace the drive with a new one; |
| Drive inner fault | / | |

| **Error code** | Main | Extra | **Display:** "Er 0A3" | |
|---|---|---|---|---|
| | 0A | 3 | **Content:** Power line（U/V/W）not connected | |
| Cause | | | Confirmation | Solution |
| Power line（U/V/W）not connected | | | Check wiring of U/V/W | Make sure UVW wiring correctly;<br>Replace the motor with a new one; |
| Motor inner fault | | | / | |

| **Error code** | Main | Extra | **Display:** "Er 0A5" | |
|---|---|---|---|---|
| | 0A | 5 | **Content:** DC bus circuit error | |
| Cause | | | Confirmation | Solution |
| Main voltage L1,L2,L3 terminal under-voltage | | | Check L1,L2,L3 terminal voltage | Make sure voltage of L1,L2,L3 terminal in proper range;<br>Replace the drive with a new one; |
| Drive inner fault | | | / | |

| **Error code** | Main | Extra | **Display:** "Er 0A6" | |
|---|---|---|---|---|
| | 0A | 6 | **Content:** Temperature detection circuit error | |
| Cause | | | Confirmation | Solution |
| L1,L2,L3 terminal under-voltage | | | Check L1,L2,L3 terminal voltage | Make sure voltage of L1,L2,L3 terminal in proper range;<br>Replace the drive with a new one; |
| Drive inner fault | | | / | |

| **Error code** | Main | Extra | **Display:** "Er 0b0" | |
|---|---|---|---|---|
| | 0b | 0 | **Content:** Control power under-voltage | |
| Cause | | | Confirmation | Solution |
| L1,L2,L3 terminal under-voltage | | | Check L1,L2,L3 terminal voltage | Make sure voltage of L1,L2,L3 terminal in proper range;<br>Replace the drive with a new one; |
| Drive inner fault | | | / | |

| **Error code** | Main | Extra | **Display:** "Er 0c0" | |
|---|---|---|---|---|
| | 0c | 0 | **Content:** DC bus over-voltage | |
| Cause | | | Confirmation | Solution |
| Main power L1,L2,L3 terminal over-voltage | | | Check L1,L2,L3 terminal voltage | Decrease L1,L2,L3 terminal Voltage;<br>Keep UVW and PE cable in proper space;<br>Restore factory default;<br>Replace the drive with a new one; |
| Short circuit of UVW and PE cable | | | | |
| Inner brake circuit damaged | | | / | |
| Drive inner fault | | | / | |

| **Error code** | Main | Extra | **Display:** "Er 0d0" | |
|---|---|---|---|---|
| | 0d | 0 | **Content**: DC bus under-voltage | |
| Cause | | | Confirmation | Solution |

| | | |
|---|---|---|
| Main power L1,L2,L3 terminal under-voltage | Check L1,L2,L3 terminal voltage | Input voltage is too large;<br>Short circuit between cable U/V/W and cable PE;<br>Restore factory default;<br>Replace the drive with a new one; |
| Drive inner fault | / | |

| **Error code** | Main | Extra | **Display:** "Er 0d2" | |
|---|---|---|---|---|
| | 0d | 2 | **Content**: Lack of supply power | |
| Cause | | | Confirmation | Solution |
| No input supply power | | | Check L1,L2,L3 terminal voltage | Increase L1,L2 terminal voltage;<br>Replace the drive with a new one; |
| Drive inner fault | | | / | |

| **Error code** | Main | Extra | **Display:** "Er 0E0" | |
|---|---|---|---|---|
| | 0E | 0 | **Content:** Over-current | |
| Cause | | | Confirmation | Solution |
| Short of drive output wire | | | Short of drive output wire, whether short circuit to pg ground or not | Ensure drive output wire no short circuit, ensure motor no. Damage;<br>Adjust motor wiring sequence;<br>Replace the drive with a new one;<br>Adjust parameter to proper range;<br>Adjust control command: open filter function; |
| Abnormal wiring of motor | | | Check motor wiring order | |
| Short of igbt module | | | Cut off drive output wiring, initiate "srv_on" and drive motor, check whether over-current exists | |
| Abnormal setting of control parameter | | | Modify the parameter | |
| Abnormal setting of control command | | | Check control command whether command changes too violently or not | |

| **Error code** | Main | Extra | **Display:** "Er 0E1" | |
|---|---|---|---|---|
| | 0E | 1 | **Content**: IPM over-current | |
| Cause | | | Confirmation | Solution |
| Short of Drive output wire | | | Short of drive output wire, whether short circuit to PG ground or not | Ensure drive output wire no short circuit, ensure motor no damage;<br>Adjust motor wiring sequence;<br>Replace the drive with a new one;<br>Adjust parameter to proper range;<br>Adjust control command: open filter function; |
| Abnormal wiring of motor | | | Check motor wiring order | |
| Short of IGBT module | | | Cut off drive output wiring, initiate "srv_on" and drive motor, check whether over-current exists | |
| Short of IGBT module | | | / | |
| Abnormal setting of control parameter | | | Modify the parameter | |
| Abnormal setting of control command | | | Check control command whether command changes too violently or not | |

| **Error code** | Main | Extra | **Display:** "Er 0F0" | |
|---|---|---|---|---|
| | 0F | 0 | **Content**: Drive over-heat | |
| Cause | | | Confirmation | Solution |
| The temperature of power module have exceeded upper limit | | | Check drive radiator whether the temperature is too high or not | Strengthen cooling conditions, promote the capacity of drive and motor, enlarge acceleration/deceleration time, reduce load |

| **Error code** | Main | Extra | **Display:** "Er 100" |
|---|---|---|---|
| | 10 | 0 | **Content:** Motor over-load |

| Cause | Confirmation | Solution |
|---|---|---|
| Load is too heavy | Check actual load if the value of parameter exceed maximum or not | Decrease load, adjust limit parameter;<br>Modify the parameter of control loop; enlarge acceleration/deceleration time;<br>Adjust wiring or replace encoder/motor for a new one;<br>Cut off brake; |
| Motor over-current | Check d04 and d15; | |
| Oscillation of machine | Check the machine if oscillation exists or not | |
| Wiring error of motor | Check wiring if error occurs or not, if line breaks or not | |
| Electromagnetic brake engaged | Check brake terminal voltage | |

| **Error code** | Main | Extra | **Display:** "Er 101" |
|---|---|---|---|
| | 10 | 1 | **Content:** Drive over-load |

| Cause | Confirmation | Solution |
|---|---|---|
| Wiring error of motor power line | Check u/v/w wiring if error occurs or not, if line breaks or not | Check u/v/w wiring if error occurs or not, if line breaks or not;<br>Motor current exceed drive current; |
| Motor doesn't match the Drive | Drive over-current | |

| **Error code** | Main | Extra | **Display:** "Er 102" |
|---|---|---|---|
| | 10 | 2 | **Content:** Motor blocked |

| Cause | Confirmation | Solution |
|---|---|---|
| Motor is blocked | Check if motor is blocked mechanically | Remove the stuff blocking motor;<br>Increase the parameters of Pr6.56 and Pr6.57(available for software version above 113);<br>Set Pr6.56 to 0 to turn off alarm(available for software version above 114); |

| **Error code** | Main | Extra | **Display:** "Er 120" |
|---|---|---|---|
| | 12 | 0 | **Content:** Resistance discharge circuit over-load |

| Cause | Confirmation | Solution |
|---|---|---|
| Regenerative energy has exceeded the capacity of regenerative resistor. | Check the speed if it is too high. Check the load if it is too large or not. | Lower motor rotational speed; decrease load inertia ,increase external regenerative resistor, improve the capacity of the drive and motor;<br>increase external regenerative resistor, replace the drive with a new one; |
| Resistance discharge circuit damage | / | |

| **Error code** | Main | Extra | **Display:** "Er 121" |
|---|---|---|---|
| | 12 | 1 | **Content:** Braking error |

| Cause | Confirmation | Solution |
|---|---|---|
| Braking circuit damage | Braking resistor short circuit | Change a new braking resistor;<br>Repair IGBT; |
| | Braking IGBT damaged | |

| **Error code** | Main | Extra | **Display:** "Er 150" |
|---|---|---|---|
| | 15 | 0 | **Content:** Encoder line braked |

| Cause | Confirmation | Solution |
|---|---|---|
| Encoder line disconnected | Check wiring if it steady or not | Make encoder wiring steady;<br>Reconnect encoder wiring;<br>Replace the motor with a new one; |
| Encoder wiring error | Check encoder wiring if it is correct or not | |
| Encoder damaged | / | |
| Encoder measuring circuit damaged | / | |

| **Error code** | Main | Extra | **Display:** "Er 151" |
|---|---|---|---|
| | 15 | 1 | **Content:** Encoder data error |

| Cause | Confirmation | Solution |
|---|---|---|
| Encoder data error | Check for interference | Anti-interference treatment |

| **Error code** | Main | Extra | **Display:** "Er 152" |
|---|---|---|---|
| | 15 | 2 | **Content:** Initialized position of encoder error |

| Cause | Confirmation | Solution |
|---|---|---|
| Communication data abnormal | Check encoder power voltage if it is dc5v ± 5% or not; check encoder cable and shielded line if it is damaged or not; Check encoder cable if it is intertwined with other power wire or not | Ensure power voltage of encoder normally, ensure encoder cable and shielded line well with FG ground, ensure encoder cable separated with other power wire;<br>Replace the motor with a new one; |
| Encoder damaged | / | |
| Encoder measuring circuit damaged | / | |

| **Error code** | Main | Extra | **Display:** "Er 153" |
|---|---|---|---|
| | 15 | 3 | **Content:** Encoder battery under voltage |

| Cause | Confirmation | Solution |
|---|---|---|
| Multi-turn absolute encoder power off | Check battery | Change a battery;<br>Motor damaged, replace the motor with a new one;<br>Clear alarm after changing battery; |
| | /Check motor | |
| | /Clear drive alarm | |

| **Error code** | Main | Extra | **Display:** "Er 170" |
|---|---|---|---|
| | 17 | 0 | **Content:** Encoder data error |

| Cause | Confirmation | Solution |
|---|---|---|
| Communication data abnormal | Check encoder power voltage if it is DC5V ± 5% or not ; check encoder cable and shielded line if it is damaged or not; check encoder cable whether it is intertwined with other power wire or not | Ensure power voltage of encoder normally, ensure encoder cable and shielded line well with FG ground, ensure encoder cable separated with other power wire;<br>Replace the motor with a new one; |
| Encoder damaged | / | |
| Encoder measuring circuit damaged | / | |

| **Error code** | Main | Extra | **Display:** "Er 171" |
|---|---|---|---|
| | 17 | 1 | **Content:** Motor parameters error |

| Cause | Confirmation | Solution |
|---|---|---|
| Motor parameters error | | Input motor parameters to match with drive or replace the motor with a new one |

| **Error code** | Main | Extra | **Display:** "Er 180" |
|---|---|---|---|
| | 18 | 0 | **Content:** Position error over-large error |

| Cause | Confirmation | Solution |
|---|---|---|
| Unreasonable set of position error parameter | Check parameter Pr0.14 value if it is too small or not | Enlarge the value of Pr0.14;<br>Enlarge the value of Pr1.00, Pr1.05;<br>Enlarge the value of Pr1.03, Pr5.22;<br>Increase acceleration/ deceleration time decrease speed, decrease load;<br>Check encoder wiring on proper way while multiple drive working; |
| Gain set is too small | Check parameter Pr1.00, Pr1.05 value if it is too small or not | |
| Torque limit is too small | Check parameter Pr0.13, Pr5.22 value whether too small or not | |
| Outside load is too large | Check acceleration/ deceleration time if it is too small or not , check motor rotational speed if it is too big or not ; check load if it is too large or not | |

| **Error code** | Main | Extra | **Display:** "Er 181" |
|---|---|---|---|
| | 18 | 1 | **Content:** Velocity error over-large error |

| Cause | Confirmation | Solution |
|---|---|---|
| The deviation of inner position command velocity is too large with actual speed | Check the value of Pr_602 if it is too small or not | Enlarge the value of Pr_602, or set the value to 0, make position deviation over-large detection invalid;<br>Enlarge the value of Pr_312, Pr_313;<br>Adjust gain of velocity control, improve trace performance; |
| The acceleration/ decelerate time Inner position command velocity is too small | Check the value of Pr_312, pa_313 if it is too small or not | |

| **Error code** | Main | Extra | **Display:** "Er 190" |
|---|---|---|---|
| | 19 | 0 | **Content:** Motor vibration |

| Cause | Confirmation | Solution |
|---|---|---|
| Overlarge inertia | Check inertia | Cut down the value of Pr003. Pr004;<br>Activate notch function; |
| Current vibration | Current vibration | |
| Current loop is too strong | Current loop is too strong | |

| **Error code** | Main | Extra | **Display:** "Er 1A0" |
|---|---|---|---|
| | 1A | 0 | **Content:** Over-speed 1 |

| Cause | Confirmation | Solution |
|---|---|---|
| Motor speed has exceeded the first speed limit (Pr3.21) | Check speed command if it is too large or not; check the voltage of analog speed command if it is too large or not; check the value of pr3.21 if it is too small or not; check input frequency and division frequency coefficient of command pulse if it is proper or not; check encoder if the wiring is correct or not | Adjust the value of input speed command, enlarge the value Pr3.21 value, modify command pulse input frequency and division frequency coefficient, ensure encoder wiring correctly; |

| Error code | Main | Extra | Display: "Er 1A1" |
|---|---|---|---|
| | 1A | 1 | Content: Speed out of control |

| Cause | Confirmation | Solution |
|---|---|---|
| Control maladjustment | UVW wrong connection | Anti-interference treatment or change motor;<br>The special assessment of practical application set 0 to 4 for Pr137 to held ERR1A1 alarm; |
| Encoder error | Monitor D30 count increasing | |
| Special application | The rotation direction of the motor is opposite with motor force direction. | |

| Error code | Main | Extra | Display: "Er 1b0" |
|---|---|---|---|
| | 1b | 0 | Content: Input pulse format incorrect or out of frequency |

| Cause | Confirmation | Solution |
|---|---|---|
| The input pulse frequency is too high | Too high pulse frequency | To decrease pulse input frequency, less than 500K;<br>Set Pr138 to 2 to turn off alarm; |

| Error code | Main | Extra | Display: "Er 1b1" |
|---|---|---|---|
| | 1b | 1 | Content: Incorrect electronic gear ratio |

| Cause | Confirmation | Solution |
|---|---|---|
| Out of range | Numerator denominator is zero, or setting values out of range | Reduce the number of pulses per revolution; |
| | | |

| Error code | Main | Extra | Display: "Er 210" |
|---|---|---|---|
| | 21 | 0 | Content: I/F input interface allocation error |

| Cause | Confirmation | Solution |
|---|---|---|
| The input signal is assigned with two or more functions. | Check the value of Pr_400, Pr_401, Pr_402,Pr_403,Pr_404 if it is proper or not | Ensure the value of Pr_400, Pr_401, Pr_402, Pr_403, Pr_404 set correctly; |
| The input signal isn't assigned with any functions. | Check the value of Pr_400, Pr_401,Pr_402,Pr_403,Pr_404 if it is proper or not | |

| Error code | Main | Extra | Display: "Er 211" |
|---|---|---|---|
| | 21 | 1 | Content: I/F input interface function set error |

| Cause | Confirmation | Solution |
|---|---|---|
| Signal allocation error | Check the value of Pr_400, Pr_401, Pr_402,pa_403,pa_404 if it is proper or not | Ensure the value of Pr_400, Pr_401, Pr_402, Pr_403, Pr_404 set correctly; |

| Error code | Main | Extra | Display: "Er 212" |
|---|---|---|---|
| | 21 | 2 | Content: I/F input interface function set error |

| Cause | Confirmation | Solution |
|---|---|---|
| The input signal is assigned with two or more functions. | Check the value of Pr_410, Pr_411, Pr_412, Pr_413, if it is | Ensure the value of Pr_410, Pr_411, Pr_412,Pr_413 set correctly; |

| | | |
|---|---|---|
| | proper or not | |
| The input signal isn't assigned with any functions. | Check the value of Pr_410, Pr_411, Pr_412, Pr_413, if it is proper or not | |

| **Error code** | Main | Extra | **Display:** "Er 240" |
|---|---|---|---|
| | 24 | 0 | **Content:** CRC verification error when EEPROM parameter is saved |

| Cause | Confirmation | Solution |
|---|---|---|
| L1,L2,L3 terminal under-voltage | Check L1,L2,L3 terminal voltage | Ensure L1,L2,L3 terminal voltage in proper range;<br>Replace the drive with a new one;<br>Download the suitable project file to drive for motor; |
| Drive is damaged | save the parameters again | |
| The setting of drive maybe default setting which isn't suitable for motor. | Check the setting of drive if it is suitable for your motor | |

| **Error code** | Main | Extra | **Display:** "Er 260" |
|---|---|---|---|
| | 26 | 0 | **Content:** Positive negative over-travel input valid |

| Cause | Confirmation | Solution |
|---|---|---|
| Positive /negative over-travelling input signal has been conducted | Check the state of positive negative over-travel input signal | / |

| **Error code** | Main | Extra | **Display:** "Er 270~ Er 272" |
|---|---|---|---|
| | 27 | 0~2 | **Content**: Analog input out of range |

| Cause | Confirmation | Solution |
|---|---|---|
| Analog input out of range | | Try to adjust analog input within limited range; |

| **Error code** | Main | Extra | **Display:** " Er 570" |
|---|---|---|---|
| | 57 | 0 | **Content**: Forced alarm input valid |

| Cause | Confirmation | Solution |
|---|---|---|
| Forced-alarm input signal has been conducted | Check forced-alarm input signal | Ensure input signal wiring correctly; |

# 6.3 Alarm Clear

**For alarm can be cleared:**

1. Use auxiliary function "AF_ACL"
   a. Press M to select auxiliary function
   b. Press SET to enter into "AF_ACL"
   c. Press and hold ◀ to clear the alarm
2. Set IO input function as Alarm clear input " (A-CLR)", refer to switch input interface connection to clear the alarm

**For alarm cannot be cleared:**

1. Restart the power-supply to clear the alarm.

# Chapter 7 Display and Operation

## 7.1 Introduction

The operation interface of servo drive consists of six LED nixie tubes and five key , which are used for servo drive's status display and parameter setting. The inter face layout is as follows :

**Figure 7-1 front panel**

**Table 7.1 The name and function of keys**

| Name | Key | Function |
|---|---|---|
| Display | / | There are 5 LED nixie tubes to display monitor value, parameter value. |
| Mode key | **M** | Press this key to switch among 4 modes:<br>1.Data monitor mode<br>2.Parameter setting mode<br>3.Auxiliary function mode<br>4.EEPROM written mode |
| Set key | **Set** | Entrance for submenu, confirming the current setting |
| Up key | ▲ | Press this key to increase the current setup value |
| Down key | ▼ | Press this key to decrease the current setup value |
| Left key | ◄ | Press this key to shift to the next digit on the left |

## 7.2 Panel Display and Operation

### 7.2.1 Panel Operation Flow Figure

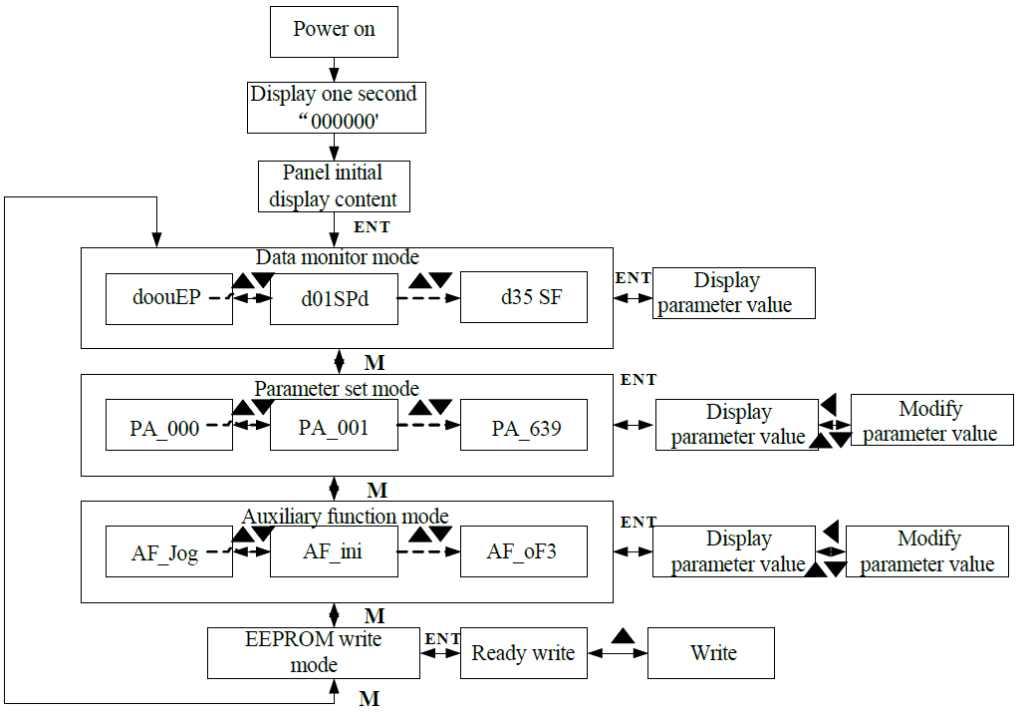



**Figure 7-2 the flow diagram of panel operation**

（1） The front panel display rEAdY for about one second firstly after turning on the power of the drive. Then if no abnormal alarm occurs, monitor mode is displayed with the value of initial parameter; otherwise, abnormal alarm code is displayed.

（2） Press M key to switch the data monitor mode → parameter setting mode → auxiliary function mode → EEPROM written mode.

（3） If new abnormal alarm occurs, the abnormal alarm will be displayed immediately in abnormal mode No. matter what the current mode is, press M key to switch to the other mode.

（4） In data monitor mode, press ▲ or ▼ to select the type of monitor parameter; Press ENT to enter the parameter type , then press ◀ to display the high 4 bits "H" or low 4 bits "L" of some parameter values.

（5） In parameter setting mode, press ◀ to select current editing bit of parameter. Press ▲ or ▼ to change current editing bit of parameters. Press ENT key to enter the parameter setting mode of corresponding parameters. Press ◀ to select current bit of parameter value when editing it, press ▲ or ▼ to change the value of the bit. Press ENT to save it and switch to the interface of parameter.

## 7.2.2 Drive Operating Data Monitor

**Table 7.2 Function List of Drive Monitor**

| Serial Number | Name | Specification | Display | Unit | Data Format (X, Y Is Numerical Value) |
|---|---|---|---|---|---|
| 0 | d00uE | Positional command deviation | d00uE | pulse | Low-bit "L xxxx" High-bit "H xxxx" |
| 1 | d01SP | Motor speed | d01SP | r/min | "r xxxx" |
| 2 | d02cS | Positional command speed | d02CS | r/min | "r xxxx" |
| 3 | d03cu | Velocity control command | d03Cu | r/min | "r xxxx" |

| | | | | | |
|---|---|---|---|---|---|
| 4 | d04tr | Torque feedback | d04tr | % | “r xxxx” |
| 5 | d05nP | Feedback pulse sum | d05nP | pulse | Low-bit “L xxxx”<br>High-bit”H xxxx” |
| 6 | d06cP | Command pulse sum | d06CP | pulse | Low-bit “L xxxx”<br>High -bit”H xxxx” |
| 7 | d07 | Maximum torque feedback | d07 | / | “ xxxx” |
| 8 | d08FP | Frequency of pulse signal | d08FP | pulse | Low-bit “L xxxx”<br>High -bit”H xxxx” |
| 9 | d09cn | Control mode | d09Cn | / | Position:“PoScn”<br>Speed:”SPdcn”<br>Torque:”trqcn”<br>Composite mode”<br>cnt” |
| 10 | d10Io | I/O signal status | d10 Io | / | Refer instructions for details |
| 11 | d11Ai | Analog input value | d11Ai | v | “x yyyy”<br>x:AI1 A,AI2 b,AI3 c<br>yyyy:value |
| 12 | d12Er | Error factor and reference of history | d12Er | / | “Er xxx” |
| 13 | d13 rn | Alarm display | d13rn | / | “m xxx” |
| 14 | d14 r9 | Regeneration load factor | d14r9 | % | “rg xxx” |
| 15 | d15 oL | Over-load factor | d15oL | % | “oL xxx” |
| 16 | d16Jr | Inertia ratio | d16Jr | % | “J xxx” |
| 17 | d17ch | Factor of No.-motor running | d17Ch | / | “cP xxx” |
| 18 | d18ic | No. of changes in I/O signals | d18ic | / | “n xxx” |
| 19 | d19 | / | d19 | / | “ xxxx” |
| 20 | d20Ab | Absolute encoder data | d20Ab | pulse | Low-bit “L xxxx”<br>High-bit”H xxxx” |
| 21 | d21AE | Absolute external scale position | d21AE | pulse | Low-bit “L xxxx”<br>High -bit”H xxxx” |
| 22 | d22rE | No. of Encoder/external scale communication errors monitor | d22rE | times | “n xxx” |
| 23 | d23 id | Communication axis address | d23id | / | “id xxx”<br>“Fr xxx” |
| 24 | d24PE | Encoder positional deviation(encoder unit) | d24PE | pulse | Low-bit “L xxxx”<br>High -bit”H xxxx” |
| 25 | d25PF | Encoder scale deviation (external scale unit) | d25PF | pulse | Low-bit “L xxxx”<br>High -bit”H xxxx” |
| 26 | d26hy | hybrid deviation (command unit) | d26hy | pulse | Low-bit “L xxxx”<br>High -bit”H xxxx” |
| 27 | d27 Pn | Voltage across PN [V] | d27Pn | V | “u xxx” |
| 28 | d28 No. | Software version | d28No. | / | “d xxx”<br>“F xxx”<br>“P xxx” |
| 29 | d29AS | Drive serial number | d29AS | / | “n xxx” |
| 30 | d30NS | Motor serial number | d30sE | / | Low-bit “L xxxx”<br>High -bit”H xxxx” |
| 31 | d31 tE | Accumulated operation time | d31tE | / | Low-bit “L xxxx”<br>High -bit”H xxxx” |
| 32 | d32Au | Automatic motor identification | d32Au | / | “r xxx” |
| 33 | d33At | Drive temperature | d33At | ℃ | “th xxx” |
| 34 | d34 | / | d34 | / | “t xxx” |

| | | | | | |
|---|---|---|---|---|---|
| 35 | d35 SF | Safety condition monitor | d35SF | / | “xxxxxx” |

**Instructions:**

**1. d01SP Motor speed**

Drive display s 0 after power on, in disable state. While in enable state, display r 0. Motor speed display r xxx. So users can distinguish in disable state or in enable state by display s 0 or r 0 .

**2. d10 Io I/O signal status**

The upper half of the nixie tube is valid, the lower half is invalid, the decimal point represents the input and output state, lit represents the input, Not bright represents the output

**Input**: , from low to high, the order is SI1, SI2…SI10. The next figue represents SI1/SI8/SI10 input are valid, other inputs are invalid.

**Output**: , from low to high, the order is SO1, SO2…SO10. The next figue represents SO1 output are valid, other inputs are invalid.

**3. d11Ai Analog input value**

d11Ai is used to monitor the state of the three channels of simulation. The horizontal line on the leftmost digital tube represents which channel of simulation, specifically, the horizontal line above represents the first channel of simulation, the horizontal line in the middle represents the second channel of simulation, and the horizontal line below represents the third channel of simulation. The analog display unit is 0.001V, and the fourth and fifth decimal places on the right represent negative signs. Analog monitoring switch by up and down keys. Example the third analog value of -11.5v is shown as follows:

**4. Parameter high and low bit, positive and negative Numbers.**

The highest and lowest digits of data and the signs are shown as follows. The first and second decimal points on the right are bright, indicating the data of high order. The two decimal points are Not lit, indicating the data of low order. The fourth and fifth decimal places on the right indicate negative Numbers, otherwise positive Numbers

Users can choose to set the initial display state of power supply to any of the below:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pr5.28★ | Name | LED initial status | | | Mode | P | S | T |
| | Range | 0~35 | Unit | — | Default | 1 | | |
| | Data Type | 16bit | Access | R/W | Address | 0539H | | |
| | Repower | - | | | | | | |

You can select the type of data to be displayed on the front panel LED (7-segment) at the initial status after power-on.

| Setup Value | Content | Setup Value | Content | Setup Value | Content |
|---|---|---|---|---|---|
| 0 | Positional command deviation | 10 | I/O signal status | 27 | Voltage across PN [V] |
| 1 | Motor speed | 11 | Analog input value | 28 | Software version |
| 2 | Positional command speed | 12 | Error factor and reference of history | 29 | Drive serial number |
| 3 | Velocity control command | 16 | Inertia ratio | 30 | Motor serial number |
| 4 | Torque command | 17 | Factor of No.-motor running | 31 | Accumulated operation time |
| 5 | Feedback pulse sum | 23 | Communication axis address | 33 | Temperature information |
| 6 | Command pulse sum | 24 | Encoder positional deviation [encoder unit] | 36 | Safety condition monitor |
| 9 | Control mode | | | | |

**Table 7.3 "d17 ch" Motor No. Rotate Reason Code Definition**

| Code | Display Code | Specification | Content |
|---|---|---|---|
| 0 | cP 0 | Working Normally | |
| 1 | cP 1 | DC bus under-voltage | / |
| 2 | cP 2 | No. entry of Srv-On input | The Servo-ON input (SRV-ON) is Not connected to COM- |
| 3 | cP 3 | POT/NOT input is valid | Pr_504=0,POT is open , speed command is positive direction<br>NOT is open , speed command is negative direction |
| 4 | cP 4 | Drive fault | / |
| 5 | cP 5 | The relay inside the drive isn't closed | / |
| 6 | cP 6 | Pulse input prohibited (INH) | Pr518=0,INH is open |
| 8 | cP 8 | CL is valid | Pr517=0,deviation counter clear is connected to COM- |
| 9 | cP 9 | speed zero-clamp is valid | Pr315=1, speed zero-clamp is open |

## 7.2.3 Auxiliary Function

**Table 7.4 setting interface System parameter**

| No. | Name | Specification | Display Code | Operation Flow |
|---|---|---|---|---|
| 0 | AFjog | Trial run | AFjog | Please refer to the chapter of"trial run" |
| 1 | AFInI | Initialization of parameter | AFInI | 1. press SET to enter operation, display "InI -"。<br>2.press ▲ once to display "InI---", indicated initialization; after finishing it, display"FinSh"。 |
| 2 | AFunL | Release of front | AFunL | 1. press SET to enter operation, display "unL -"。 |

| | | | | |
|---|---|---|---|---|
| | | panel lock | | 2. press ▲button one time , display “FinSh”,indicated unlock the panel successfully |
| 3 | AFAcL | Alarm clear | AFAcL | 1. press SET to enter operation, display“Acl -”。<br>2. press ▲once , display “FinSh”, indicated alarm clear successfully |
| 4 | AFoF1 | A1 automatic offset adjustment | AFoF1 | 1.press SET to enter operation, display “of1 -”。<br>2.press ▲once , display “StArt”, indication start correct, then display“FiniSh”indicated correction finished。 |
| 5 | AFoF2 | A2 automatic offset adjustment | AFoF2 | 1.press SET to enter operation, display “oF2 -”。<br>2.press ▲once , display “StArt”, indicated start to correct the offset, then display“FinSh”indicated that correction finished。 |
| 6 | AFoF3 | A3 automatic offset adjustment | AFoF3 | 1.press SET to enter operation, display “oF3 -”。<br>2.press ▲once , display “StArt”, indicated start to correct the offset, then display“FinSh”indicated correction finished . |
| 7 | AFEnc | Motor Angle correction | AFEnc | 1. Press SET once to enter operation, display “Enc -”<br>2. press ▲once , display “StArt”, indicated start to correct the angle, then display“FiniSh”indicated correction finished |
| 8 | AF tUn | Reserved | AFtUn | |
| 9 | AF_GL | Inertia ratio identification | AF_GL | 1. Press SET once to enter operation, display “G---”<br>2. Press◀ once，display “StUon”<br>3. Press▲，motor running，indicated start to identification<br>4. Finishing，display G xxx，xxx indicated Inertia ratio value |
| 10 | AFrSt | Soft reset | AFrSt | 1. Press SET once to enter operation, display “rSt -”<br>2. Press▲ and hold on，display “StArt” Then，finished |

**Table 7.5 The Locked Panel Conditions**

| Mode | The Locked Panel Conditions |
|---|---|
| Monitor mode | No. limitation: all monitored data can be checked. |
| Parameter set up mode | No. parameter can be changed but setting can be checked. |
| Auxiliary function mode | CanNot be run except for” release of front panel lock” |
| EEPROM writing mode | No. limitation |

## 7.2.4 Saving Parameter

Operation procedure:

1. press M to select EEPROM writing mode, display “EESet”;
2. Press ENT to enter into writing mode operation:
3. Press and hold ▲, display LED from” EP -” to” EP--”, then it becomes” EP---”, finally it become” StArt”,

indicated EEPROM writing operation have been began;
4. "Error" means that writing is unsuccessful， while "Finish" show that the writing is successful; Follow steps 3 and 4 to repeat the operation; the drive may be damaged if repeat of several times still fails. The drive needs to repair.
5. The drive needs to power off and restart again if writing is successful.

**NOTE:** Don't turn off the power if EEPROM writing operation goes on, otherwise it may cause writing wrong data; if this happens, please reset all the parameters, then do EEPROM writing operation again.

### 7.2.5 Abnormal Alarm

The front panel will automatically enter the abnormal alarm display mode if drive error occurs while it displays the corresponding error code. Please refer to Chapter 6 of alarm processing about the detail of error code.

## 7.3 Trial Run

**Attention**

- Ground the earth terminal of the motor and drive without fail, the PE terminal of drive must be reliably connected with the grounding terminal of equipment.
- The drive power need with isolation transformer and power filter in order to guarantee the security and anti-jamming capability.
- Check the wiring to make sure correctness before power on.
- Install a emergency stop protection circuit externally, the protection can stop running immediately to prevent accident happened and the power can be cut off immediately.
- If drive alarm occurs, the cause of alarm should be excluded and servo on signal must be invalid before restarting the drive.
- The high voltage also will contain in several minutes even if the servo drive is powered off, please don't touch terminal strip or separate the wiring.
-

**Note:** there are two kinds of trial run: trial run without load and trial run with load. The user needs to test the Drive without load for safety first.

**Contact tech@leadshine.com if you need more technical service.**

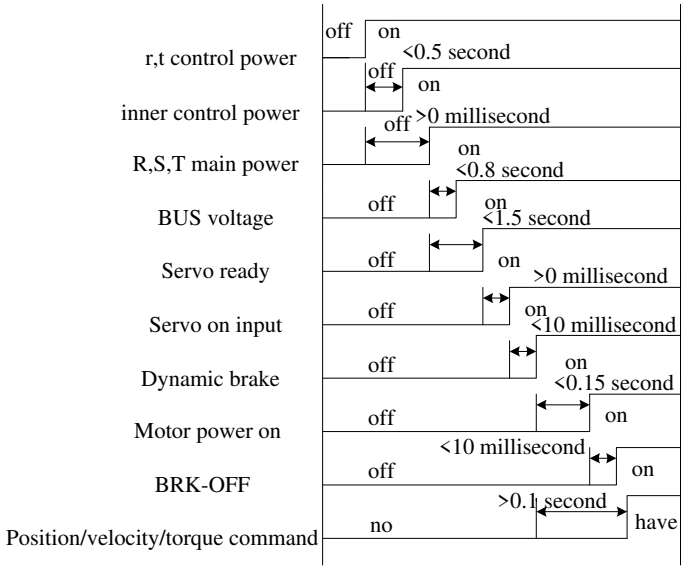
### 7.3.1 Inspection before Trial Run

**Table7.6 Inspection Item Before Run**

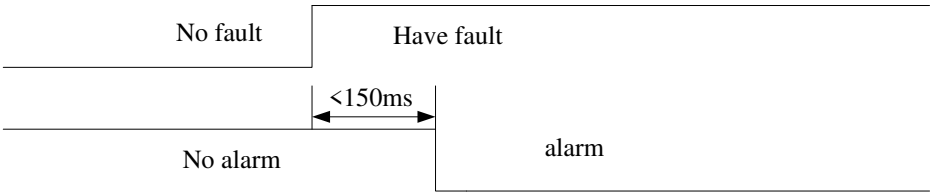
| No. | Item | Content |
|---|---|---|
| 1 | Inspection on wiring | 1. Ensure the following terminals are properly wired and securely connected : the input power terminals, motor output power terminal ,encoder input terminal CN2, control signal terminal CN1, communication terminal CN4(it is unnecessary to connect CN1 andCN4 in Jog run mode)<br>2. Short among power input lines and motor output lines are forbidden, and No. short connected with PG ground. |
| 2 | Confirmation of power supply | 1. The range of control power input r; t must be in the rated range.<br>2. The range of the main power input R, S, T must be in the rated range.<br>3. Single phase 220VAC input is sufficient if the power of drive is No. more 1.5kw. |
| 3 | Fixing of | The motor and drive must be firmly fixed |

| | position | |
|---|---|---|
| 4 | Inspection without load | The motor shaft must Not be with a mechanical load. |
| 5 | Inspection on control signal | 1, all of the control switch must be placed in OFF state.<br>2, servo enables input “Srv_on” must be in OFF state. |

## 7.3.2 Timing Chart on Power-Up




## 7.3.3 Timing Chart on Fault

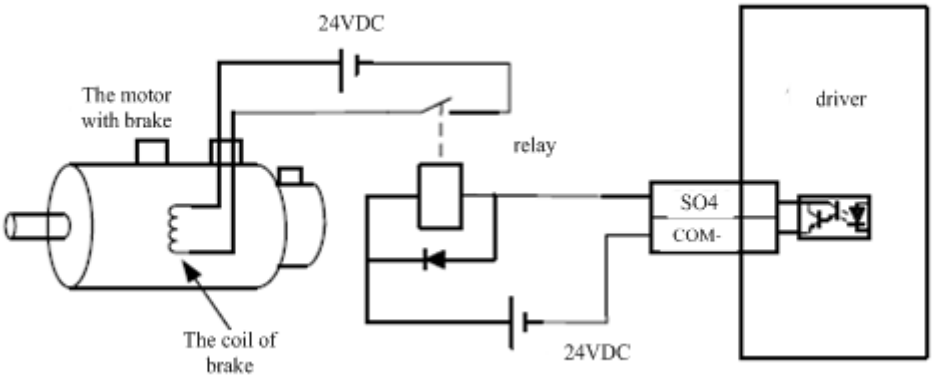



## 7.3.4 Holding Brake

In applications where the motor drive the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling gravity while the power to the servo is shut off .

**Never use this for “Brake” purpose to stop the load in motion.**
**Use this built-in brake for “holding” purpose only. That is to hold the stalling status.**

For the brake release timing at power-on ,or braking timing at servo-off/servo-alarm while the motor is in motion ,refer to chapter 7.1.2 timing chart on power-up.
You can follow the diagram about the wiring below:




About the wire of brake, there should be an 24VDC for brake, the brake will be loosed with the 24VDC input, and the drive give an output signal to control the connection or disconnection of the 24VDC, pin 31 and pin 35 of CN1 is the control signal, and it is forbidden to connect these signal directly for the power of 24VDC, it will destroy the hardware of servo drive.
And if you connect the pin31 and pin35 for controlling the brake, just make sure the setting value of Pr4.13. The default is 00000303h, if the drive works in torque mode, this value should be changed to 00030303h.

## 7.3.5 Trial Run Jog Control

After installation and connection is completed, check the following items before turning on the power:

Wiring.(Especially power input and motor output)
Short or grounded.
Loose connection.
Unstable mounting.
Separation from the mechanical system.

It is unnecessary to connect control signal terminal CN1 and communication terminal CN4 in Jog run mode. It is recommended that motor runs at low speed for safety, while the speed depends on the parameters below: there are two different modes : **speed JOG mode** and **location JOG mode.**

**Table 7.7 Parameter Setup of Velocity JOG**

| No. | Parameter | Name | Set Value | Unit |
|---|---|---|---|---|
| 1 | Pr0.01 | Control mode setting | 1 | / |
| 2 | Pr3.12 | Acceleration time setup | User-specified | millisecond |
| 3 | Pr3.13 | Deceleration time setup | User-specified | millisecond |
| 4 | Pr3.14 | Sigmoid acceleration/deceleration time setup | User-specified | millisecond |
| 5 | Pr6.04 | JOG trial run command speed | User-specified | rpm |

**Table 7.8 Parameter Setup of Position JOG**

| No. | Parameter | Name | Value | Unit |
|---|---|---|---|---|
| 1 | Pr0.01 | Control mode setting | 0 | / |
| 2 | Pr3.12 | Acceleration time setup | User-specified | millisecond |
| 3 | Pr3.13 | Deceleration time setup | User-specified | millisecond |
| 4 | Pr3.14 | Sigmoid acceleration/deceleration time setup | 0 | millisecond |
| 5 | Pr6.04 | JOG trial run command speed | User-specified | rpm |
| 6 | Pr6.20 | distance of trial running | User-specified | 0.1 rotation |

| | | | | |
|---|---|---|---|---|
| 7 | Pr6.21 | waiting time of trial running | User-specified | millisecond |
| 8 | Pr6.22 | cycling times of trial running | User-specified | times |

◆JOG trial run operation process
1. Set all parameters above corresponding to velocity JOG or position JOG;
2. Enter EEPROM writing mode, and save the value of modified parameters ;
3. The drive need to restart after the value is written successfully;
4. Enter auxiliary function mode, and go to “AFJog "sub-menu;
5. Press ENT once, and display Jog - ";
6. Press once, and display ” Srvon " if No. exception occurs; press once again if “Error " occurs, it should display “Srvon "; If “Error " still occurs, please switch to data monitoring mode “d17 Ch "sub-menu, find the cause why motor doesn’t rotate, fix the trouble and try again;
7. In position JOG mode, the motor will rotate directly; if motor doesn’t rotate, switch to data monitoring mode d17 Ch "sub-menu, find the cause why motor doesn’t rotate, fix the trouble and try again;
In speed JOG mode, press once, the motor rotates once (hold will make motor rotating to value of Pr6.04); press once, the motor rotates once (hold will make motor rotating to value of Pr6.04); if motor doesn’t rotate, switch to data monitoring mode d17 Ch "sub-menu, find the cause why motor doesn’t rotate, fix the trouble and try again;
8. Press SET will exit JOG control in JOG run mode.

# Chapter 8 Application Case

### Operation Mode Selection

EL7 series AC servo drive support the position, speed, torque three basic modes of operation, and can switch freely between the three basic modes of operation by switch or modify parameters.

**Table 8.1 Parameter setup of Operation Mode Selection**

| No. | Mode | Parameter | Specification |
|---|---|---|---|
| 1 | Position mode | Pr0.01=0 | The position control is performed based on the positional command (pulse train) from the host controller or the command set in the servo drive. |
| 2 | Velocity mode | Pr0.01=1 | The velocity control is performed according to the analog speed command from the host controller or the speed command set in the servo drive. |
| 3 | Torque mode | Pr0.01=2 | The torque control is performed according to the torque command specified in the form of analog voltage or the command set in the servo drive. |
| 4 | 1st mode: position mode 2nd mode: speed mode | Pr0.01=3 | The control mode is switched through external input. |
| 5 | 1st mode: position mode 2nd Mode: torque mode | Pr0.01=4 | The control mode is switched through external input. |
| 6 | 1st mode: speed mode 2nd Mode: torque mode | Pr0.01=5 | The control mode is switched through external input. |

The step of changing the operation mode:

1, Switch the drive to Servo Off status.

2, Modify the corresponding parameters of control mode to EEPROM.

Turn off/on the power to make the new mode works after setup completed.

## 8.1 Position Control

**Notice**: You must do inspection before position control test run.

**Table 8.2 Parameter Setup of Position Control**

| No. | Parameter | Name | Input | Value | Unit |
|---|---|---|---|---|---|
| 1 | Pr0.01 | control mode setup | / | 0 | / |
| 2 | Pr0.06 | command pulse rotational direction setup | | 0 | |
| 3 | Pr0.07 | command pulse input mode setup | | 0~3 | |
| 4 | Pr0.08 | Command pulse per one motor revolution | | User-specified | Pulse |
| 5 | Pr0.09 | 1st numerator of electronic gear | | 1 | |
| 6 | Pr0.10 | denominator of electronic gear | | 1 | |
| 7 | Pr2.22 | positional command smoothing filter | | User-specified | 0.1ms |
| 8 | Pr2.23 | positional command FIR filter | | User-specified | 0.1ms |
| 9 | Pr3.12 | Acceleration time setup | / | User-specified | millisecond |

| | | | | | |
|---|---|---|---|---|---|
| 10 | Pr3.13 | Deceleration time setup | / | User-specified | millisecond |
| 11 | Pr3.14 | Sigmoid acceleration/deceleration time setup | / | User-specified | millisecond |
| 12 | Pr4.00 | SI1 input select: servo-enable | Srv_on | Hex:0003 | / |

◆ Wiring Diagram

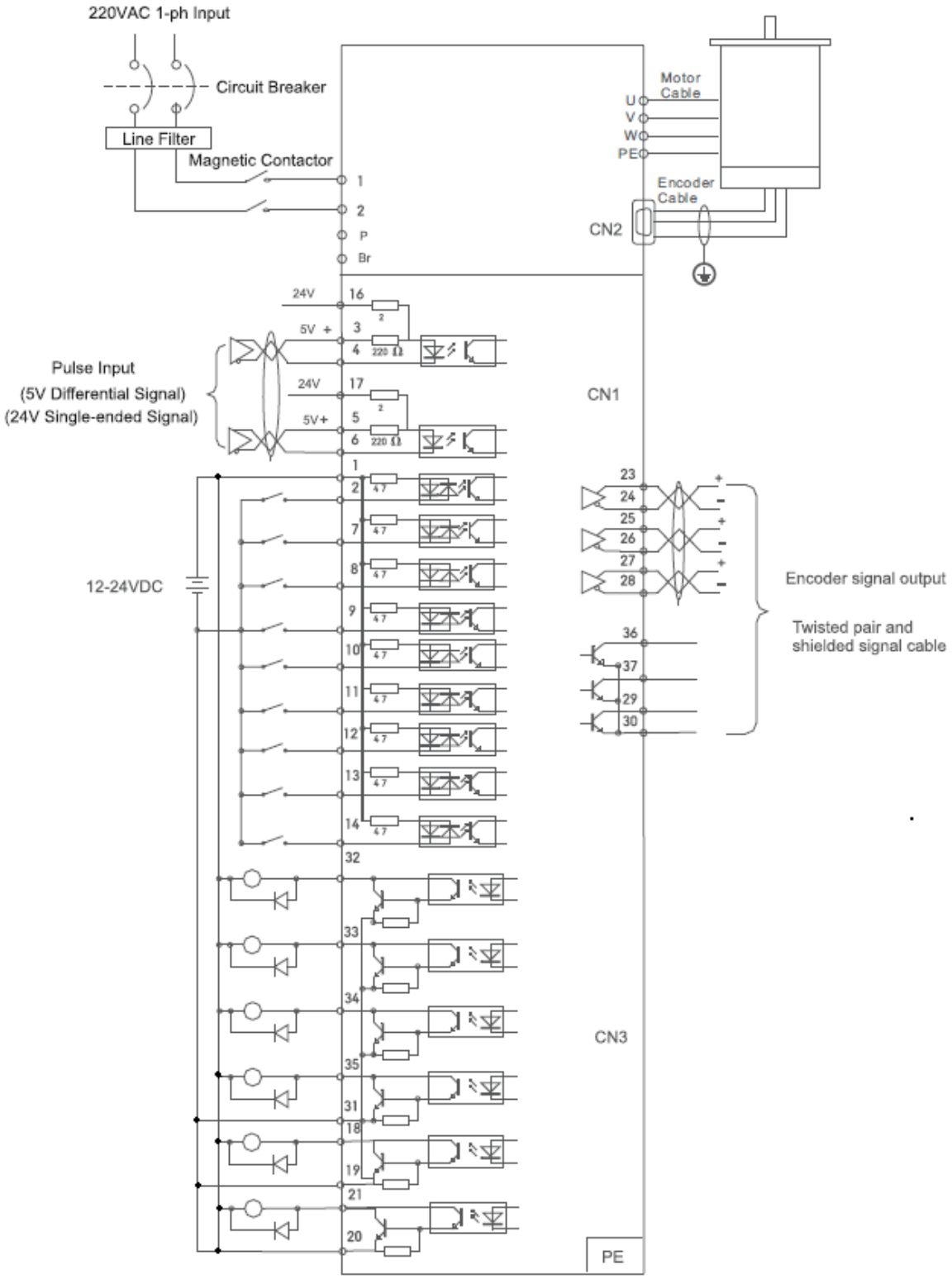
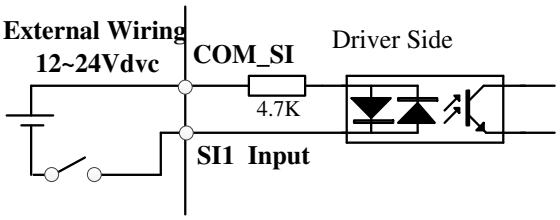



**Figure 8-1 Position Mode Typical Wiring Diagram**

**Note:**

**For drive is more than 1.5kw, 3 phase is better than single phase, connect L1, L2, L3**




**Digital Input for Servo Enable**

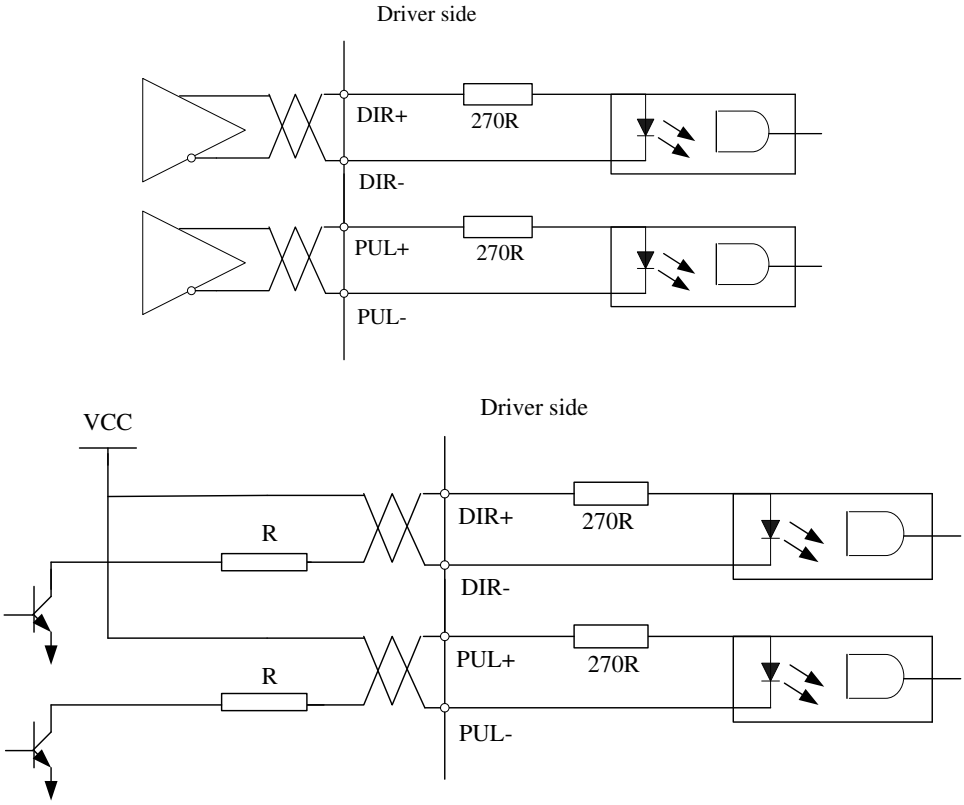



**Figure 8-2 Control Terminal CN1 Signal Wiring in Position Control Mode**

**◆Operation Steps**

1. Connect terminal CN1.
2. Enter the power (DC12V to 24V) to control signal (the COM_SI + and SI1).
3. Enter the power to the drive.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the drive)
5. Connect the "Srv_on" input to bring the drive to servo-on status and energize the motor.
6. Enter low-frequency pulse and direction signal to run the motor at low speed.
7. Check the motor rotational speed at monitor mode whether, ("d01SP"),
   Rotational speed is as per the setup or Not, and
   The motor stops by stopping the command (pulse) or Not
   if the motor does Not run correctly, refer to the Factor of No.-Motor running in data monitor mode ("d17Ch ").

The drive is widely used for precise positioning in position control mode.

Related parameters setup of position mode

## 8.1.1 Pulse Command and Rotation Direction

The positional commands of the following 3 types (pulse train) are available.

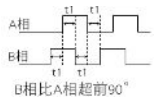
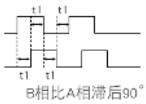
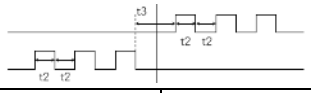
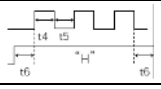
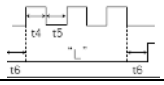
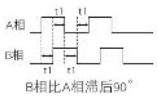
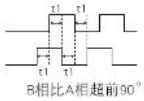
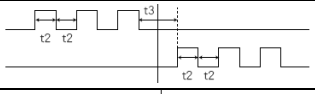
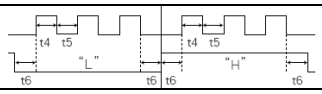
◆Phase A/B pulse

◆Positive direction pulse/negative direction pulse

◆Pulse + direction

Please set the pulse configuration and pulse counting method based on the specification and configuration of installation of the host controller.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pr0.06*** | Name | Command pulse rotational direction setup | | | Mode | **P** | |
| | Range | 0~1 | Unit | — | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 000D | |
| | Effective | Power-on again | | | | | |
| Set command pulse input rotate direction, command pulse input type | | | | | | | |
| **Pr0.07*** | Name | Command Pulse Input Mode Setup | | | Mode | **P** | |
| | Range | 0~3 | Unit | — | Default | 1 | |
| | Data length | 16bit | Access | R/W | Address | 0x 000F | |
| | Effective | Power-on again | | | | | |

| Pr0.06 | Pr0.07 | Command pulse format | Signal | Positive direction command | Negative direction command |
|---|---|---|---|---|---|
| 0 | 0 or 2 | 90 degrees phase difference 2-phase pulse(phase A +phase B) | Pulse sign |   |   |
| | 1 | Positive direction pulse + negative direction pulse | Pulse sign |   | |
| | 3 | Pulse + sign | Pulse sign |   |   |
| 1 | 0 or 2 | 90 degrees phase difference 2 phase pulse(phase A +phase B) | Pulse sign |   |   |
| | 1 | Positive direction pulse + negative direction pulse | Pulse sign |   | |
| | 3 | Pulse + sign | Pulse sign |   | |

Command pulse input signal allow largest frequency and smallest time width

| Puls/sign signal input I/F | | Permissible max. Input frequency | Smallest time width | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | t1 | t2 | t3 | t4 | t5 | t6 |
| Pulse series interface | Long distance interface | 500kpps | 2 | 1 | 1 | 1 | 1 | 1 |
| | Open-collector output | 200kpps | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |

## 8.1.2 Electronic Gear Function

The function multiplies the input pulse command from the host controller by the predetermined dividing or multiplying factor and applies the result to the position control section as the positional command. By using this function, desired motor rotations or movement distance per unit input command pulse can be set.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr0.08** | Name | Command pulse counts per one motor revolution | | | Mode | **P** | **V** | **T** |
| | Range | 0-8388608 | Unit | P | Default | 0 | | |
| | Data length | 32bit | Access | R/W | Address | 0x 0010<br>0x 0011 | | |
| | Effective | Power-on again | | | | | | |
| Set the command pulse that causes single turn of the motor shaft.<br>1) If Pr008≠0 , the actual motor rotation turns = pulse number / Pr008<br>2) If Pr008 = 0 , Pr0.09 1st numerator of electronic gear and Pr0.10 denominator of electronic gear become valid. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr0.09** | Name | 1st numerator of electronic gear | | | Mode | **P** | | |
| | Range | 1~1073741824 | Unit | — | Default | 1 | | |
| | Data length | 32bit | Access | R/W | Address | 0x 0012<br>0x 0013 | | |
| | Effective | Power-on again | | | | | | |
| Set the numerator of division/multiplication operation made according to the command pulse input. | | | | | | | | |
| **Pr0.10** | Name | 1st denominator of electronic gear | | | Mode | **P** | | |
| | Range | 1~1073741824 | Unit | — | Default | 1 | | |
| | Data length | 32bit | Access | R/W | Address | 0x 0014<br>0x 0015 | | |
| | Effective | Power-on again | | | | | | |

Set the denominator of division/multiplication operation made according to the command pulse input.

| Pr0.09 | Pr0.10 | Command division/multiplication operation |
|---|---|---|
| 1-10737 41824 | 1-10737 41824 | Command pulse input → 【Pr0.09 set value】 / 【Pr0.10 set value】 → position command |

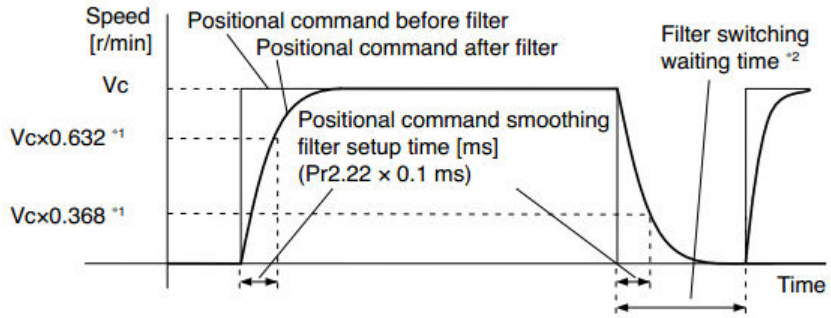
1. Settings:
   1)The drive input command pulse number is X
   2)The pulse number of encoder after frequency division and frequency doubling is Y
   3)The number of pulses per revolution of the motor encoder is Z
   4)Number of turns of motor is W
2. Calculations:
   1)Y=X* Pr0.09 / Pr0.10
   2)17-bit encoder: Z=2^17 = 131072
   23-bit encoder: Z=2^23 = 8388608

## 8.1.3 Position Command Filter

To make the positional command divided or multiplied by the electronic gear smooth, set the command filter.
In the following situations, it is necessary to consider adding position command filtering:
(1) The position instruction output by the controller is not accelerated or decelerated;
(2) Low command pulse frequency;
(3) When the electronic gear ratio is more than 10 times.
The position command filter can make the position command smoother and the motor rotation more stable.

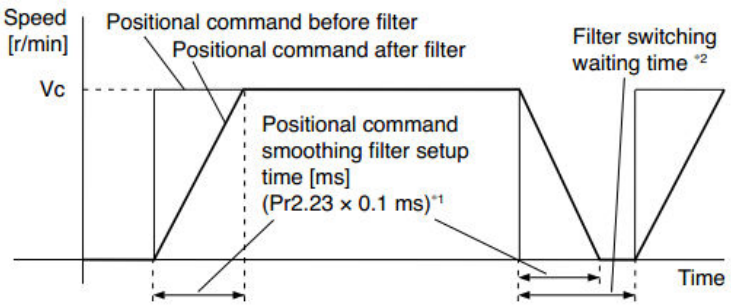
| Pr2.22 | Name | Positional command smoothing filter | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | 0.1ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 022D | | |
| | Effective | Power-on again | | | | | | |

- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied ,set up the time constant of the 1st delay filter as shown in the figure below




| Pr2.23 | Name | Positional command FIR filter | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 022F | | |
| | Effective | Power-on again | | | | | | |

- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied, set up the Vc arrival time as shown in the figure below.




## 8.1.4 Motor Encoder Pulse Output

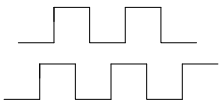
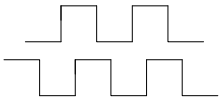
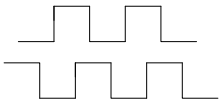
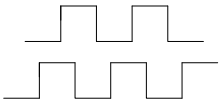
The information on the amount of movement can be sent to the host controller in the form of A and B phase pulses from the servo drive.

| Pr0.11＊ | Name | Output pulse counts per one motor revolution | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~2500 | Unit | P/r | Default | 2500 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0017 | | |
| | Effective | Power-on again | | | | | | |
| | For example, if this parameter is set to 1000, it means that the frequency division output signal of the encoder outputs 4000 pulses per turn. | | | | | | | |

| Pr0.12＊ | Name | Reversal of pulse output logic | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0019 | | |
| | Effective | Power-on again | | | | | | |

You can set up the phase B logic and the output source of the pulse output. With this parameter, you can reverse the phase relation between the phase A pulse and phase B pulse by reversing the phase B logic.

**< reversal of pulse output logic >**

| Pr0.12 | phase A Logic | CCW direction rotation | CW direction rotation |
|---|---|---|---|
| 0 | Standard | Phase A<br>  <br>Phase B | Phase A<br>  <br>Phase B |
| 1 | Reverse | phase A<br>  <br>Phase B | Phase A<br>  <br>Phase B |

## 8.1.5 Position Complete Output (INP)

The completion of positioning can be verified by the positioning complete output (INP).When the absolute value of the positional deviation counter at the position control is equal to or below the positioning complete
Range by the parameter, the output is ON. Presence and absence of positional command can be specified as one of judgment conditions.

| Pr4.31 | Name | Positioning complete range | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.0001rev | Default | 10 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 043F | | |
| | Effective | Immediate | | | | | | |
| | Set up the timing of positional deviation at which the positioning complete signal (INP1) is output. | | | | | | | |

| Pr4.32 | Name | Positioning complete output setup | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | command unit | Default | 0 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Data length | 16bit | Access | R/W | Address | 0x 0441 |
| | Effective | Immediate | | | | |

Select the condition to output the positioning complete signal (INP1).

| Setup Value | Action Of Positioning Complete Signal |
|---|---|
| 0 | The signal will turn on when the positional deviation is smaller than Pr4.31 [positioning complete range]. |
| 1 | The signal will turn on when there is No. position command and position deviation is smaller than Pr4.31 [positioning complete range]. |
| 2 | The signal will turn on when there is No. position command, the zero-speed detection signal is ON and the positional deviation is smaller than Pr4.31 [positioning complete range]. |
| 3 | The signal will turn on when there is No. position command and the positional deviation is smaller than Pr4.31 [positioning complete range].Then holds "ON" states until the next position command is entered. Subsequently, ON state is maintained until Pr4.33 INP hold time has elapsed. After the hold time, INP output will be turned ON/OFF according to the coming positional command or condition of the positional deviation. |

| Pr4.33 | | | | | | |
|---|---|---|---|---|---|---|
| | Name | INP hold time | | | Mode | P |
| | Range | 0~30000 | Unit | 1ms | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0443 |
| | Effective | Immediate | | | | |

Set up the hold time when Pr 4.32 positioning complete output setup=3

| Setup Value | State Of Positioning Complete Signal |
|---|---|
| 0 | The hold time is maintained definitely, keeping ON state until next positional command is received. |
| 1-30000 | ON state is maintained for setup time (ms) but switched to OFF state as the positional command is received during hold time. |

And the output port should be assigned for "INP", for details of these parameters, refer to Pr_410 – Pr415.

# 8.2 Velocity Control

The drive is widely used for accuracy speed control in velocity control mode. You can control the speed according to the analog speed command from the host controller or the speed command set in servo drive.

**Notice:** You must do inspection before position control test run.

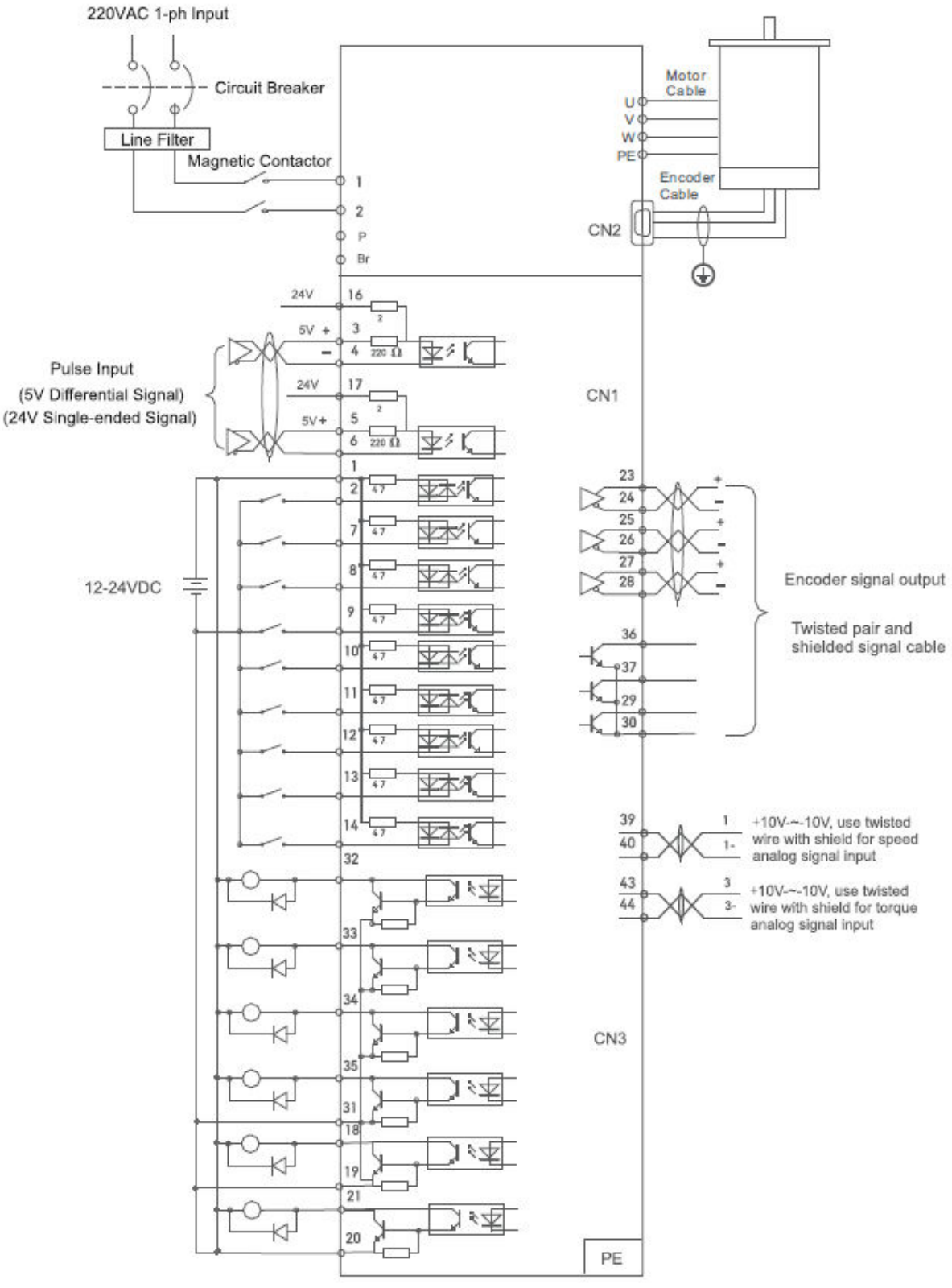



**Figure 8-3 Velocity Mode Typical Wiring Diagram**

**Note: For drive is more than 1.5kw, 3 phases is better than single phase, connect L1, L2, L3**

**Notice:** Analog input for Torque/Velocity mode is only available for EL7-RS***Z

Pls do inspection before velocity control test run

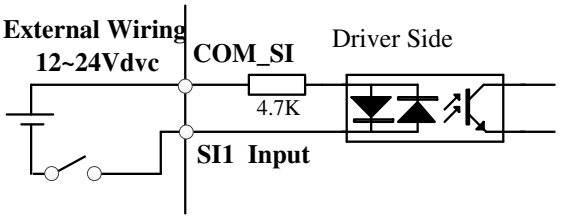
Related parameters setup of velocity mode

## 8.2.1 Velocity Control by Analog Command

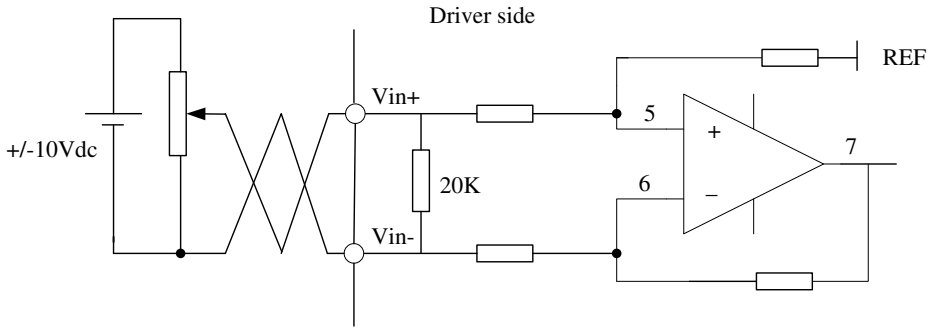
**Table 8.3 Parameter Setup of Velocity Controlled By Analog Input**

| No. | Parameter | Name | Input | Setup Value | Unit |
|---|---|---|---|---|---|
| 1 | Pr0.01 | Control mode setup | / | 1 | / |
| 2 | Pr3.12 | Acceleration time setup | / | User-specified | millisecond |
| 3 | Pr3.13 | Deceleration time setup | / | User-specified | millisecond |
| 4 | Pr3.14 | Sigmoid acceleration/deceleration time setup | / | User-specified | millisecond |
| 5 | Pr3.15 | Zero speed clamping function select | / | 2 | / |
| 6 | Pr3.00 | Velocity setup internal and external switching | / | 0 | / |
| 7 | Pr3.01 | Speed Command direction selection | / | User-specified | / |
| 8 | Pr3.02 | Speed command input gain | / | User-specified | Rpm/V |
| 9 | Pr3.03 | Speed setting input reversal | / | User-specified | / |
| 10 | Pr4.22 | Analog input I(AI1) offset setup | / | User-specified | 0.359mv |
| 11 | Pr4.23 | Analog input I(AI1) filter | / | User-specified | 0.01ms |
| 12 | Pr4.00 | SI1 input select: servo-enable | | Hex:0003 | / |

◆ Wiring Diagram




**Digital Input for Servo Enable**




**Analog Input for Velocity Control**

**Notice:** Analog input for Torque/Velocity mode is only available for EL7-RS***Z
Pls do inspection before velocity control test run.

**◆Operation steps**

1. Connect terminal CN1.
2. Enter the power (DC12V to 24V) to control signal (the COM_I and DI3).
3. Enter the power to the drive.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the drive)

5. Connect the “Srv_on” input to enable drive and energize the motor.
6. Input DC voltage between velocity command input, AI1+ and AI1-, and increase input voltage.
7. Check the motor rotational speed at monitor mode, (“d01SP”)
   Whether rotational speed is as setup or Not, and whether the motor stops with zero command or Not

8. When you want to change the rotational speed and direction, set up the following parameters again.
   Pr3.00. Pr3.01. Pr3.03
   If the motor does Not run correctly, refer to the Factor of No.-Motor running in data monitor mode (“d17Ch”).

The analog speed command input voltage is converted to equivalent digital speed command. You can set the filter to eliminate noise or adjust the offset.

| Pr3.00 | Name | Speed setup, Internal /External switching | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0301 |
| | Effective | Immediate | | | | |

This drive is equipped with internal speed setup function so that you can control the speed with contact inputs only.

| Setup Value | Speed Setup Method |
|---|---|
| 0 | Analog speed command(SPR) |
| 1 | Internal speed command 1st to 4th speed(Pr3.04-Pr3.07) |
| 2 | Internal speed command 1st to 3rd speed (Pr3.04-Pr3.06), Analog speed command(SPR) |
| 3 | Internal speed command 1st to 8th speed (Pr3.04-Pr3.11) |

**<relationship between Pr3.00 Internal/External switching speed setup and the internal command speed selection 1-3 and speed command to be selected>**

| Setup Value | 1st Selection Of Internal Command Speed (Intspd1) | 2nd Selection Of Internal Command Speed (Intspd2) | 3rd Selection Of Internal Command Speed (Intspd3) | Selection Of Speed 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 | | Analog speed command |
| 3 | The same as [Pr3.00=1] | | OFF | 1st to 4th speed |
| | OFF | OFF | ON | 5th speed |
| | ON | OFF | ON | 6th speed |
| | OFF | ON | ON | 7th speed |
| | ON | ON | ON | 8th speed |

| Pr3.01 | Name | Speed command rotational direction selection | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0303 |
| | Effective | Immediate | | | | |

Select the Positive /Negative direction specifying method

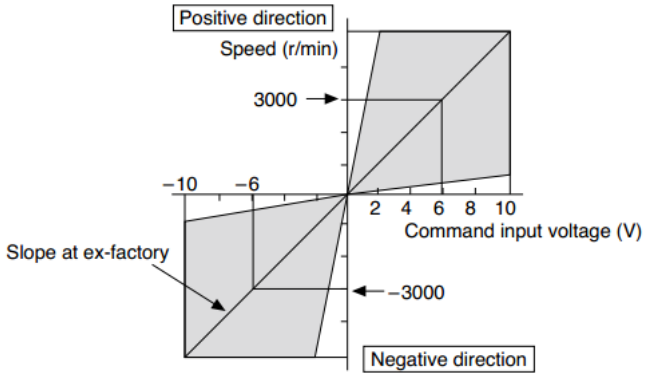
| Setup Value | Velocity Value | Velocity Command Signal(VC-SIGN) | Velocity Command Direction |
|---|---|---|---|
| 0 | + | No. effect | Positive direction |
| | - | No. effect | Negative direction |
| 1 | Sign Not effect | OFF | Positive direction |
| | Sign Not effect | ON | Negative direction |

| Pr3.02 | Name | Input gain of speed command | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | (r/min)/V | Default | 500 |
| | Data length | 16bit | Access | R/W | Address | 0x 0305 |
| | Effective | Immediate | | | | |

Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.
You can set up "slope" of relation between the command input voltage and motor speed, with Pr3.02. Default is set to Pr3.02=500(r/min)/V, hence input of 6V becomes 3000r/min.

Notice:

1. Do Not apply more than ±10V to the speed command input(SPR).
2. When you compose a position loop outside of the drive while you use the drive in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
3. Pay an extra attention to oscillation caused by larger setup of Pr3.02




| Pr3.03 | Name | Reversal of speed command input | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 1 |
| | Data length | 16bit | Access | R/W | Address | 0x 0307 |
| | Effective | Immediate | | | | |

Specify the polarity of the voltage applied to the analog speed command (SPR).

| Setup Value | Motor Rotating Direction | |
|---|---|---|
| 0 | Standard | [+ voltage]→ [+ direction] \ [- voltage]→ [-direction] |
| 1 | Reversed | [+ voltage]→ [- direction] \ [- voltage]→ [+direction] |

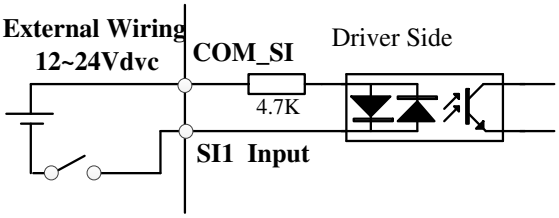
**Caution:** When you compose the servo drive system with this drive set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup do Not match.

## 8.2.2 Velocity Mode Control by Internal Speed Command

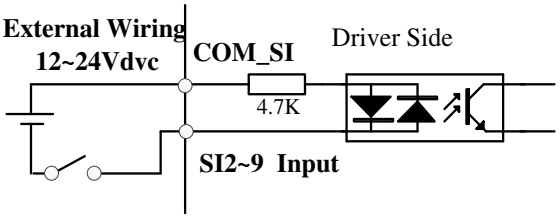
**Table 8.4 Parameter Setup of Velocity Controlled by Analog Input**

| No. | Parameter | Name | Input | Setup Value | Unit |
|---|---|---|---|---|---|
| 1 | Pr0.01 | Control mode setup | / | 1 | / |
| 2 | Pr3.12 | Acceleration time setup | / | User-specified | millisecond |
| 3 | Pr3.13 | Deceleration time setup | / | User-specified | millisecond |
| 4 | Pr3.14 | Sigmoid acceleration/deceleration time setup | / | User-specified | millisecond |
| 5 | Pr3.15 | Zero speed clamping function select | / | 2 | / |
| 6 | Pr3.00 | Velocity setup internal and external switching | / | 3 | / |
| 7 | Pr3.01 | Speed Command direction selection | / | User-specified | / |
| 10 | Pr4.22 | Analog input I(AI3) offset setup | / | User-specified | 0.359mv |
| 11 | Pr4.23 | Analog input I(AI3) filter | / | User-specified | 0.01ms |
| 12 | Pr4.00 | SI1 input select: servo-enable | | Hex:0003 | / |

◆ Wiring Diagram




**Digital Input for Servo Enable**




**Digital Input for Velocity Control_ INTSPD1/ INTSPD2/ INTSPD3/ VC-SIGN**

You can control the speed by using the internal speed command set to the parameter. By using the internal speed command selection 1, 2, 3(INTSPD 1, 2, 3), you can select best appropriate one

| Pr3.00 | Name | Speed setup, Internal /External | Mode | | V | |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | | switching | | | | |
| | Range | 0~3 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0301 |
| | Effective | Immediate | | | | |

This drive is equipped with internal speed setup function so that you can control the speed with contact inputs only.

| Setup Value | Speed Setup Method |
|---|---|
| 0 | Analog speed command(SPR) |
| 1 | Internal speed command 1st to 4th speed(Pr3.04-Pr3.07) |
| 2 | Internal speed command 1st to 3rd speed (Pr3.04-Pr3.06), Analog speed command(SPR) |
| 3 | Internal speed command 1st to 8th speed (Pr3.04-Pr3.11) |

**<relationship between Pr3.00 Internal/External switching speed setup and the internal command speed selection 1-3 and speed command to be selected>**

| Setup Value | 1st Selection Of Internal Command Speed (Intspd1) | 2nd Selection Of Internal Command Speed (Intspd2) | 3rd Selection Of Internal Command Speed (Intspd3) | Selection Of Speed 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 | | Analog speed command |
| 3 | The same as [Pr3.00=1] | | OFF | 1st to 4th speed |
| | OFF | OFF | ON | 5th speed |
| | ON | OFF | ON | 6th speed |
| | OFF | ON | ON | 7th speed |
| | ON | ON | ON | 8th speed |

| Pr3.01 | | | | | | |
|---|---|---|---|---|---|---|
| | Name | Speed command rotational direction selection | | | Mode | V |
| | Range | 0~1 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0303 |
| | Effective | Immediate | | | | |

Select the Positive /Negative direction specifying method

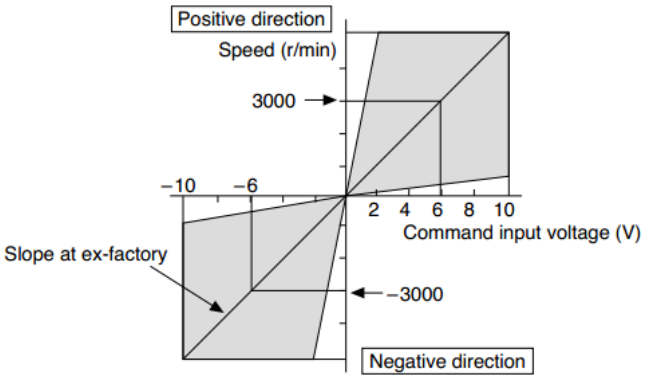
| Setup Value | Velocity Value | Velocity Command Signal(VC-SIGN) | Velocity Command Direction |
|---|---|---|---|
| 0 | + | No. effect | Positive direction |
| | - | No. effect | Negative direction |
| 1 | Sign Not effect | OFF | Positive direction |
| | Sign Not effect | ON | Negative direction |

| Pr3.02 | Name | Input gain of speed command | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | (r/min)/V | Default | 500 |
| | Data length | 16bit | Access | R/W | Address | 0x 0305 |
| | Effective | Immediate | | | | |

Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.
You can set up "slope" of relation between the command input voltage and motor speed, with Pr3.02. Default is set to Pr3.02=500(r/min)/V, hence input of 6V becomes 3000r/min.

Notice:

1. Do Not apply more than ±10V to the speed command input(SPR).
2. When you compose a position loop outside of the drive while you use the drive in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
3. Pay an extra attention to oscillation caused by larger setup of Pr3.02




| Pr3.03 | Name | Reversal of speed command input | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 1 |
| | Data length | 16bit | Access | R/W | Address | 0x 0307 |
| | Effective | Immediate | | | | |

Specify the polarity of the voltage applied to the analog speed command (SPR).

| Setup Value | Motor Rotating Direction | |
|---|---|---|
| 0 | Standard | [+ voltage]→ [+ direction] \ [- voltage]→ [-direction] |
| 1 | Reversed | [+ voltage]→ [- direction] \ [- voltage]→ [+direction] |

**Caution:** When you compose the servo drive system with this drive set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup do Not match.

| Pr3.04 | Name | 1st speed of speed setup | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x0309 |
| | Effective | Immediate | | | | |
| Pr3.05 | Name | 2nd speed of speed setup | | | Mode | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 030B |
| | Effective | Immediate | | | | |
| Pr3.06 | Name | 3rd speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 030D |
| | Effective | Immediate | | | | |
| Pr3.07 | Name | 4th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 030F |
| | Effective | Immediate | | | | |
| Pr3.08 | Name | 5th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 0311 |
| | Effective | Immediate | | | | |
| Pr3.09 | Name | 6th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 0313 |
| | Effective | Immediate | | | | |
| Pr3.10 | Name | 7th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | |
| | Data length | 16bit | Access | R/W | Address | 0x 0315 |
| | Effective | Immediate | | | | |
| Pr3.11 | Name | 8th speed of speed setup | | | Mode | V |
| | Range | -10000~10000 | Unit | r/min | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0317 |
| | Effective | Immediate | | | | |
| Set up internal command speeds, 1st to 8th | | | | | | |

## 8.2.3 Speed Command Acceleration and Deceleration

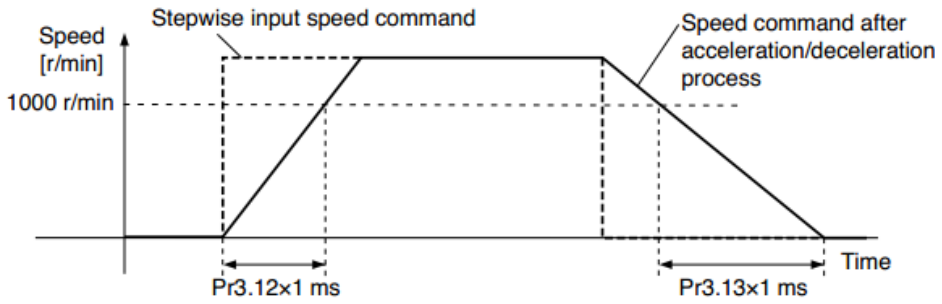
On the basis of speed command input, acceleration and deceleration are added as internal speed commands to control the speed. This function can be used when entering the ladder-like speed command and internal speed setting. In addition, the acceleration and deceleration function can also be used when the vibration is reduced by the change of acceleration

| | | | | | | |
|---|---|---|---|---|---|---|
| Pr3.12 | Name | Time setup acceleration | | | Mode | V |
| | Range | 0~10000 | Unit | Ms/ | Default | 100 |

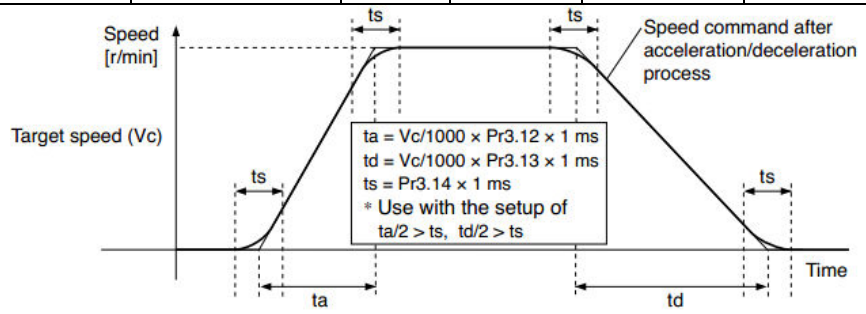
| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | (1000r/min) | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0319 |
| | Effective | Immediate | | | | |
| **Pr3.13** | Name | Time setup deceleration | | | Mode | V |
| | Range | 0~10000 | Unit | Ms/ (1000r/min) | Default | 100 |
| | Data length | 16bit | Access | R/W | Address | 0x 031B |
| | Effective | Immediate | | | | |

Set up acceleration/deceleration processing time in response to the speed command input.
Set the time required for the speed command(stepwise input)to reach 1000r/min to Pr3.12
Acceleration time setup. Also set the time required for the speed command to reach from 1000r/min to 0 r/min, to Pr3.13 deceleration time setup.
Assuming that the target value of the speed command is Vc(r/min), the time required for acceleration/deceleration can be computed from the formula shown below.

Acceleration time (ms)=Vc/1000 *Pr3.12 *1ms
Deceleration time (ms)=Vc/1000 *Pr3.13 *1ms




| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr3.14** | Name | Sigmoid acceleration /deceleration time setup | | | Mode | V |
| | Range | 0~1000 | Unit | ms | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 031D |
| | Effective | Power-on again | | | | |



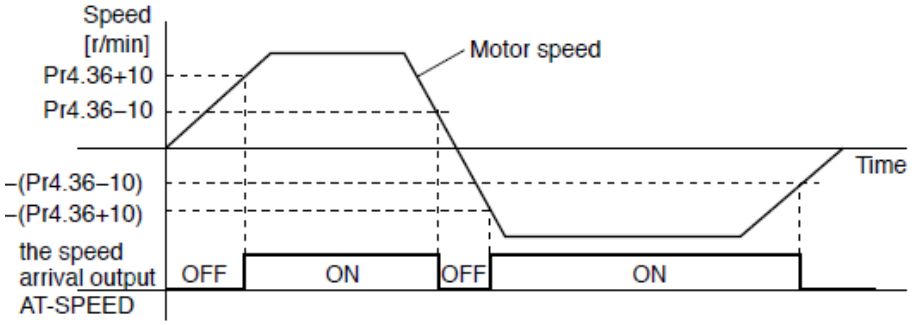
| |
|---|
| Set S-curve time for acceleration/deceleration process when the speed command is applied. According to Pr3.12 Acceleration time setup and Pr3.13 Deceleration time setup, set up sigmoid time with time width centering the inflection point of acceleration/deceleration. |

## 8.2.4 Attained Speed Signal AT-SPEED Output

When the motor speed reaches the speed set by the parameter Pr_436 (setting of arrival speed), the output speed reaches the output (AT-SPEED) signal.
This function can be configured by IO output function parameters, as described in IO Pr4.10 parameters. When the speed meets the set conditions, the set corresponding output IO port can output ON.

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr4.36** | Name | At-speed(Speed arrival) | | | Mode | V |
| | Range | 10~2000 | Unit | r/min | Default | 1000 |
| | Data length | 16bit | Access | R/W | Address | 0x 0449 |
| | Effective | Immediate | | | | |

Set the detection timing of the speed arrival output (AT-SPEED).
When the motor speed exceeds this setup value, the speed arrive output (AT-SPEED) is output.
Detection is associated with 10r/min hysteresis.




## 8.2.5 Speed Coincidence Output (V-COIN)

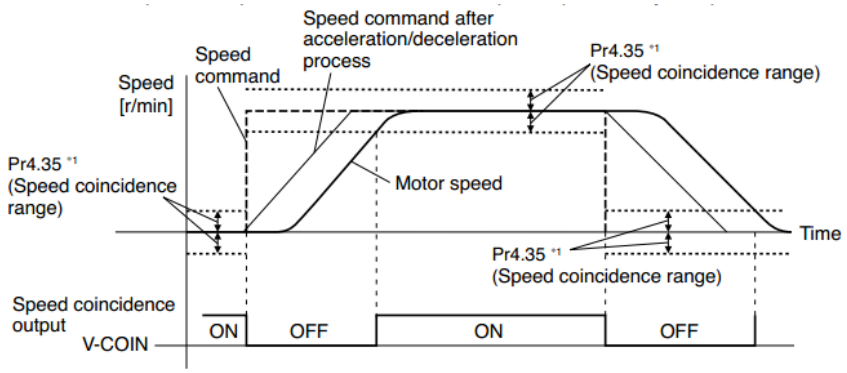
When the speed command (before acceleration and deceleration processing) is consistent with the motor speed, the output speed is consistent (V-COIN). If the difference between the speed command and the motor speed before acceleration and deceleration processing in the drive is within the parameter Pr_435 (setting the same speed range), it is judged to be consistent.
This function can be configured by IO output function parameters, as described in IO Pr4.10 parameters. When the speed difference meets the setting conditions, the corresponding output IO port set can output ON.
Among them, the in place signal of PV mode is synchronized with the v-coin signal

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr4.35** | Name | Speed coincidence range | | | Mode | V |
| | Range | 10~2000 | Unit | r/min | Default | 50 |
| | Data length | 16bit | Access | R/W | Address | 0x 0447 |
| | Effective | Immediate | | | | |

Set the speed coincidence (V-COIN) output detection timing.
Output the speed coincidence (V-COIN) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter.

Because the speed coincidence detection is associated with 10 r/min hysteresis, actual detection range is as shown below.

Speed coincidence output OFF -> ON timing (Pr4.35 -10) r/min
Speed coincidence output ON -> OFF timing (Pr4.35 +10) r/min




## 8.2.6 Zero-Speed Clamp (ZEROSPD)

You can forcibly set the speed command to 0 by using the speed zero clamp input.

| Pr3.15 | Name | Speed zero-clamp function selection | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 0~3 | Unit | 0.1HZ | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 031F |
| | Effective | Immediate | | | | |

1. If Pr3.15=0, the function of zero clamp is forbidden. It means the motor rotates with actual velocity which is controlled by the analog voltage input 1 even if the velocity is less than 10 rpm. The motor runs No. matter what the value of Pr3.16 is. The actual velocity is controlled by external the analog voltage input.
2. If Pr3.15=1 and the input signal of Zero Speed is available in the same time, the function of zero clamp works. It means motor will stop rotating in servo-on condition No. matter what the velocity of motor is, and motor stop rotating No. matter what the value of Pr3.16 is.
3. If Pr3.15=2 , the function of zero clamp belongs to the value of Pr3.16. If the actual velocity is less than the value of Pr3.16, the motor will stop rotating in servo-on condition.

| Pr3.16 | Name | Speed zero-clamp level | | | Mode | V |
|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | r/min | Default | 30 |
| | Data length | 16bit | Access | R/W | Address | 0x 0321 |
| | Effective | Immediate | | | | |

When analog speed command value less than speed zero-clamp level setup, actual speed will set to 0.

**Other setup for SI/SO function**

For details of SI input function, refer to Pr4.00 – Pr4.09.

For details of SO output function, refer to Pr4.10 – Pr4.15.

# 8.3 Torque Control

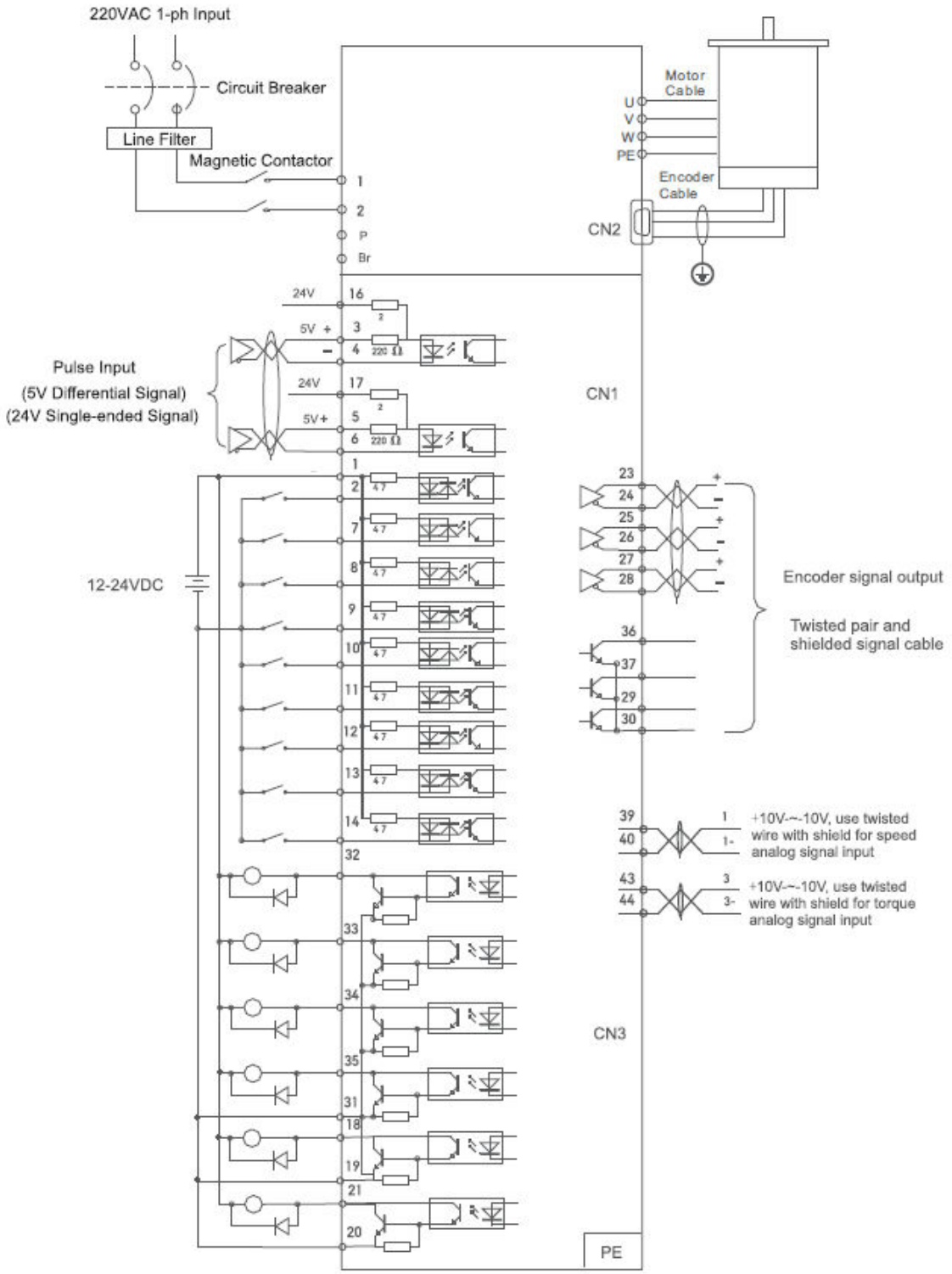



**Figure 8-4 Torque Mode Typical External Wiring Diagram**

**Note:** For drive is more than 1.5kw, 3 phases is better than single phase, connect L1, L2, L3
**Notice:** Analog input for Torque/Velocity mode is only available for EL7-RS***Z
Pls do inspection before velocity control test run

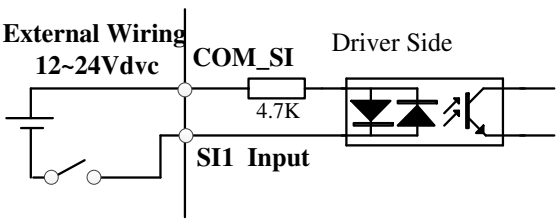
## 8.3.1 Torque Mode Control by Analog Command Input

The analog torque command input voltage is converted to equivalent digital torque command. You can set the filter to eliminate Noise or adjust the offset. The torque control is performed according to the torque command specified in the form of analog voltage. For controlling the torque, the speed limit input is required in addition to the torque command to maintain the motor speed within the speed limit.

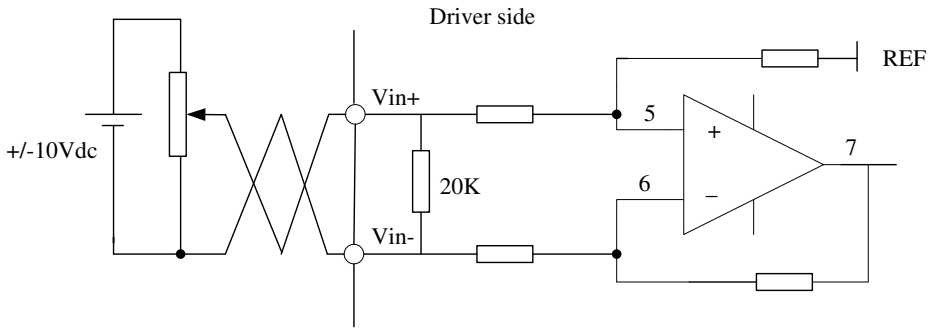
**Table 8.6 Parameter Setup of Torque Control**

| No. | Parameter | Name | input | Setup value | Unit |
|---|---|---|---|---|---|
| 1 | Pr0.01 | Control mode setup | / | 2 | / |
| 6 | Pr3.17 | Selection of torque command | / | 0 | / |
| | Pr3.18 | Torque command direction selection | | | |
| 7 | Pr3.19 | Torque command direction input gain | / | User-specified | 0.1V/100% |
| 8 | Pr3.20 | Torque setup input reversal | / | User-specified | / |
| 9 | Pr3.21 | Speed limit value 1 | / | User-specified | r/min |
| | Pr3.22 | Torque limit value in torque mode control. | / | | % |
| 10 | Pr4.00 | SI1 input select: servo-enable | Srv_on | hex:030000 | / |

◆ Wiring Diagram




**Digital Input for Servo Enable**




**Analog Input for Torque Control**

**Notice:** Analog input for Torque/Velocity mode is only available for EL7-RS***Z
Pls do inspection before velocity control test run.

**◆Operation Steps**

1. Connect terminal CN1.
2. Enter the power (DC12V to 24V) to control signal (the COMI + and DI1).
3. Enter the power to the drive.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the drive)

5. Connect the “Srv_on” input to enable drive and energize the motor.
6. Input DC voltage between torque command input, VIN+ and VIN-, and increase input voltage.
7. Check the motor torque at monitor mode ("d04tr “), whether actual torque as setup or Not
8. When you want to change the torque magnitude, direction and velocity limit value against the command voltage, set up the following parameters : Pr3.19. Pr3.20. Pr3.21

If the motor does Not run correctly, refer to the Factor of No.-Motor running in data monitor mode (“d17Ch”).

Related parameters setup of torque control mode.

| Pr3.17 | Name | Selection of torque command | | | Mode | | T |
|---|---|---|---|---|---|---|---|
| | Range | 0/1/2 | Unit | | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 0323 | |
| | Effective | Immediate | | | | | |

| Setup value | Torque command input | Velocity limit input |
|---|---|---|
| 0 | Analog input 3 | Parameter value (P3.21) |
| 1 | Analog input 3 | Analog input 1 for Speed limit |
| 2 | Parameter value (P3.22) | Parameter value (P3.21) |
| 3 | Analog input 3 | Speed limit 0 |

| Pr3.18 | Name | Torque command direction selection | | | Mode | | T |
|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 0325 | |
| | Effective | Immediate | | | | | |

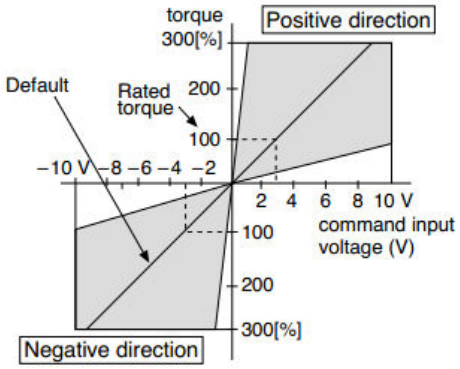
Select the direction positive/negative direction of torque command

| Setup Value | Details |
|---|---|
| 0 | Specify the direction with the sign of torque command<br>Torque command input[+] → positive direction, [-] → negative direction |
| 1 | Specify the direction with torque command sign(TC-SIGN).<br>OFF: positive direction ON: negative direction |

| Pr3.19 | Name | Torque command input gain | | | Mode | | T |
|---|---|---|---|---|---|---|---|
| | Range | 10~100 | Unit | 0.1V/100% | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 0327 | |
| | Effective | Immediate | | | | | |

Based on the voltage (V) applied to the analog torque command (TRQR),set up the conversion gain to torque command(%)

- Unit of the setup value is 0.1V/100%] and set up input voltage necessary to produce the rated torque.
- Default setup of 30 represents 3V/100%




| Pr3.20 | Name | Torque command input reversal | | | Mode | | T |
|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 0329 | |
| | Effective | Immediate | | | | | |

Set up the polarity of the voltage applied to the analog torque command (TRQR).

| Setup Value | Direction Of Motor Output Torque | |
|---|---|---|
| 0 | Non-reversal | [+ voltage]→ [+ direction] [- voltage]→ [-direction] |
| 1 | reversal | [+ voltage]→ [- direction] [- voltage]→ [+direction] |

## 8.3.2 Torque Limit Function

The speed limit is one of protective functions used during torque control.
This function regulates the motor speed so that it doesn't exceed the speed limit while the torque is controlled.

| Pr3.20 | Name | Torque command input reversal | | | Mode | | T |
|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 0329 | |
| | Effective | Immediate | | | | | |

Set up the polarity of the voltage applied to the analog torque command (TRQR).

| Setup Value | Direction Of Motor Output Torque | |
|---|---|---|
| 0 | Non-reversal | [+ voltage]→ [+ direction] [- voltage]→ [-direction] |
| 1 | reversal | [+ voltage]→ [- direction] [- voltage]→ [+direction] |

| Pr3.21 | Name | Speed limit value 1 | | | Mode | | T |
|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | r/min | Default | 0 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Data length | 16bit | Access | R/W | Address | 0x 032B |
| | Effective | Immediate | | | | |
| Set up the speed limit used for torque control.<br>During the torque controlling, the speed set by the speed limit cannot be exceeded. | | | | | | |

**Other setup for SI/SO function**

For details of SI input function, refer to Pr400 – Pr409.

For details of SO output function, refer to Pr10 – Pr415.

# 8.4 Inertia Ratio Identification

| Pr0.04 | Name | Inertia ratio | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | % | Default | 250 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0009 | | |
| | Effective | Immediate | | | | | | |
| You can set up the ratio of the load inertia against the rotor (of the motor) inertia.<br>**Pr0.04=( load inertia/rotate inertia)×100%**<br>Notice:<br>If the inertia ratio is correctly set, the setup unit of Pr1.01 and Pr1.06 becomes (Hz).<br>When the inertia ratio of Pr0.04 is larger than the actual value, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr0.04 is smaller than the actual value, the setup unit of the velocity loop gain becomes smaller. | | | | | | | | |

## 8.4.1 On-Line Inertia Ratio Identification

The motor is operated by the controller, and the motor speed is above 400rmp. The running stroke has obvious acceleration, uniform speed and deceleration process, and the load inertia ratio can be tested by running 2-3 times continuously. The inertia ratio of the test is viewed in drive Operating Data Monitor-> d16Jr. Set the monitor value into Pr0.04.

## 8.4.2 Off-Line Inertia Ratio Identification

**Pre-conditions：** 1. Servo disable. 2. Positive limit and negative limit invalid

**Steps:**

1. Set the trial running speed Pr6.04, and the setting of Pr6.04 should Not be too large
2. Enter auxiliary inertia ratio identification function on the drive panel, AF_GL
3. Press ENT once to enter operation， display “G---”
4. Press ◀ once， display “StUon”
5. Press ▲ once， motor start running to identification
6. After finishing， display G XXX, which represents the measured inertia ratio value
7. Set the monitor value minus 100 into Pr0.04.

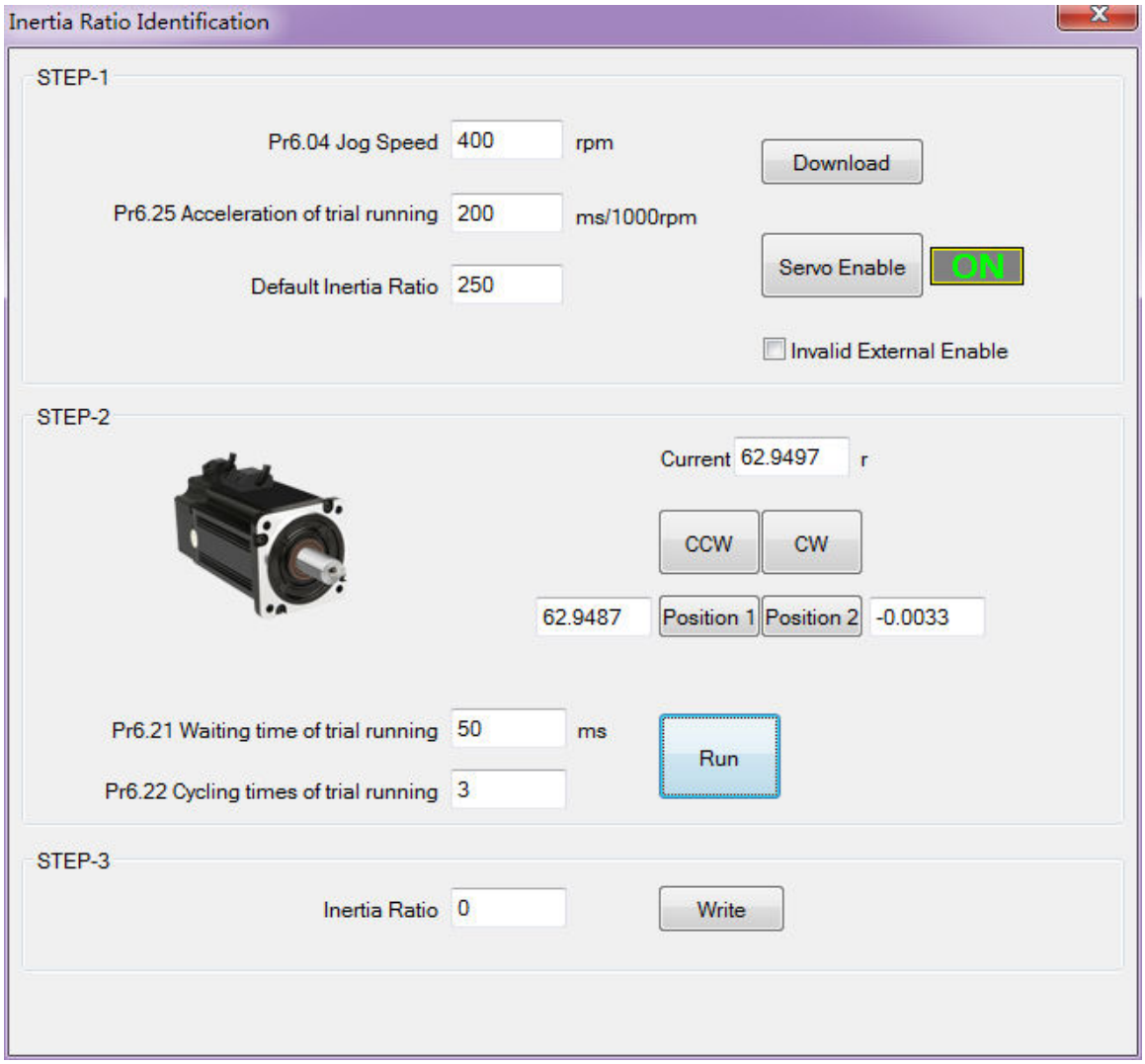
### 8.4.3 Motion Studio Inertia Ratio Identification

This inertia ratio identification function also added in Motion Studio configuration software.

**Pre-conditions：** 1. Servo disable.  2. Positive limit and negative limit invalid

**Steps:**

1. Set the Jog speed Pr6.04, and the setting should Not be too large(600~1000rpm is recommend)
   Set the Acc Pr6.25 (50~100 ms/1000rpm is recommend)
   Set the Default Inertia Ratio.
   **Download** these settings, then **Servo Enable**.
2. Click "CCW" to make motor run to CCW direction，click "Position 1" to save the position limit 1
   Click "CW" to make motor run to CW direction，click "Position 2" to save the position limit 2
   Click "Run" to start Inertia ratio identification.




3. After finishing，Click"Write"to save the Inertia ratio identification result.

## 8.5 Vibration Suppression

Specific resonance frequency can be obtained from PC upper computer software according to waveform

monitoring, and filter frequency can be set to effectively suppress the oscillation ripple of a certain frequency in the current instruction.

The width of the Notch is the ratio of the frequency of the Notch center at a depth of 0 to the frequency range width of the attenuation rate of -3db.

The depth of the trap is: when the set value is 0, the input of the center frequency is completely disconnected; when the set value is 100, it represents the ratio of input and output that are completely passed

**How to use:**

1. Set Pr2.00=1
2. Decrease Pr0.03 to get higher stiffness, higher position loop gain and velocity loop gain. Decrease Pr0.03 gradually, while abnormal sound or oscillation occurred, decreases the current value by 2.
3. Execute movement by controller or Motion Studio, drive will record Notch frequency automatically.
4. Upload the drive parameters, the record Notch frequency saved in Pr2.07.
   Read the value of Pr2.07, and set this value into Pr2.01. Then reset Pr2.07 to 2000.
5. Saving parameters setting.

| Pr2.00 | Name | Adaptive filter mode setup | | | Mode | P V |
|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 0201 |
| | Effective | Immediate | | | | |

Set up the resonance frequency to be estimated by the adaptive filter and the special the operation after estimation.

| Setup Value | Details | |
|---|---|---|
| 0 | Adaptive filter: invalid | Parameters related to the 3rd and 4th Notch filter hold the current value. |
| 1 | Adaptive filter,1 filter is valid, one time | One adaptive filter is valid, parameters related to the 3rd Notch filter will be updated based on adaptive performance. After updated, Pr2.00 returns to 0, stop self-adaptation. |
| 2 | Adaptive filter, 1 filter is valid, It will be valid all the time | One adaptive filter is valid, parameters related to the 3rd Notch filter will be updated all the time based on adaptive performance. |
| 3-4 | Not use | Forbid Non-professional to use |

| Pr2.01 | Name | 1st notch frequency | | | Mode | P V T |
|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 |
| | Data length | 16bit | Access | R/W | Address | 0x 0203 |
| | Effective | Immediate | | | | |

Set the center frequency of the 1st Notch filter

Notice: the Notch filter function will be invalid by setting up this parameter to “2000”.

| Pr2.02 | Name | 1st notch width selection | | | Mode | P V T |
|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | — | Default | 2 |
| | Data length | 16bit | Access | R/W | Address | 0x 0205 |
| | Effective | Immediate | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Set the width of Notch at the center frequency of the 1st Notch filter.<br>Notice: Higher the setup, larger the Notch width you can obtain. Use with default setup in Normal operation. | | | | | | |
| Pr2.03 | Name | 1st notch depth selection | | | Mode | P | V T |
| | Range | 0~99 | Unit | — | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 0207 | |
| | Effective | Immediate | | | | | |
| | Set the depth of Notch at the center frequency of the 1st Notch filter.<br>Notice: Higher the setup, shallower the Notch depth and smaller the phase delay you can obtain. | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pr2.04 | Name | 2nd notch frequency | | | Mode | P | V T |
| | Range | 50~2000 | Unit | Hz | Default | 2000 | |
| | Data length | 16bit | Access | R/W | Address | 0x 0209 | |
| | Effective | Immediate | | | | | |
| | Set the center frequency of the 2nd Notch filter<br>Notice: the Notch filter function will be invalid by setting up this parameter to “2000”. | | | | | | |
| Pr2.05 | Name | 2nd notch width selection | | | Mode | P | V T |
| | Range | 0~20 | Unit | — | Default | 2 | |
| | Data length | 16bit | Access | R/W | Address | 0x 020B | |
| | Effective | Immediate | | | | | |
| | Set the width of Notch at the center frequency of the 2nd Notch filter.<br>Notice: Higher the setup, larger the Notch width you can obtain. Use with default setup in Normal operation. | | | | | | |
| Pr2.06 | Name | 2nd notch depth selection | | | Mode | P | V T |
| | Range | 0~99 | Unit | — | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 020D | |
| | Effective | Immediate | | | | | |
| | Set the depth of Notch at the center frequency of the 2nd Notch filter.<br>Notice: Higher the setup, shallower the Notch depth and smaller the phase delay you can obtain. | | | | | | |

# 8.6 Third Gain Switching

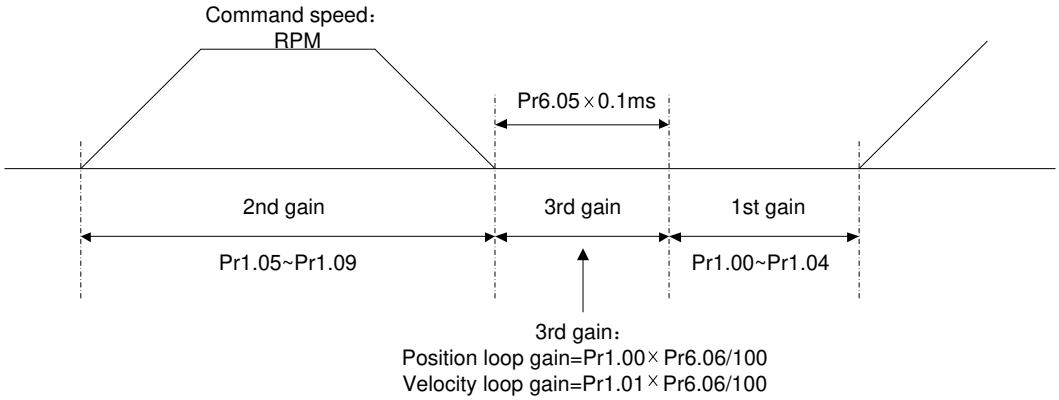
In addition to the conventional switch between the first and second gain, add the third gain switch function to shorten the positioning and setting time.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pr6.05 | Name | Position 3rd gain valid time | | | Mode | P | |
| | Range | 0~1000 | Unit | 0.1ms | Default | 0 | |
| | Data length | 16bit | Access | R/W | Address | 0x 060B | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |
| | Set up the time at which 3rd gain becomes valid.<br>When Not using this parameter, set Pr6.05=0, Pr6.06=100<br>This is valid for only position control/full-closed control. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pr6.06** | Name | Position 3rd gain multiplication | | | Mode | **P** |
| | Range | 0~1000 | Unit | 100% | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x 060D |
| | Effective | Immediate | | | | |
| | Set up the 3rd gain by multiplying factor of the 1st gain<br>3rd gain= 1st gain * Pr6.06/100. | | | | | |

This function is only effective for position control. When Pr6.06 is set to Non-0 value, the third gain function will be turned on. Pr6.05 is set to specify the value of the third gain. When switching from the second gain to the first gain, there will be a transition from the third gain. The switching time is set as Pr1.19. Take Pr1.15=7(with or without position instruction as the first and second gain of conditional switching) as an example to illustrate the figure below:




# 8.7 Friction Torque Compensation

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr6.07** | Name | Torque command additional value | | | Mode | **P** | **V** | **T** |
| | Range | -100~100 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 060F | | |
| | Effective | Immediate | | | | | | |
| **Pr6.08** | Name | Positive torque compensation value | | | Mode | **P** | **V** | **T** |
| | Range | -100~100 | Unit | % | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0611 | | |
| | Effective | Immediate | | | | | | |
| **Pr6.09** | Name | Negative torque compensation value | | | Mode | **P** | **V** | **T** |
| | Range | -100~100 | Unit | % | Default | 0 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Data length | 16bit | Access | R/W | Address | 0x 0613 |
| | Effective | Immediate | | | | |
| | These three parameters may apply feed forward torque superposition directly to torque command. | | | | | |

# 8.8 Regenerative Resister Setting

When the torque of the motor is opposite to the direction of rotation (such as deceleration, z-axis falling down, etc.), energy will feedback to the drive. At this time, the energy feedback received by the capacitor in the drive, which makes the voltage of the capacitor rise. When it rises to a certain voltage value, the excess energy needs to be consumed by the regenerative resistance.

# 8.9 Security Features

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr0.16** | Name | External regenerative resistance | | | Mode | **P** | **V** | **T** |
| | Range | 10~50 | Unit | Ω | Default | 100 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0021 | | |
| | Effective | Immediate | | | | | | |
| | Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr0.17** | Name | External regenerative resistor power value | | | Mode | **P** | **V** | **T** |
| | Range | 0~10000 | Unit | W | Default | 20 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0023 | | |
| | Effective | Immediate | | | | | | |
| | Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current. | | | | | | | |

## 8.9.1 Speed Limit

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr3.24*** | Name | Motor rotate maximum speed limit | | | Mode | **P** | **V** | **T** |
| | Range | 0~10000 | Unit | r/min | Default | 3000 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0331 | | |
| | Effective | Immediate | | | | | | |
| | Set up motor running max rotate speed, but can't be exceeded motor allowed max rotate speed. | | | | | | | |

## 8.9.2 Torque Limit (TL-SEL)

| Pr5.21 | Name | Selection of torque limit | Mode | P | V | T |
|---|---|---|---|---|---|---|
| | Range | 0~5 | Unit | — | Default | 0 |
| | Data length | 16bit | Access | R/W | Address | 0x052B |
| | Effective | Immediate | | | | |

Set up the torque limiting method

| Setup Value | | Limiting Value |
|---|---|---|
| 0 | | Pr0.13 |
| 1 | | Pr5.22 |
| 2 | TL-SEL off | Pr0.13 |
| | TL-SEL on | Pr5.22 |
| 5 | | Pr0.13 Positive torque limit<br>Pr5.22 Negative torque limit |

| Pr5.22 | Name | 2nd torque limit | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 300 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 052D | | |
| | Effective | Immediate | | | | | | |

Set up the 2nd limit value of the motor torque output
The value of the parameter is limited to the maximum torque of the applicable motor.

| Pr0.13 | Name | 1st torque limit | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 300 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 001B | | |
| | Effective | Immediate | | | | | | |

You can set up the limit value of the motor output torque, as motor rate current %, the value can't exceed the maximum of output current.

# 8.10 Multi-Turn Absolute Encoder

The absolute encoder remember position, When the absolute encoder is used for the first time, user need to move to the home position, and clear the absolute position value of multiple turns through the drive to set the home position. It is unnecessary to return to home position in the future (except for the absolute encoder alarm and other situations). It is recommended that the motor is stationary when reading the position to prevent dynamic data jump.

## 8.10.1 Parameters Setting

| Pr0.15 | Name | Absolute encoder setup | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~15 | Unit | | Default | 0 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 001F | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Power-on again | | | | |

How to use:

**0: Incremental position mode**:
The encoder is used as a incremental encoder, and the position retentive at power failure is Not supported.

**1: Absolute position linear mode**:
The encoder is used as an absolute encoder, and the position retentive at power failure is supported.
It is applicable to the scenario where the travel range of device load is fixed and the encoder multi-turn data dose Not overflow.

**2: Absolute position rotation mode**:
The encoder is used as an absolute encoder, and the position retentive at power failure is supported.
It is mainly applicable to the scenario where the load travel range is Not limited and the number of motor single-direction revolution is less than 0~(Pr6.63+1)

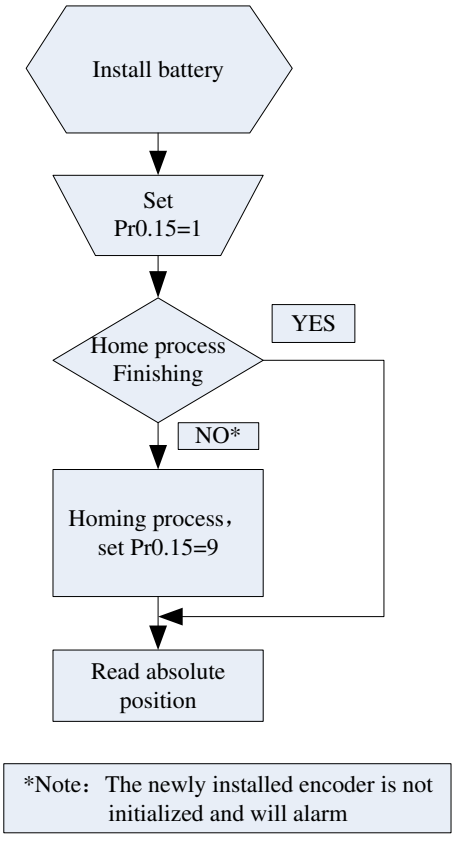
**5: Clean multi-turn alarm**, and open multi-turn absolute function.
It will become 1 when Normal clearance, if it's still 5 after 3seconds, please deal with according to 153 alarm processing.

**9: Clear multi-turn position and reset multi-turn alar**m, open multi-turn absolute function.
It will become 1 when Normal clearance, if it's still 9 after 3seconds, please deal with according to 153 alarm processing. Please remember to do mechanical homing.

**Notes:** Set to 9 after homing process finished and servo disabled, valid after Effective.

## 8.10.2 Read Absolute Position

1. Steps：



（1）Firstly, select the multi-turns absolute encoder motor, install the battery, and confirm whether the drive version supports multi-turns absolute encoder motor;
（2）Set Pr0.15=1 to open absolute encoder. If it is the first time of installation, the drive will alarm Err153. The reason is that the multi-turn position is invalid due to the newly installed battery of the motor. At this time, it is necessary to return to the home position of the machine and perform the multi-turn position reset operation (see multi-turn position reset).
（3）When the absolute value origin is set and there is No. battery fault, the alarm will be cancelled
（4）Finally, the user can read the absolute position, even if the power off the position will Not lost.

2. Read absolute position
The absolute encoder counting mode is that when the motor rotates clockwise, the number of turns is defined as negative; while motor rotates counterclockwise the number of turns is defined as positive. The maximum rotation number is -32768 to +32767. After the number of turns is out of range, if the number of turns is 32767 counterclockwise, it will reverse to -32768, -32767... ; If the number of turns clockwise -32768, it will reverse to 32767, 32766...

Absolute encoder read mode: read 6064h data object

3. Clear absolute position
Before clear absolute position, the machine needs to return to the home point. After clear absolute position, the absolute position =0, the single-turn position remains unchanged, and the absolute value of the encoder is cleared to alarm
Set Pr0.15=9: multi-turn zero clearing and reset multi-turn alarm, open multi-turn absolute function. It will become 1 when Normal clearance, if it's still 9 after 3seconds, please deal with according to 153 alarm processing.  Please remember to do mechanical homing.

## 8.10.3 Alarm

1. Introductions
The multi-turns absolute encoder alarm function can determine whether the absolute encoder is valid or Not, such as battery under voltage or power failure, encoder fault, etc., users can judge the absolute encoder alarm through bus alarm output, IO alarm output, and drive operation panel alarm. At this time, the controller should stop operation immediately, and the absolute motion operation can only be carried out after the alarm is eliminated

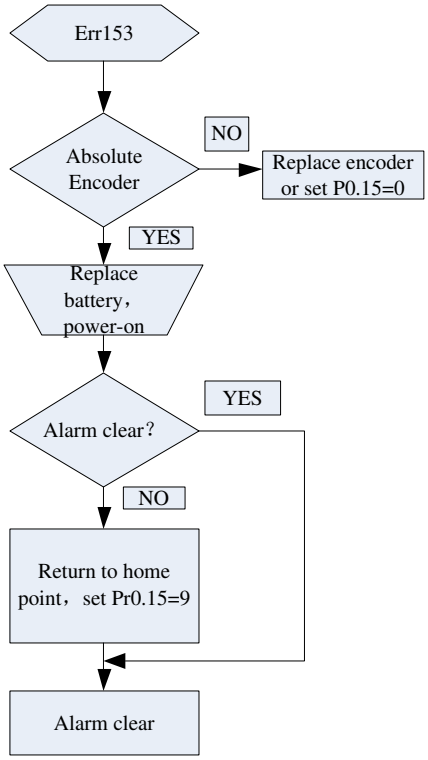
2. Alarm output
Absolute encoder alarm can be displayed by the panel Err153, IO output alarm signal, or read alarm information by communication

3. The drive sends an absolute encoder alarm Err153, the main situation is as follows:
（1）When the absolute encoder is used for the first time, absolute encoder alarm will be generated due to the new battery of the motor. At this time, it is necessary to return to the home point and perform multi-turn zero clearing operation
（2）When the battery under voltage is lower than 3.2v, absolute encoder alarm will be generated by the drive.

At this time, the alarm will be automatically eliminated after the battery is recharged by replacing the battery

（3）When the battery voltage is lower than 2.5v, or the battery has a power failure, the absolute encoder alarm will be generated. Even if the battery is replaced, the alarm cannot be eliminated. At this time, the return to the home point and multi-turn zero clearing operation should be performed

4. Alarm processing flow chart




# 8.11 Other Functions

## 8.11.1 Zero Speed Output（ZSP）

This function can be configured by IO output function parameters, as described in IO Pr4.10 parameters. When the enabling and time meet the setting conditions, the corresponding output IO port set can output ON

## 8.11.2 Position Deviation Cleared（CL）

This function can be configured by IO input function parameters, as described in IO Pr4.00 parameters.

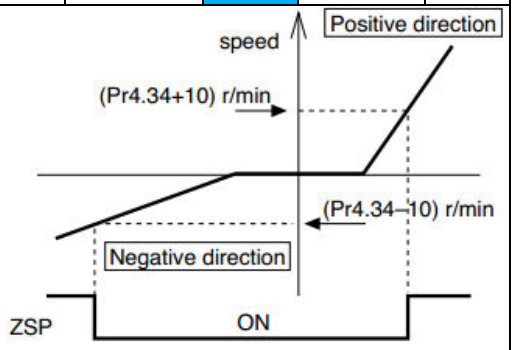
| Pr4.34 | Name | Zero-speed | Mode | P | V | T |
|---|---|---|---|---|---|---|
| | Range | 10~20000 | Unit | r/min | | |
| | Data length | 16bit | Access | R/W | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Effective | Immediate | | | | |

You can set up the timing to feed out the Zero-speed detection output signal (ZSP or TCL) in rotate speed (r/min).

The zero-speed detection signal(ZSP) will be fed out when the motor speed falls below the setup of this parameter, Pr4.34

- The setup of pr4.34 is valid for both positive and negative direction regardless of the motor rotating direction.
- There is hysteresis of 10[r/min]




| Pr5.17 | Name | Counter clear input mode | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | — | Default | 3 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0523 | | |
| | Effective | Immediate | | | | | | |

Set up the clearing conditions of the counter clear input signal

| Setup Value | Clear Condition |
|---|---|
| 0/2/4 | Invalid |
| 1 | Always clear |
| 3 | Only clear one time |

## 8.11.3 Position Setup Unit Select

| Pr5.20 | Name | Position setup unit select | | | Mode | P | | |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 2 | | |
| | Data length | 16bit | Access | R/W | Address | 0x 0529 | | |
| | Effective | Immediate | | | | | | |

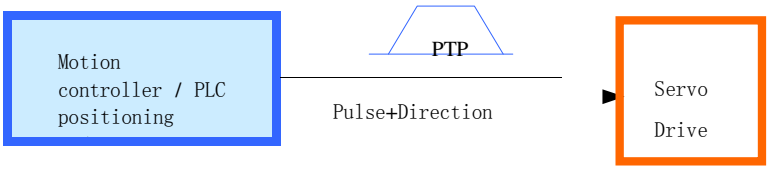
Specify the unit to determine the range of positioning complete and excessive positional deviation

| Setup Value | Unit |
|---|---|
| 0 | Encoder unit |
| 1 | Command unit |
| 2 | 10000pulse/rotation |

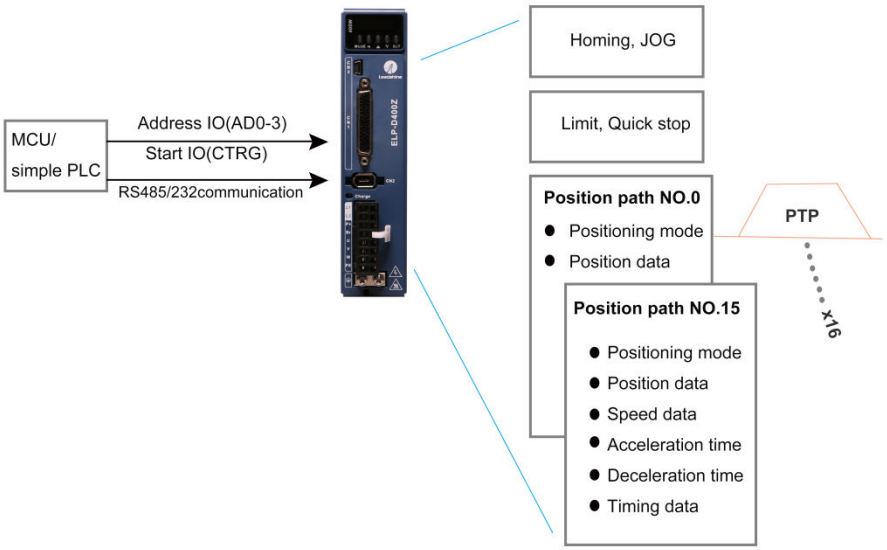
# Chapter 9 PR-Mode

## 9.4 Overview of PR-Mode

PR is uniaxial motion control function which is controlled by procedure software. Mainly uniaxial motion command control, save the motion control function of the controller.




General positioning motion control system




PR-Mode motion control system

### 9.4.1 Main Function

Main function as below：

| PR function | Specification |
|---|---|
| **Homing** | Set the homing position by homing process.<br>1. Homing method selectable. Limit switch homing, home switch homing, and manual homing all selectable,<br>2. Homing direction settable<br>3. Home deviation position settable.<br>Can be positioned to the specified position after homing.<br>4. Homing acceleration and deceleration settable<br>**Remark： Cannot input external pulse during homing process!** |

| | |
|---|---|
| **JOG** | Trigger positive/negative movement by digital input, for debugging.<br>1. Positive move，Negative move<br>2. JOG speed and acceleration selectable |
| **Position limit** | Protect machine by position limit.<br>1. Positive and negative limit switch.<br>2. Software position limit setting.<br>3. Position limit deceleration settable.<br>**Remark：Software position limit effective after homing process finished.** |
| **E-stop** | Digital input E-stop signal, stop positioning movement. |
| **Execute movement by digital input** | Select 16 motion path by digital input(ADD0~ADD3 allocation to digital input)<br>Execute select motion path by digital input (CTRG allocation to digital input)<br>1. Motion path can be set as position mode, speed mode and homing mode.<br>2. Digital input rising edge / double edge..<br>3. Support continuous positioning<br>4. Up to 16 motion path<br>5. Position, speed, acceleration/deceleration are settable.<br>6. Pause time settable<br>**Remark： Double edge trigger only effective for CTRG !** |
| **Execute movement by RS485** | Execute movement by RS485 communication. |

Remark：（1）For PR-mode, position command adopt unit: 10000pulse/rotation.
（2）PR position control mode, Pr0.01=6.

## 9.4.2 Programmable Digital Inputs and Outputs in PR-Mode

IO terminal wiring and parameter configuration：Newly added IO of PR on the base of standard IO

Related parameters：

| Parameters | Name | Specification |
|---|---|---|
| Pr4.00-Pr4.08 | SI input selection | Specific of the 9 input terminals' function distribution，refer to functional allocation table. |
| Pr4.10-Pr4.15 | SO output selection | Specific of the 6 output terminals' function distribution，refer to functional allocation table. |

IO terminal functional allocation table：

| Input | | | Output | | |
|---|---|---|---|---|---|
| **Signal name** | **Symbol** | **set value** | **signal** | **Symbol** | **set value** |

| | | Normally open | Normally closed | name | | Normally open | Normally closed |
|---|---|---|---|---|---|---|---|
| Trigger command | CTRG | 20h | A0h | Accomplish commands | CMD_OK | 20h | A0h |
| Homing signal | HOME | 21h | A1h | Accomplish path | MC_OK | 21h | A1h |
| Forced to stop | STP | 22h | A2h | Homing | HOME_OK | 22h | A2h |
| PositiveJOG | JOG+ | 23h | A3h | Torque limit | TQL | 06h | 86h |
| NegativeJOG | JOG- | 24h | A4h | | | | |
| Forward limit | PL | 25h | A5h | | | | |
| Reverse limit | NL | 26h | A6h | | | | |
| Home signal | ORG | 27h | A7h | | | | |
| Path address 0 | ADD0 | 28h | A8h | | | | |
| Path address 1 | ADD1 | 29h | A9h | | | | |
| Path address 2 | ADD2 | 2ah | Aah | | | | |
| Path address 3 | ADD3 | 2bh | Abh | | | | |
| Torque switch | TC-SEL | 09h | 89h | | | | |

Remark：CMD_OK means PR instruction is sent，maybe motor is not yet in place.
MC_OK means PR instruction is sent and motor is in place.
CTRG, HOME is edge trigging, but effective level need to last more than 1ms.

# 9.5 PR-Mode Parameters

PR-Mode parameters contain 8th and 9th parameters, 8th parameters are e-stop and control parameter, 9th parameters is store path table.

## 9.5.1 8th Parameters Specification

| Parameters | Name | Definition | Register address |
|---|---|---|---|
| Pr8.00 | PR control setting | PR-Mode control function<br>Bit0：0：CTRG rising edge trigger<br>1：CTRG double edge trigger<br>Bit1：0：software limit invalid<br>1：software limitvalid<br>Bit2：0：not execute homing after power on | 0x6000 |

| | | | |
|---|---|---|---|
| | | 1：execute homing after power on<br>Bit3: 0：Absolute encoder functioninvalid<br>1：Absolute encoder function valid | |
| Pr8.01 | PR motion path number | Up to 16 paths | 0x6001 |
| Pr8.02 | Control register | Write 0x1P, P path movement<br>Write 0x20, Homing<br>Write 0x21, set current position as homing position<br>Write 0x40, e-stop<br>Read 0x00P, positioning finished, can receive new data<br>Read 0x10P, In operation<br>Read 0x20P, In positioning | 0x6002 |
| Pr8.06 | Positive software limit H | | 0x6006 |
| Pr8.07 | Positive software limit L | | 0x6007 |
| Pr8.08 | Negative software limit H | | 0x6008 |
| Pr8.09 | Negative software limit L | | 0x6009 |
| Pr8.10 | Homing method | **Homing method**<br>Bit0：homing direction<br>=0： Negative direction<br>=1： Positive direction.<br>Bit1：Whether go to the set position after homing<br>=0：no<br>=1：yes.<br>Bit2-7：Homing mode<br>0：homing with limit switch detect<br>1：homing with homing switch detect<br>2：homing with single turn Z signal detect<br>3：homing with torque detect<br>8：set current position as homing position<br>Bit8：<br>0：homing process without Z signal detect<br>1：homing process with Z signal detect | 0x600A |
| Pr8.11 | Homing position H | | 0x600B |
| Pr8.12 | Homing position L | | 0x600C |
| Pr8.13 | Homing stop positionH | | 0x600D |
| Pr8.14 | Homing stop position L | | 0x600E |
| Pr8.15 | Homing high speed | | 0x600F |
| Pr8.16 | Homing low speed | | 0x6010 |
| Pr8.17 | Homing acceleration | | 0x6011 |
| Pr8.18 | Homing deceleration | | 0x6012 |
| Pr8.19 | Holding time of homing with torque detect | | 0x6013 |
| Pr8.20 | Torque value of homing with torque detect | | 0x6014 |
| Pr8.21 | Overpass distance setting while homing | | 0x6015 |

<table>
<tr><td>Pr8.22</td><td>Deceleration of E-stop while position limit active</td><td></td><td>0x6016</td></tr>
<tr><td>Pr8.23</td><td>Deceleration of E-stop</td><td></td><td>0x6017</td></tr>
<tr><td>Pr8.26</td><td>IO combined trigger mode</td><td>0：invalid，CTRG signal trigger<br>1：valid after homing process finished<br>2：valid without homing process<br>When Pr8.26=1 or 2, IO combined triggering takes effect.<br>Trigger the PR path by the combination of ADD0~ADD3.
<table>
<tr><th>ADD3</th><th>ADD2</th><th>ADD1</th><th>ADD0</th><th>Path</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>No action</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>Path 1</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>Path 2</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>Path 3</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>Path 4</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>Path 5</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>Path 6</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>Path 7</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Path 8</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>Path 9</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>Path 10</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>ON</td><td>Path 11</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>Path 12</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>ON</td><td>Path 13</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>Path 14</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>Path 15</td></tr>
</table></td><td>0x601A</td></tr>
<tr><td>Pr8.27</td><td>IO combined filtering</td><td></td><td>0x601B</td></tr>
<tr><td>Pr8.28</td><td>Output value of S code</td><td></td><td>0x601C</td></tr>
<tr><td>Pr8.29</td><td>PR alarm</td><td>=0x100：Homing overpass limit switch<br>=0x101：Homing process not complete and stop urgently<br>=0x20x：Path X overpass the limit switch</td><td>0x601D</td></tr>
<tr><td>Pr8.39</td><td>JOG speed</td><td></td><td>0x6027</td></tr>
<tr><td>Pr8.40</td><td>Acceleration of JOG</td><td></td><td>0x6028</td></tr>
<tr><td>Pr8.41</td><td>Deceleration of JOG</td><td></td><td>0x6029</td></tr>
<tr><td>Pr8.42</td><td>Command position H</td><td></td><td>0x602A</td></tr>
<tr><td>Pr8.43</td><td>Command position L</td><td></td><td>0x602B</td></tr>
<tr><td>Pr8.44</td><td>Motor position H</td><td></td><td>0x602C</td></tr>
<tr><td>Pr8.45</td><td>Motor position L</td><td></td><td>0x602D</td></tr>
</table>

## 9.5.2 9th Parameters Specification

| Parameters | Name | Definition | Register address |
|---|---|---|---|
| Pr9.00 | Path0 Mode | The motion mode of Path0 motion | 0x6200 |

| | | | |
|---|---|---|---|
| | | **Bit0-3：** TYPE:<br>0 No Action<br>1 position mode<br>2 velocity mode<br>3 homing mode<br>4 stop<br>**Bit4:** INS,<br>0 do not interrupt<br>1 interrupt（All interrupt now）<br>**Bit5:** OVLP，<br>0 do not overlap<br>1 overlap<br>**Bit6-7:**<br>0 absolute position<br>1 relative to command<br>2 relative to motor<br>**Bit8-13：**<br>0-15 Jump to the corresponding path<br>**Bit14：** JUMP:<br>0 do not jump<br>1 jump | |
| Pr9.01 | Path0 position H | | 0x6201 |
| Pr9.02 | Path0 position L | | 0x6202 |
| Pr9.03 | Path0 speed | rpm | 0x6203 |
| Pr9.04 | Path0 acceleration | ms/1000rpm | 0x6204 |
| Pr9.05 | Path0 deceleration | ms/1000rpm | 0x6205 |
| Pr9.06 | Path0 Pause time | The pause of path, delay time parameter etc, | 0x6206 |
| Pr9.07 | Special Parameters | Path 0 is mapped to Pr8.02 parameters | 0x6207 |

# 9.6 PR-Mode Motion Control

## 9.6.1 Homing

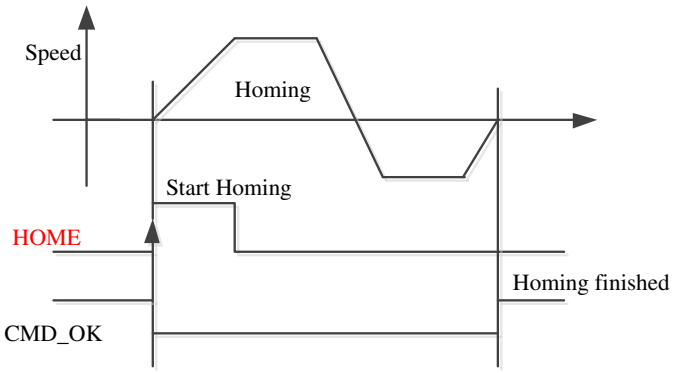
Homing method include homing with single turn Z signal detect, homing with limit switch detect, homing with homing switch detect, homing with torque detect, set current position as homing position.

**Related parameters：**

| Parameters | Name | Definition | Register address |
|---|---|---|---|
| Pr8.00 | Pr control setting | PR-Mode control function<br>Bit0：0：CTRG rising edge trigger<br>1：CTRG double edge trigger<br>Bit1：0：software limit invalid | 0x6000 |

| | | | |
|---|---|---|---|
| | | 1：software limitvalid<br>Bit2：0：not execute homing after power on<br>1：execute homing after power on<br>Bit3: 0：Absolute encoder functioninvalid<br>1：Absolute encoder function valid | |
| Pr8.01 | PR motion path number | Up to 16 paths | 0x6001 |
| Pr8.02 | Control register | Write 0x1P, P path movement<br>Write 0x20, Homing<br>Write 0x21, set current position as homing position<br>Write 0x40, e-stop<br>Read 0x00P, positioning finished, can receive new data<br>Read 0x10P, In operation<br>Read 0x20P, In positioning | 0x6002 |
| Pr8.06 | Positive software limit H | | 0x6006 |
| Pr8.07 | Positive software limit L | | 0x6007 |
| Pr8.08 | Negative software limit H | | 0x6008 |
| Pr8.09 | Negative software limit L | | 0x6009 |
| Pr8.10 | Homing method | **Homing method**<br>Bit0：homing direction<br>=0： Negative direction<br>=1： Positive direction.<br>Bit1：Whether go to the set position after homing<br>=0：no<br>=1：yes.<br>Bit2-7：Homing mode<br>0：homing with limit switch detect<br>1：homing with homing switch detect<br>2：homing with single turn Z signal detect<br>3：homing with torque detect<br>8：set current position as homing position<br>Bit8：<br>0：homing process without Z signal detect<br>1：homing process with Z signal detect | 0x600A |
| Pr8.11 | Homing position H | | 0x600B |
| Pr8.12 | Homing position L | | 0x600C |
| Pr8.13 | Homing stop positionH | | 0x600D |
| Pr8.14 | Homing stop position L | | 0x600E |
| Pr8.15 | Homing high speed | | 0x600F |
| Pr8.16 | Homing low speed | | 0x6010 |
| Pr8.17 | Homing acceleration | | 0x6011 |
| Pr8.18 | Homing deceleration | | 0x6012 |
| Pr8.19 | Holding time of homing with torque detect | | 0x6013 |
| Pr8.20 | Torque value of homing | | 0x6014 |

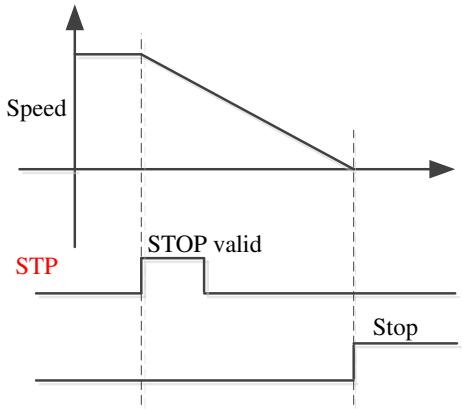
| | | | |
|---|---|---|---|
| | with torque detect | | |
| Pr8.21 | Overpass distance setting while homing | | 0x6015 |




CMD_OK and MC_OK Both of them can be used to represent action is complete, after the signal effective, there will have a delay within 1 ms.

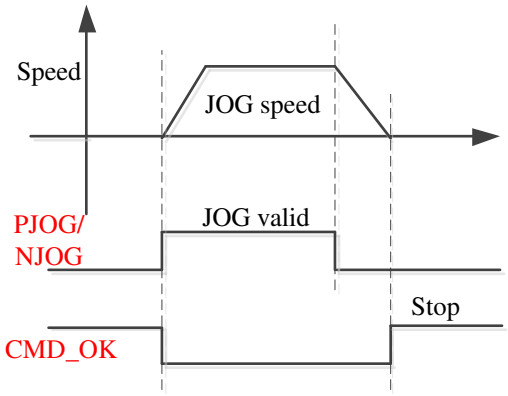
## 9.6.2 Position Limit and E-Stop

Position limit and E-stop




## 9.6.3 JOG

JOG




## 9.6.4 Path Motion

There are three modes of positioning path：Position mode, velocity mode and homing mode.

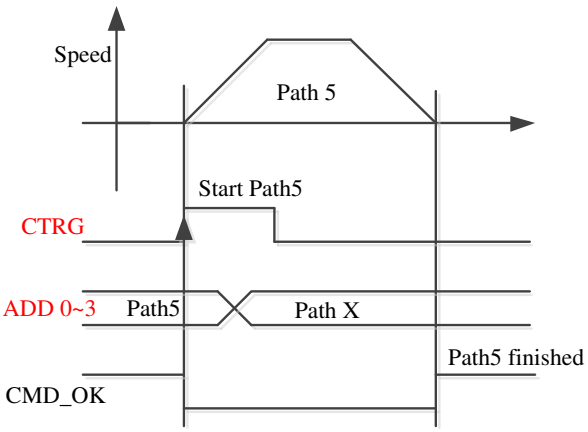
**Related parameters：**

| Parameters | Name | Definition | Register address |
|---|---|---|---|
| Pr9.00 | Path0 Mode | The motion mode of Path0 motion<br>**Bit0-3：** TYPE:<br>0 No Action<br>1 position mode<br>2 velocity mode<br>3 homing mode<br>4 stop<br>**Bit4:** INS,<br>0 do not interrupt<br>1 interrupt（All interrupt now）<br>**Bit5:** OVLP,<br>0 do not overlap<br>1 overlap<br>**Bit6-7:**<br>0 absolute position<br>1 relative to command<br>2 relative to motor<br>**Bit8-13：**<br>0-15 Jump to the corresponding path<br>**Bit14：** JUMP:<br>0 do not jump<br>1 jump | 0x6200 |
| Pr9.01 | Path0 position H | | 0x6201 |
| Pr9.02 | Path0 position L | | 0x6202 |
| Pr9.03 | Path0 speed | rpm | 0x6203 |

| | | | |
|---|---|---|---|
| Pr9.04 | Path0 acceleration | ms/1000rpm | 0x6204 |
| Pr9.05 | Path0 deceleration | ms/1000rpm | 0x6205 |
| Pr9.06 | Path0 Pause time | The pause of path, delay time parameter etc, | 0x6206 |
| Pr9.07 | Special Parameters | Path 0 is mapped to Pr8.02 parameters | 0x6207 |

### 9.6.4.1 Single Path Motion

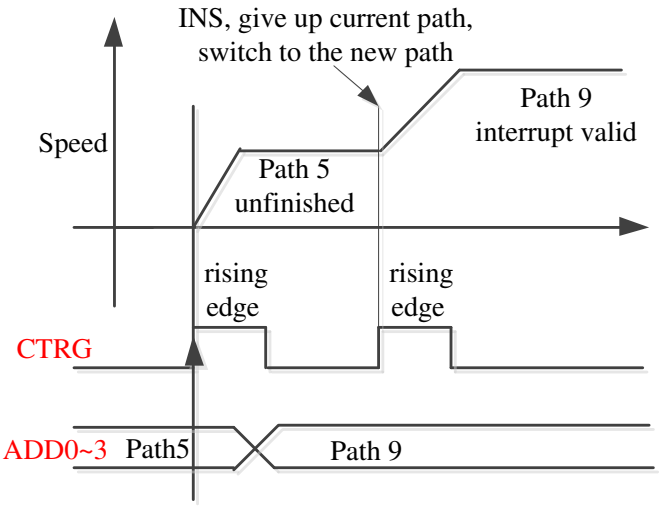
CTRG rising edge /double edge trigger the motion(Pr8.00)，take CTRG rising edge signal to trigger path5 as example:




### 9.6.4.2 Multi Path Interrupt Motion

Interrupt function means a higher path's priority. Interrupt the current valid path, give up the current path and run the new path directly. Similar to the interrupt priority of functions.

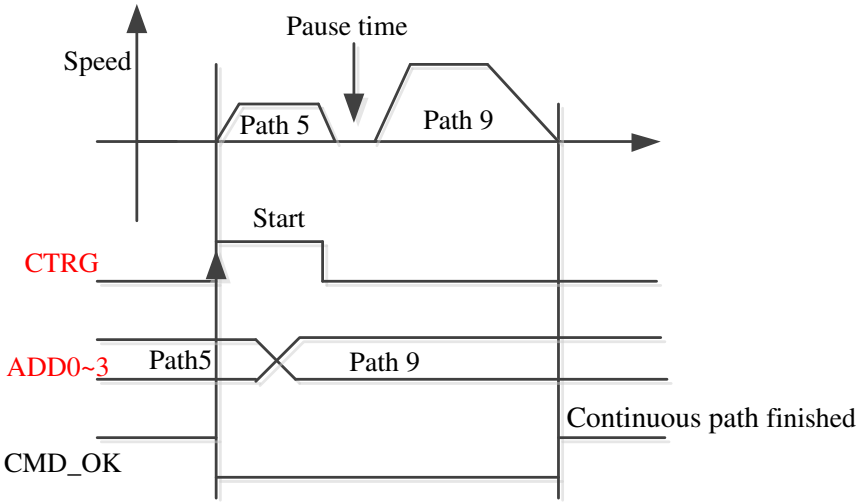
Pr9.00 bit4 = 0, interrupt




### 9.6.4.3 Continuous Path Motion without Overlap

After the first path motion finished and pause time delay, start another path motion automatically without trigger signal.

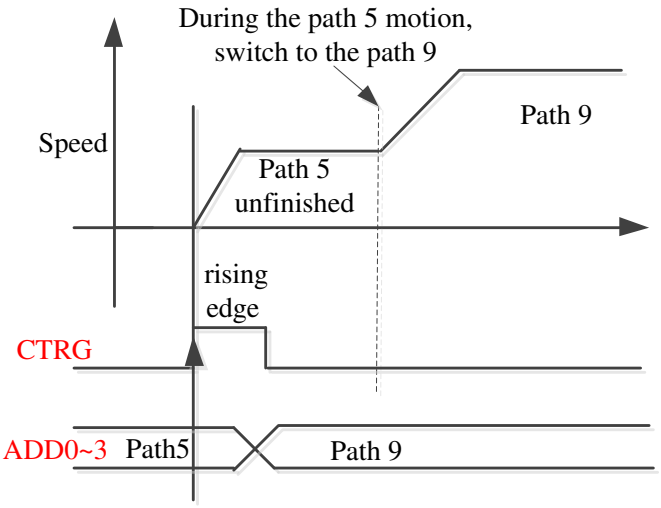
P9.00 bit5 = 0, continuous path motion without overlap




### 9.6.4.4 Continuous Path Motion with Overlap

During the first path motion in process, start another path motion automatically without trigger signal.

Pr9.00 bit5 = 1, continuous path motion with overlap



# 9.7 Execute movement of PR-Mode

## 9.7.1 Execute Movement by Configuration Software

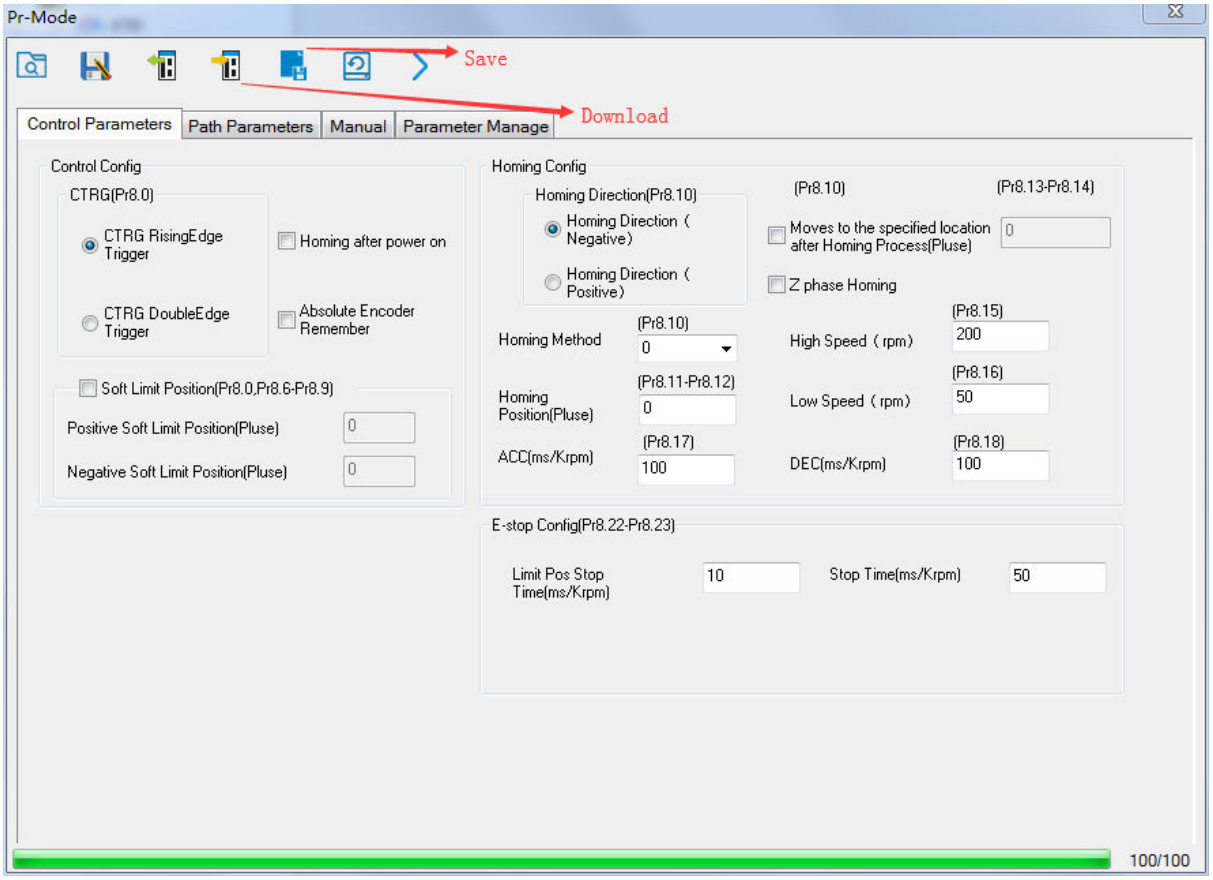
Configuration software is used for drive parameter setting and save, debugging steps are:

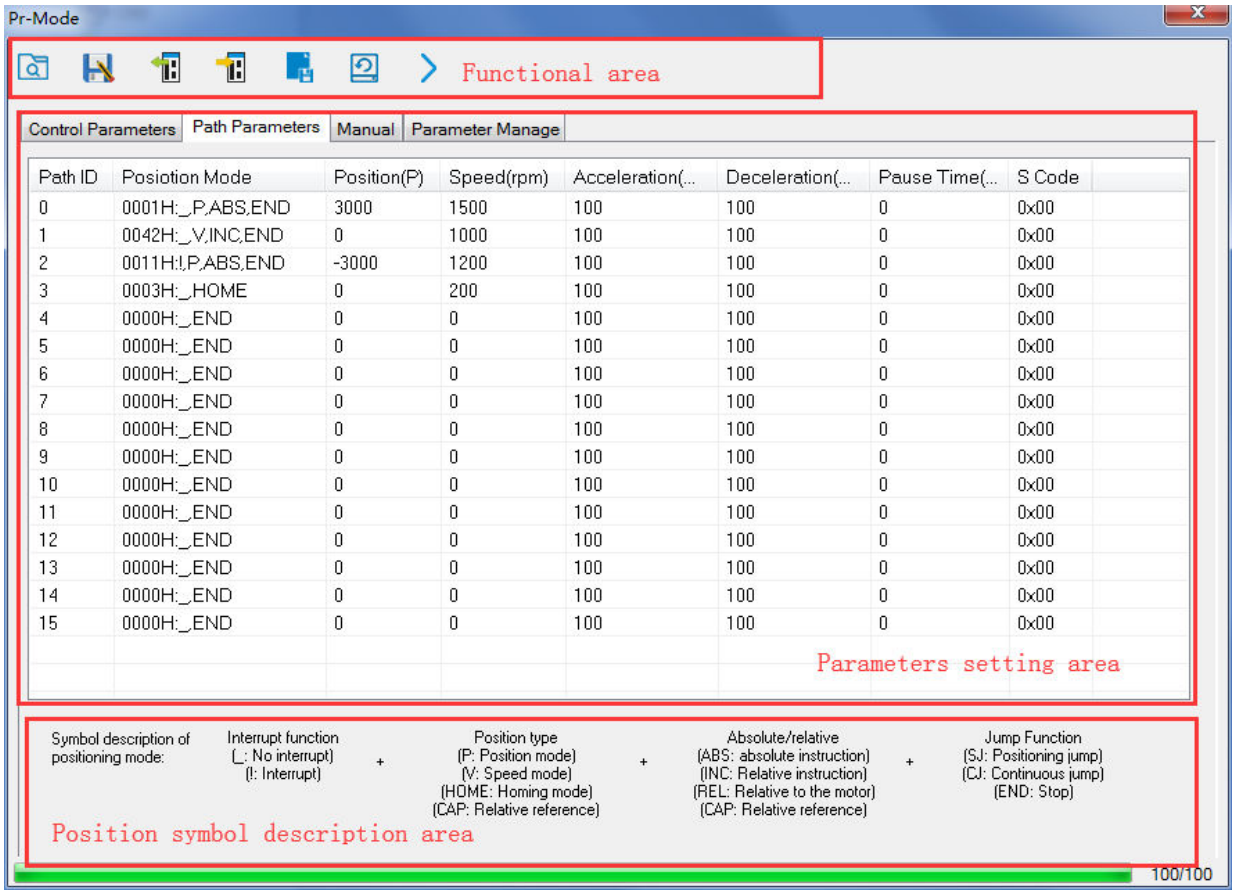
1. Check the wirings.

2. Set the work mode to be PR mode（Pr0.01=6），Internal SERVO-enabled （Pr4.00=83），set the distribution of IO register Pr4.00-Pr4.13) Confirm the running direction and so on.

3. Setting up the PR basic control parameters through upper computer's "PR-Mode" interface. Include: trigger setting, software limit, JOG function, homing function, e-stop function and so on.

4. Setting up the PR positioning path parameters in configuration software " PR-Mode " interface, include:






| Path ID | Posiotion Mode | Position(P) | Speed(rpm) | Acceleration(... | Deceleration(... | Pause Time(... | S Code |
|---|---|---|---|---|---|---|---|
| 0 | 0001H:_P,ABS,END | 3000 | 1500 | 100 | 100 | 0 | 0x00 |
| 1 | 0042H:_V,INC,END | 0 | 1000 | 100 | 100 | 0 | 0x00 |
| 2 | 0011H:!,P,ABS,END | -3000 | 1200 | 100 | 100 | 0 | 0x00 |
| 3 | 0003H:_HOME | 0 | 200 | 100 | 100 | 0 | 0x00 |
| 4 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 5 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 6 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 7 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 8 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 9 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 10 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 11 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 12 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 13 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 14 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |
| 15 | 0000H:_END | 0 | 0 | 100 | 100 | 0 | 0x00 |

For the convenience of the positioning model expressing, use mnemonic symbol to express, such as:

_P , ABS , SJ1 means that path is position addressing, position value is absolute position, jump to No.1 path with delay, and cannot interrupt running.

!V , ABS , SJ1 means that path is speed running, jump to No.1 path with delay, and can interrupt running.

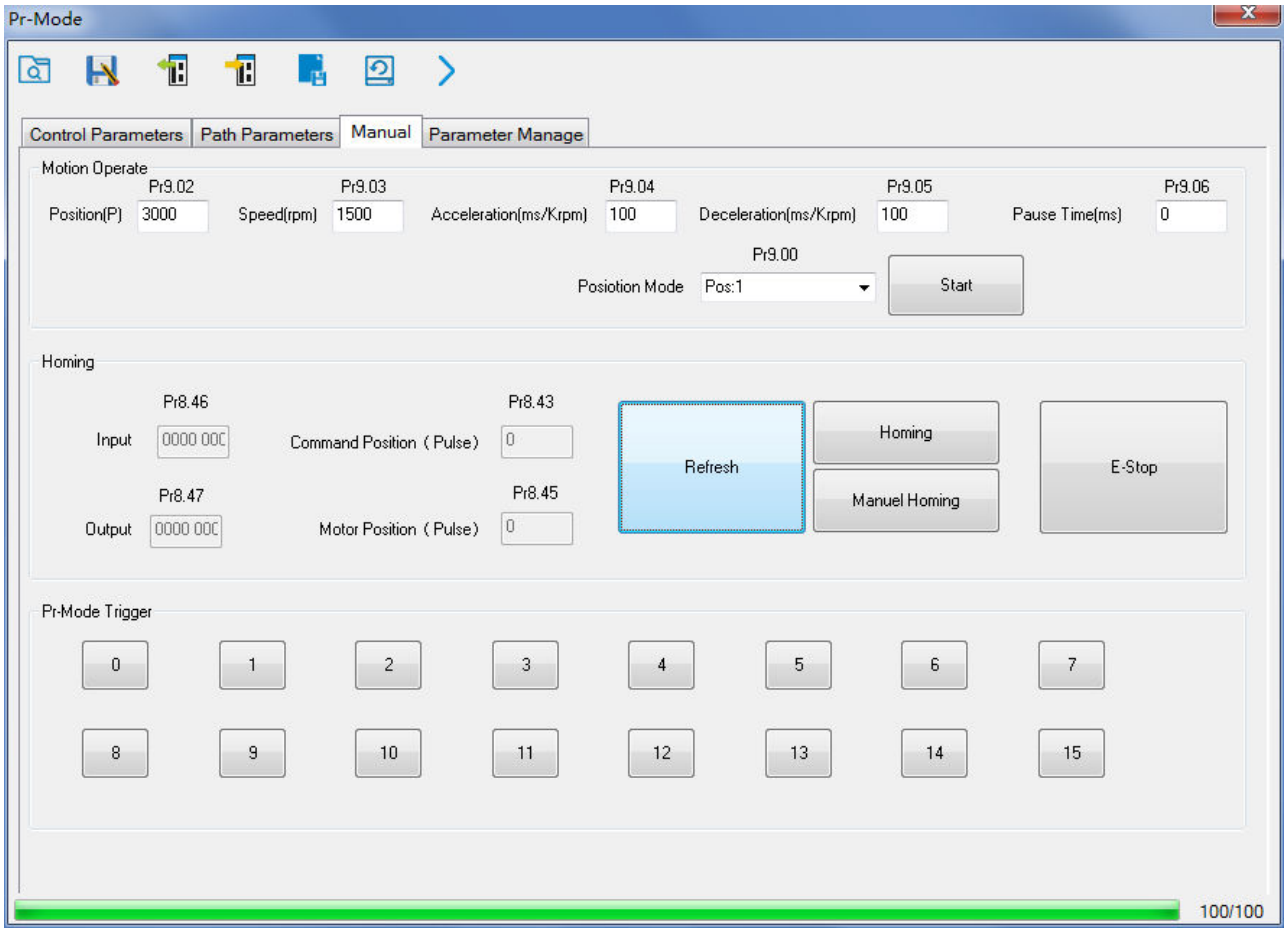
_HOME means that path is homing movement.

_END means that path is E-stop.

5. Test run

After confirming that the parameters are set correctly, the test begins. The interface is shown below

Click the number marked red in the figure and click start to run according to the speed in the path parameter configuration diagram. Click the corresponding number and click to run at the configured speed. If not, check that the parameters are set correctly




## 9.7.2 Execute Movement by Digital Signal

PR-Mode motion can be triggered by IO signal.

| Parameters | Name | Specification |
|---|---|---|
| Pr4.00-Pr4.08 | SI input selection | Specific of the 9 input terminals' function distribution，refer to functional allocation table. |
| Pr4.10-Pr4.15 | SO output selection | Specific of the 6 output terminals' function distribution，refer to functional allocation table. |

IO terminal functional allocation table：

| Input | | | | Output | | | |
|---|---|---|---|---|---|---|---|
| Signal name | Symbol | Set value | | signal name | Symbol | Set value | |
| | | Normally open | Normally close | | | Normally open | Normally close |
| Trigger command | CTRG | 20h | A0h | Accomplish commands | CMD_OK | 20h | A0h |
| Homing signal | HOME | 21h | A1h | Accomplish path | MC_OK | 21h | A1h |

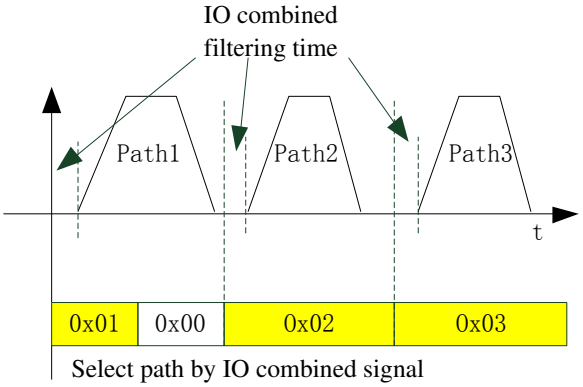
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Forced to stop | STP | 22h | A2h | Accomplish homing | HOME_OK | 22h | A2h |
| PositiveJOG | JOG+ | 23h | A3h | Torque limit | TQL | 06h | 86h |
| NegativeJOG | JOG- | 24h | A4h | | | | |
| Forward limit | PL | 25h | A5h | | | | |
| Reverse limit | NL | 26h | A6h | | | | |
| Home signal | ORG | 27h | A7h | | | | |
| Path address 0 | ADD0 | 28h | A8h | | | | |
| Path address 1 | ADD1 | 29h | A9h | | | | |
| Path address 2 | ADD2 | 2ah | Aah | | | | |
| Path address 3 | ADD3 | 2bh | Abh | | | | |
| Torque switch | TC-SEL | 09h | 89h | | | | |

## IO Trigger

The trigger mode of path motion is divided into edge trigger and IO combination trigger. Determined by control parameter Pr8.26; The edge trigger selects the motion path by the combination of paths, and then triggers the edge event of IO CTRG signal to start a motion. The IO combination trigger means that the combination of IO path select signal is directly used to trigger the motion without IO CTRG signal, the path 0 is invalid. When the IO combination signal turns into a non-zero path, the path will run once triggered after IO filtering. The timing diagram is shown below：

| Parameters | Name | Range | Default Value | Definition |
|---|---|---|---|---|
| Pr8.26 | IO combined trigger mode | 0~65535 | 0 | 0: invalid，CTRG signal trigger<br>1: valid after homing process finished<br>2: valid without homing process |
| Pr8.27 | IO combined filtering | 0~65535 | 10 | IO combined filtering time |

Notes：The path 0 is invalid, so the path 0 cannot be triggered by the IO combined signal, so the IO combined signal will trigger the motion from path 1 to path 15.




**IO combined signal trigger sequence**

Notes 1：The path 0 is invalid, so the path 0 cannot be triggered by the IO combined signal. If users want to

trigger incremental position, the IO combined signal should be as follow:
Path X IO combined signal —> Path 0 IO combined signal —> Path Y IO combined signal, trigger incremental position multiple times by these 3 steps.

Notes 2：If the IO combined trigger mode=2（Pr8.26=2）, when the drive is powered on , the motion will be triggered while the IO combined signal select path≠0.

## 9.7.3 Execute Movement by RS485 Communication

Communication control mode can realize same function as IO operation, users can modify parameters and trigger action to run, can control more than one drive by field bus, save the wiring and obtain good flexibility. Communications control includes two modes: Fixed trigger mode and immediately trigger mode.

### 9.7.3.1 Parameters Setting

<table>
<tr><th>Parameters</th><th>Name</th><th>Specification</th></tr>
<tr><td>Pr0.01</td><td>Control Mode Setup</td><td>Set Pr0.01=6 for PR-Mode</td></tr>
<tr><td>Pr4.00</td><td>SI1 Input selection</td><td>Set 83 for internal Servo-Enable<br>Set 03 for external Servo-Enable（Digital input for Servo-Enable）</td></tr>
<tr><td>Pr5.29</td><td>Mode setup of RS485 communication</td><td>
<table>
<tr><th>Setup Value</th><th>Data bit</th><th>Parity-check</th><th>Stop bit</th></tr>
<tr><td>0</td><td>8</td><td>Even Parity</td><td>2</td></tr>
<tr><td>1</td><td>8</td><td>Odd Parity</td><td>2</td></tr>
<tr><td>2</td><td>8</td><td>Even Parity</td><td>1</td></tr>
<tr><td>3</td><td>8</td><td>Odd Parity</td><td>1</td></tr>
<tr><td>4</td><td>8</td><td>None</td><td>1</td></tr>
<tr><td>5</td><td>8</td><td>None</td><td>2</td></tr>
</table>
</td></tr>
<tr><td>Pr5.30</td><td>Baud rate setup of RS485 communication</td><td>
<table>
<tr><th>Setup value</th><th>Baud rate</th><th>Setup 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>Pr5.31</td><td>RS485 slave axis ID</td><td>Modbus sub-station address number(Slave ID)</td></tr>
</table>

| | | |
|---|---|---|
| Pr8.02 | PR trigger | （16bit，485 address..0x6002）<br>Write 0x1P, P path movement<br>Write 0x20, Homing<br>Write 0x21, set current position as homing position<br>Write 0x40, e-stop<br>Read 0x00P, positioning finished, can receive new data<br>Read 0x10P, In operation<br>Read 0x20P, In positioning |

### 9.7.3.2 PR-Mode Parameters Communication Address

8th parameters：0x6000+(Parameters NO - 800）

The address of Pr8.06: 0x6000+(806-800)=0x6006

9th parameters：0x6200+( Parameters NO - 900）

The address of Pr9.06: 0x6200+(906-900)=0x6206

### PR-Mode parameters address

| RS485 address | Parameter | Name | Specification |
|---|---|---|---|
| 0x6000 | Pr8.00 | PR control setting | HEX |
| 0x6002 | Pr8.02 | Control register | HEX |
| 0x6006 | Pr8.06 | Positive software limit H | Pulse |
| 0x6007 | Pr8.07 | Positive software limit L | Pulse |
| 0x6008 | Pr8.08 | Negative software limit H | Pulse |
| 0x6009 | Pr8.09 | Negative software limit L | Pulse |
| 0x600a | Pr8.10 | Homing method | HEX |
| 0x600c | Pr8.12 | Homing position H | Pulse |
| 0x600d | Pr8.13 | Homing stop positionH | Pulse |
| 0x600e | Pr8.14 | Homing stop position L | Pulse |
| 0x600f | Pr8.15 | Homing high speed | r/min |
| 0x6010 | Pr8.16 | Homing low speed | r/min |
| 0x6011 | Pr8.17 | Homing acceleration | ms/Krpm |
| 0x6012 | Pr8.18 | Homing deceleration | ms/Krpm |
| 0x6016 | Pr8.22 | Deceleration of E-stop while | r/min |
| 0x6017 | Pr8.23 | Deceleration of E-stop | r/min |
| 0x602a | Pr8.42 | Command positionH | Read only |
| 0x602b | Pr8.43 | Command positionL | Read only |
| 0x602c | Pr8.44 | Motor position H | Read only |
| 0x602d | Pr8.45 | Motor position L | Read only |
| 0x602e | Pr8.46 | Input IO status | Read only |
| 0x602f | Pr8.47 | Output IO status | Read only |
| | Pr9.00~Pr9.07 | Path 0 parameters | |

| | | | |
|---|---|---|---|
| 0x6200 | Pr9.00 | Path0 Mode | HEX |
| 0x6201 | Pr9.01 | Path0 position H | Pulse |
| 0x6202 | Pr9.02 | Path0 position L | Pulse |
| 0x6203 | Pr9.03 | Path0 speed | r/min |
| 0x6204 | Pr9.04 | Path0 acceleration | ms/Krpm |
| 0x6205 | Pr9.05 | Path0 deceleration | ms/Krpm |
| 0x6206 | Pr9.06 | Path0 Pause time | ms |
| 0x6207 | Pr9.07 | Special Parameters | |
| 0x6208~0x620f | Pr9.08~Pr9.15 | Path 1 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6210~0x6217 | Pr9.16~Pr9.23 | Path 2 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6218~0x621f | Pr9.24~Pr9.31 | Path 3 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6220~0x6227 | Pr9.32~Pr9.39 | Path 4 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6228~0x622f | Pr9.40~Pr9.47 | Path 5 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6230~0x6237 | Pr9.48~Pr9.55 | Path 6 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6238~0x623f | Pr9.56~Pr9.63 | Path 7 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6240~0x6247 | Pr9.64~Pr9.71 | Path 8 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6248~0x624f | Pr9.72~Pr9.79 | Path 9 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6250~0x6257 | Pr9.80~Pr9.87 | Path 10 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6258~0x625f | Pr9.88~Pr9.95 | Path 11 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6260~0x6267 | Pr9.96~Pr9.103 | Path 12 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6268~0x626f | P9.104~Pr9.111 | Path 13 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6270~0x6277 | Pr9.112-Pr119 | Path 14 parameters | |
| The same with Pr9.00~Pr9.07 | | | |
| 0x6278~0x627f | Pr9.120-Pr127 | Path 15 parameters | |
| The same with Pr9.00~Pr9.07 | | | |

## 9.7.4 Fixed Trigger Method

Fixed trigger mode：Setup motion parameters. Then, replace CTRG and HOME signal with Pr8.02 (trigger register) to trigger the path. This mode applies to fixed motion and simple operation system.

**As below procedure：**

1. Firstly, setup homing and path 0~ path 15 which need to run, can transmit parameter configuration temporarily after power on, also can configured to save with upper computer.
2. Enable drive.
3. Implement choice and start of actions by write corresponding instructions into 0x6002 (Pr8.02) .

Write 0x01P, P path motion (write 0x011 to run path 1, write 0x013 to run path 3)

Write 0x020, homing

Write 0x021, set current position as homing position.

Write 0x040, E-stop.

Read 0x000p, means positioning accomplished, can receive new data

Read 0x01P, 0x020, 0x040 means still does not response to instructions.

Read 0x10P, means path is running.

Read 0x200, means instruction accomplished and wait for positioning.

Set path 0 parameters as the table showing, path 1~path15 parameters are the same as path 0

| Parameters | Name | Definition | Register address |
|---|---|---|---|
| Pr9.00 | Path0 Mode | The motion mode of Path0 motion<br>**Bit0-3：** TYPE:<br>0 No Action<br>1 position mode<br>2 velocity mode<br>3 homing mode<br>4 stop<br>**Bit4:** INS,<br>0 do not interrupt<br>1 interrupt（All interrupt now）<br>**Bit5:** OVLP，<br>0 do not overlap<br>1 overlap<br>**Bit6-7:**<br>0 absolute position<br>1 relative to command<br>2 relative to motor<br>**Bit8-13：**<br>0-15 Jump to the corresponding path<br>**Bit14：** JUMP:<br>0 do not jump<br>1 jump | 0x6200 |
| Pr9.01 | Path0 position H | | 0x6201 |
| Pr9.02 | Path0 position L | | 0x6202 |
| Pr9.03 | Path0 speed | rpm | 0x6203 |

| | | | |
|---|---|---|---|
| Pr9.04 | Path0 acceleration | ms/1000rpm | 0x6204 |
| Pr9.05 | Path0 deceleration | ms/1000rpm | 0x6205 |
| Pr9.06 | Path0 Pause time | The pause of path, delay time parameter etc, | 0x6206 |
| Pr9.07 | Special Parameters | Path 0 is mapped to Pr8.02 parameters | 0x6207 |

Set path 1~ path15 as same as path 0 .

Implement choice and start of actions by write corresponding instructions into 0x6002 (Pr8.02), to select which path to run.

## 9.7.5 Immediately Trigger Method

Compared with fixed trigger is limited by 16 path, immediately trigger method is more flexible. It is written to the current path at each time, at the same time trigger the operation of this path. Trigger position, speed, homing by a data frame.

This method adopt path0 to implement, path0 has 8 data in total, the last data Pr9.07 mapped to Pr8.02, write 0x10 to Pr8.02 can trigger path0 motion immediately.

**As below procedure：**

1. Firstly, configure homing and path which need to run, set these parameters by communication or set these parameters and save with upper computer. (homing must be configured)
2. Enable drive.
3. Trigger fixed path by Pr8.02
4. Or write in immediate data into Pr9.00-9.07, set Pr9.07=0x10, implement immediately running path 0.

For example：

| Order | Sending orders （Master->Slave） | | | | Return command (Slave->Master） | | |
|---|---|---|---|---|---|---|---|
| 1 | **ID** | Sub-station No. | 0~31 | | **ID** | Sub-station No. | 0~31 |
| 2 | **FC** | Function code | 0x10 | | **FC** | Function code | 0x10 |
| 3 | **ADDR** | Address | 0x62 | | **ADDR** | Address | 0x62 |
| 4 | | | 0x00 | | | | 0x00 |
| 5 | **NUM1** | Data quantity Word | 0x00 | | **NUM** | Actually written data quantity | 0x00 |
| 6 | | | 0x08 | | | | 0x08 |
| 7 | **NUM2** | Data quantity Byte | 0x10 | | **CRC** | check code | L |
| | | | | | | | H |
| 8-9 | **Pr9.00** | Mode | XXXX | | | | |
| 10-11 | **Pr9.01** | High position | XXXX | | | | |
| 12-13 | **Pr9.02** | Low position | XXXX | | | | |
| 14-15 | **Pr9.03** | Speed | XXXX | | | | |
| 16-17 | **Pr9.04** | Acceleration | XXXX | | | | |
| 18-19 | **Pr9.05** | Deceleration | XXXX | | | | |
| 20-21 | **Pr9.06** | Delay time | XXXX | | | | |
| 22-23 | **Pr9.07** | Trigger control | 0x0010 | | | | |
| 24 | **CRC** | Check code | L | | | | |
| 25 | | | H | | | | |

Please refer to parameter specification for specific data setting.

# 9.8 Operation Examples

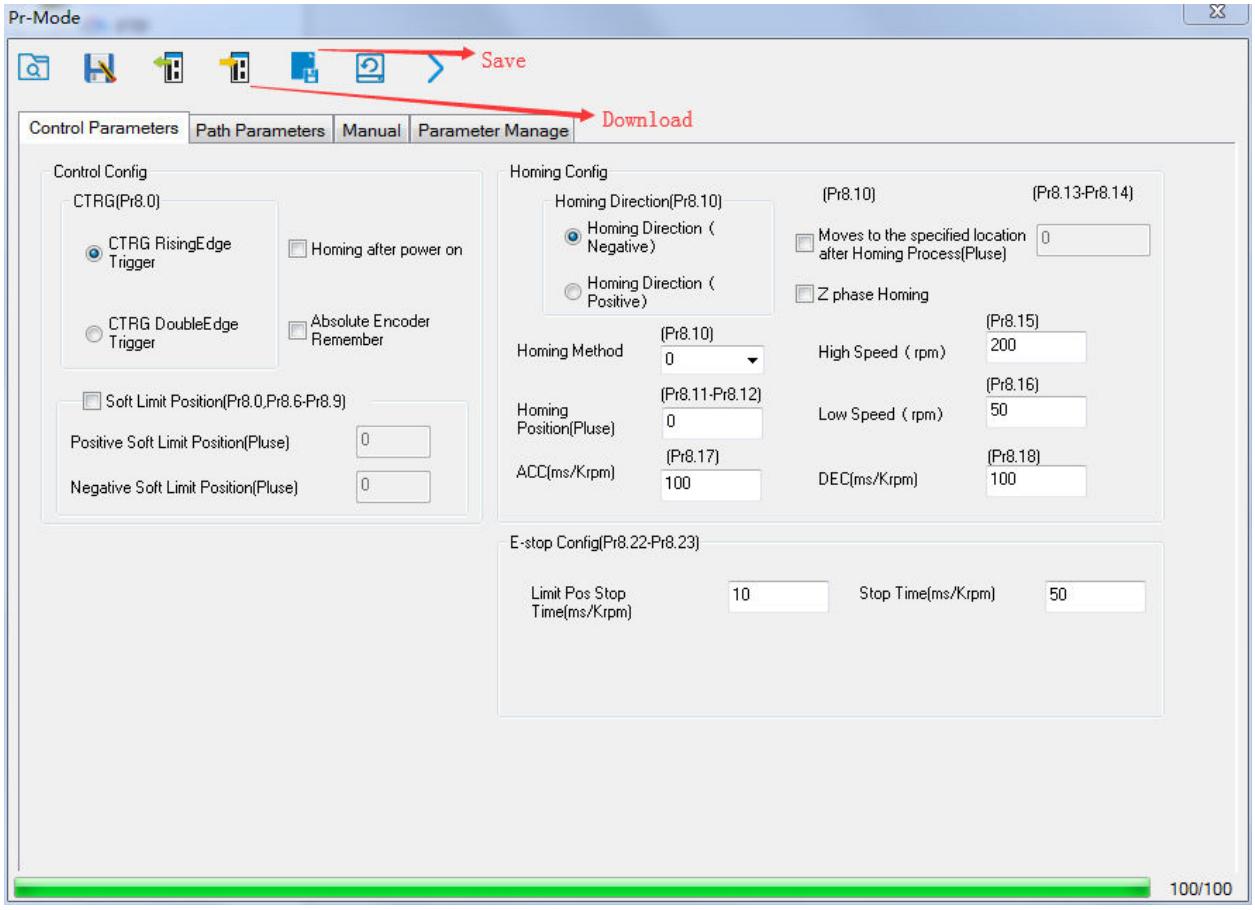
## 9.8.1 Execute Movement by Digital Signal

PR-Mode motion can be triggered by IO signal.

1. Parameters setting as follows:

| Parameters | Name | Specification |
|---|---|---|
| Pr0.01 | Control Mode Setup | Set Pr0.01=6 for PR-Mode |
| Pr4.00 | SI1 Input selection | Set Pr4.00=83 for internal Servo-Enable<br>Set Pr4.00=03 for external Servo-Enable (Digital input for Servo-Enable) |
| Pr4.00-Pr4.08 | SI input selection | Specific of the 9 input terminals' function distribution, refer to functional allocation table. |
| Pr4.10-Pr4.15 | SO output selection | Specific of the 6 output terminals' function distribution, refer to functional allocation table. |

2. Setup control parameters, such as: Trigger mode, Homing process, E-stop speed etc. The setting window as follow:




Notes: After the control parameter setting is completed, click the Download button of the toolbar to make the parameters valid. Click Save button to save the parameter to drive permanently.

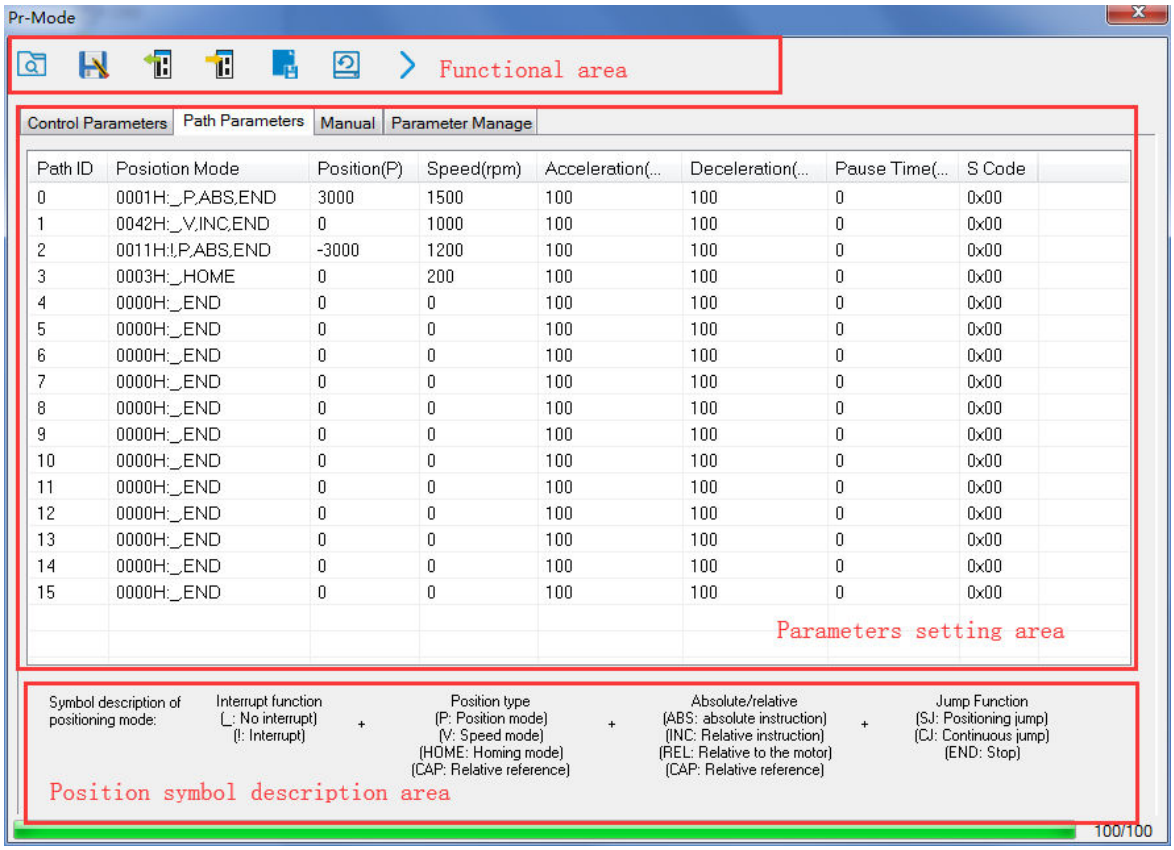
3. Setup path parameters, such as: Position mode, speed, ACC/DEC, etc.

**Functional area:** Read file, Upload, Download, Save, etc.

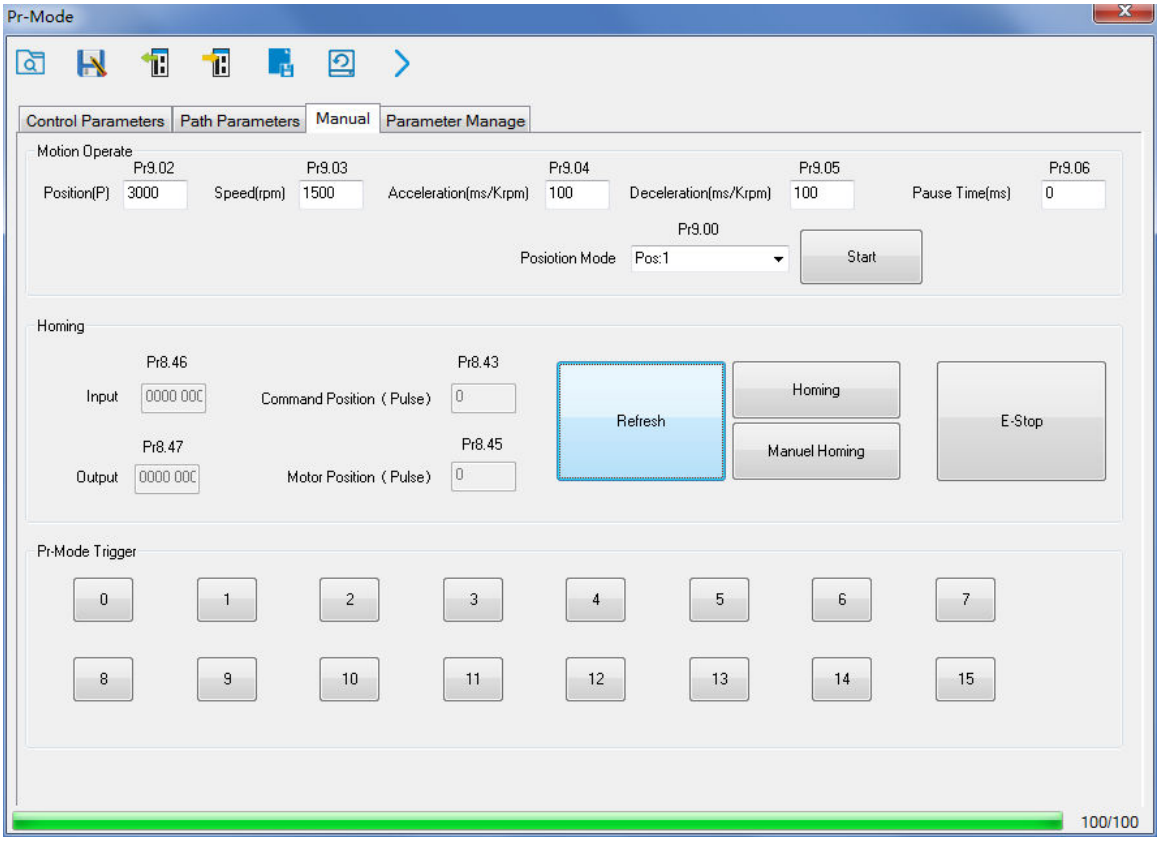
**Parameters setting area:** Position mode, speed, ACC/DEC, etc.

**Position symbol description area:** Explains the meaning of the path position symbol.

Notes: After the path parameter setting is completed, click the Download button of the toolbar to make the parameters valid. Click Save button to save the parameter to drive permanently.




4. Debug homing process, path trigger motion, input and output, etc. Its debugging interface is shown as follow:




**Notes 1:** Before using IO CTRG edge signal trigger path motion, select path number by IO combined signal, and then use IO CTRG edge signal to trigger the corresponding path motion

**Notes 2:** If IO combined trigger mode valid, the IO combined filtering time must be set to ensure that all the IO combined signal changes finished within the filtering time range.

## 9.8.2 Execute Movement by RS485 Communication

### 9.8.2.1 Write Single Data 0x06

| NO | Send | | | | Receive | | |
|---|---|---|---|---|---|---|---|
| 1 | **ID** | Slave ID | 0x01 | | **ID** | Slave ID | 0x01 |
| 2 | **FC** | Function code | 0x06 | | **FC** | Function code | 0x06 |
| 3 | **ADDR** | Address | H | | **ADDR** | Address | H |
| 4 | | | L | | | | L |
| 5 | **DATA** | Data quantity (Word) | H | | **DATA** | Actually written data quantity | H |
| 6 | | | L | | | | L |
| 7 | **CRC** | Check code | L | | **CRC** | Check code | L |
| 8 | | | H | | | | H |

**Notes：** The number of receive frame is the same as the send frame.

（1）Path 0（Absolute position mode，200000pulse，600rpm，50ms/1000rpm）

| NO | RS485 communication data frame | Details |
|---|---|---|
| 0 | 01 06 20 09 00 01 93 C8 | Servo enable |
| 1 | 01 06 62 00 00 01 57 B2 | Absolute position mode |

| | | |
|---|---|---|
| 2 | 01 06 62 01 00 03 87 B3 | 200000pulse, 16 bit H |
| 3 | 01 06 62 02 0D 40 32 D2 | 200000pulse, 16 bit L |
| 4 | 01 06 62 03 02 58 66 E8 | 600rpm |
| 5 | 01 06 62 04 00 32 56 66 | ACC: 50ms/1000rpm |
| 6 | 01 06 62 05 00 32 07 A6 | DEC: 50ms/1000rpm |
| 7 | 01 06 60 02 00 10 37 C6 | Trigger Path0 motion |
| 8 | 01 06 60 02 00 40 37 FA | E-stop |
| 9 | 01 06 20 09 00 00 52 08 | Servo disable |

（2）Path 0（Relative position mode，10000pulse，600rpm，50ms/1000rpm）

| NO | RS485 communication data frame | Details |
|---|---|---|
| 0 | 01 06 20 09 00 01 93 C8 | Servo enable |
| 1 | 01 06 62 00 00 41 56 42 | Relative position mode |
| 2 | 01 06 62 01 00 00 C7 B2 | 10000pulse, 16 bit H |
| 3 | 01 06 62 02 27 10 2D 8E | 10000pulse, 16 bit L |
| 4 | 01 06 62 03 02 58 66 E8 | 600rpm |
| 5 | 01 06 62 04 00 32 56 66 | ACC: 50ms/1000rpm |
| 6 | 01 06 62 05 00 32 07 A6 | DEC: 50ms/1000rpm |
| 7 | 01 06 60 02 00 10 37 C6 | Trigger Path0 motion |
| 8 | 01 06 60 02 00 40 37 FA | E-stop |
| 9 | 01 06 20 09 00 00 52 08 | Servo disable |

（3）Path 0（Velocity mode，600rpm，50ms/1000rpm）

| NO | RS485 communication data frame | Details |
|---|---|---|
| 0 | 01 06 20 09 00 01 93 C8 | Servo enable |
| 1 | 01 06 62 00 00 02 17 B3 | Velocity mode |
| 2 | 01 06 62 03 02 58 66 E8 | 600rpm |
| 3 | 01 06 62 04 00 32 56 66 | ACC: 50ms/1000rpm |
| 4 | 01 06 62 05 00 32 07 A6 | DEC: 50ms/1000rpm |
| 5 | 01 06 60 02 00 10 37 C6 | Trigger Path0 motion |
| 6 | 01 06 60 02 00 40 37 FA | E-stop |
| 7 | 01 06 20 09 00 00 52 08 | Servo disable |

（4）Path 1（Absolute position mode，-200000pulse，600rpm，50ms/1000rpm）

| NO | RS485 communication data frame | Details |
|---|---|---|
| 0 | 01 06 20 09 00 01 93 C8 | Servo enable |
| 1 | 01 06 62 08 00 01 D6 70 | Absolute position mode |
| 2 | 01 06 62 09 FF FC 07 C1 | -200000pulse, 16 bit H |
| 3 | 01 06 62 0A F2 C0 F3 40 | -200000pulse, 16 bit L |
| 4 | 01 06 62 0B 02 58 E7 2A | 600rpm |
| 5 | 01 06 62 0C 00 32 D7 A4 | ACC: 50ms/1000rpm |
| 6 | 01 06 62 0D 00 32 86 64 | DEC: 50ms/1000rpm |
| 7 | 01 06 60 02 00 11 F6 06 | Trigger Path1 motion |

| | | |
|---|---|---|
| 8 | 01 06 60 02 00 40 37 FA | E-stop |
| 9 | 01 06 20 09 00 00 52 08 | Servo disable |

（5）Path 1（Velocity mode，300rpm，50ms/1000rpm）

| NO | RS485 communication data frame | Details |
|---|---|---|
| 0 | 01 06 20 09 00 01 93 C8 | Servo enable |
| 1 | 01 06 62 08 00 02 96 71 | Velocity mode |
| 2 | 01 06 62 0B 01 2C E7 FD | 300rpm |
| 3 | 01 06 62 0C 00 32 D7 A4 | ACC: 50ms/1000rpm |
| 4 | 01 06 62 0D 00 32 86 64 | DEC: 50ms/1000rpm |
| 5 | 01 06 60 02 00 11 F6 06 | Trigger Path1 motion |
| 6 | 01 06 60 02 00 40 37 FA | E-stop |
| 7 | 01 06 20 09 00 00 52 08 | Servo disable |

（6）Homing

| NO | RS485 communication data frame | Details |
|---|---|---|
| 0 | 01 06 20 09 00 01 93 C8 | Servo enable |
| 1 | 01 06 60 0A 00 00 B7 C8 | Homing Method |
| 2 | 01 06 60 0F 00 64 A6 22 | High speed for homing |
| 3 | 01 06 60 10 00 1E 16 07 | Low speed for homing |
| 4 | 01 06 60 02 00 20 37 D2 | Trigger Homing process |
| 5 | 01 06 60 02 00 40 37 FA | E-stop |
| 7 | 01 06 20 09 00 00 52 08 | Servo disable |

### 9.8.2.2 Write Multiple Data 0x10

Fixed trigger is limited by 16 segment position, but immediately trigger method is flexible. It is written to the current path at each time, at the same time trigger the operation of this path. Realize position, speed, homing and such actions by a data frame.

This method adopt PR0 to implement, PR0 has 8 data in total, the last data Pr9.07 of it will mapped to Pr8.02, write in 0x10 can trigger Path0 operation immediately, realize data trigger running immediately.

**Operating steps:**

1. Firstly, configure homing and path which need to run, can power on and send parameter configuration temporarily, also can configure and save with upper computer. (homing must be configured)
2. Enable drive.

| NO | RS485 communication data frame | Details |
|---|---|---|
| 0 | 01 06 20 09 00 01 93 C8 | Servo enable |
| 1 | 01 06 20 09 00 00 52 08 | Servo disable |

3. Operate fixed path by Pr8.02
4. write in immediate data by Pr9.00-9.07, and Pr9.07=0x10, implement immediately running path 0.

Demonstrate with immediately trigger method

An example of 485 communication data frame operation is shown below:

| Order | Sending orders （Master->Slave） | | | | Return command (Slave->Master） | | |
|---|---|---|---|---|---|---|---|
| 1 | ID | Sub-station No. | 0~31 | | ID | Sub-station No. | 0~31 |

| 2 | **FC** | Function code | 0x10 | | **FC** | Function code | 0x10 |
|---|---|---|---|---|---|---|---|
| 3 | **ADDR** | Address | 0x62 | | **ADDR** | Address | 0x62 |
| 4 | | | 0x00 | | | | 0x00 |
| 5 | **NUM1** | Data quantity Word | 0x00 | | **NUM** | Actually written data quantity | 0x00 |
| 6 | | | 0x08 | | | | 0x08 |
| 7 | **NUM2** | Data quantity Byte | 0x10 | | **CRC** | check code | L |
| | | | | | | | H |
| 8-9 | **P9.00** | Mode | XXXX | | | | |
| 10-11 | **P9.01** | High position | XXXX | | | | |
| 12-13 | **P9.02** | Low position | XXXX | | | | |
| 14-15 | **P9.03** | Speed | XXXX | | | | |
| 16-17 | **P9.04** | Acceleration | XXXX | | | | |
| 18-19 | **P9.05** | Deceleration | XXXX | | | | |
| 20-21 | **P9.06** | Delay time | XXXX | | | | |
| 22-23 | **P9.07** | Trigger control | 0x0010 | | | | |
| 24 | **CRC** | Check code | L | | | | |
| 25 | | | H | | | | |

**Absolute position mode:** 01 10 62 00 00 08 10 00 01 00 01 86 A0 01 F4 00 64 00 64 00 00 00 10 AA BF

01 slave ID 01

10 function code，write multi data

62 00 first address mapped to Pr9.00

00 08 8 consecutive operating addresses from 62 00 to 62 07，mapped to Pr9.00~Pr9.07

10 Hexadecimal data of the number of data，8 register，each address data is divided into high and low bits， 8*2=16

00 01 data written down to the first addresses of 6200 mapped to Pr9.00.
Motion Mode, absolute position mode

00 01 86 A0 data written down to the second and third addresses of 6201 mapped to Pr9.01；6202 mapped to Pr9.02.
Hexadecimal data of position=100000plus. All positions in PR mode are in units of 10000P/r, 00 01 86 A0 represents 10 turns of motor rotation.

01 F4 data written down to the 4th addresses of 6203 mapped to Pr9.03
Hexadecimal data of Speed=500r/min

00 64 data written down to the 5th addresses of 6204 mapped to Pr9.04
Hexadecimal data of acceleration time=100ms

00 64 data written down to the 6th addresses of 6205 mapped to Pr9.05
Hexadecimal data of deceleration time=100ms

00 00 data written down to the 7th addresses of 6206 mapped to Pr9.06
Hexadecimal data of the delay time=0ms

00 10 data written down to the 8th addresses of 6207 mapped to Pr9.07, to trigger the action, immediately trigger method（1P，Immediately trigger path P）

AA BF the verification code, do not have to directly input, click the corresponding send area verification button automatically generated

The final analysis is as follows: speed is 500r/min, acceleration and deceleration time is 100ms, and the position of absolute positioning is 10 rotations.

01 10 62 00 00 08 10 00 01 00 00 00 00 01 F4 00 64 00 64 00 00 00 10 A0 4A
The final analysis was performed at a speed of 500r/min, acceleration and deceleration time of 100ms, and the position of absolute positioning 0 rotations.

**Relative position mode：** 01 10 62 00 00 08 10 00 41 00 01 86 A0 01 F4 00 64 00 64 00 00 00 10 EA 8F
01 slave ID 01
10 function code，write multi data
62 00 first address mapped to Pr9.00
00 08 8 consecutive operating addresses from 62 00 to 62 07，mapped to Pr9.00~Pr9.07
10 Hexadecimal data of the number of data，8 register，each address data is divided into high and low bits， 8*2=16
00 41 data written down to the first addresses of 6200 mapped to Pr9.00.
Motion Mode, relative position mode
00 01 86 A0 data written down to the second and third addresses of 6201 mapped to Pr9.01；6202 mapped to Pr9.02.
Hexadecimal data of position=100000plus. All positions in PR mode are in units of 10000P/r, 00 01 86 A0 represents 10 turns of motor rotation.
01 F4 data written down to the 4th addresses of 6203 mapped to Pr9.03
Hexadecimal data of Speed=500r/min
00 64 data written down to the 5th addresses of 6204 mapped to Pr9.04
Hexadecimal data of acceleration time=100ms
00 64 data written down to the 6th addresses of 6205 mapped to Pr9.05
Hexadecimal data of deceleration time=100ms
00 00 data written down to the 7th addresses of 6206 mapped to Pr9.06
Hexadecimal data of the delay time=0ms
00 10 data written down to the 8th addresses of 6207 mapped to Pr9.07, to trigger the action, immediately trigger method（1P，Immediately trigger path P）
EA 8F the verification code, do not have to directly input, click the corresponding send area verification button automatically generated
The final analysis is as follows: speed is 500r/min, acceleration and deceleration time is 100ms, and the position of relative positioning is 10 rotations.

**Homing mode：** 01 06 60 02 00 21 F6 12 （Back to origin high-speed, low-speed, and back to zero mode can be set in the eighth set of parameters, using default values this time）
Caution：In Pr mode, the origin induction switch is connected to the drive, which is different from the impulse control. Limited by conditions, only the current position can be demonstrated to the customer：Write 0x021，The current location manually set to zero.。
The frame format function is：
01 slave ID 01
06 function code，write single data

| NO | Send | | Receive |
|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | ID | Slave ID | 0~31 | | ID | Slave ID | 0~31 |
| 2 | FC | Function code | 0x06 | | FC | Function code | 0x06 |
| 3 | ADDR | Address | H | | ADDR | Address | H |
| 4 | | | L | | | | L |
| 5 | DATA | Data quantity (Word) | H | | DATA | Actually written data quantity | H |
| 6 | | | L | | | | L |
| 7 | CRC | check code | L | | CRC | check code | L |
| 8 | | | H | | | | H |

60 02 register address，mapped to Pr8.02

00 21 the data write into the register，Write 0x021，The current location manually set to zero.

Write 0x01P，P section positioning

Write 0x020，homing

Write 0x021，set current position as homing point

Write 0x040，e-stop

F6 12 the verification code, do not have to directly input, click the corresponding send area verification button automatically generated

After the current position is set to zero manually, you can click absolute positioning again to send it manually, indicating that the current position is set to zero manually

JOG is IO input, there is no communication control method, you can push users to write relative positioning data in real time, and trigger inching motion immediately instead.

**Velocity mode**：0110 62 00 00 08 10 00 02 00 00 00 00 03 E8 00 64 00 64 00 00 00 10 DA 41

01 slave ID 01

10 function code，write multi data

62 00 first address mapped to Pr9.00

00 08 8 consecutive operating addresses from 62 00 to 62 07，mapped to Pr9.00~Pr9.07

10 Hexadecimal data of the number of data，8 register，each address data is divided into high and low bits， 8*2=16

00 02 data written down to the first addresses of 6200 mapped to Pr9.00, speed mode

00 00 00 00 data written down to the second and third addresses of 6201 mapped to Pr9.01；6202 mapped to Pr9.02.Hexadecimal data of position=0plus. All positions in PR mode are in units of 10000P/r，, 00 00 00 00 represents 0 turns of motor rotation in Speed mode

03 E8 data written down to the fourth addresses of 6203 mapped to Pr9.03

Hexadecimal data of Speed=1000r/min

00 64 data written down to the five addresses of 6204 mapped to Pr9.04

Hexadecimal data of acceleration time=100ms

00 64 data written down to the six addresses of 6205 mapped to Pr9.05

Hexadecimal data of deceleration time=100ms

00 00 data written down to the seven addresses of 6206 mapped to Pr9.06

Hexadecimal data of the delay time=0ms

00 10 data written down to the eight addresses of 6207 mapped to Pr9.07 ， to trigger the action，

Immediately trigger method（1P，Immediately trigger path-P，The sample Pr9.00~9.07 is the

positioning related data of path-0）

DA 41 the verification code, do not have to directly input, click the corresponding send area verification button automatically generated

The final analysis is as follows: speed=1000r/min, acceleration and deceleration time is 100ms, velocity mode

**E-stop:** 01 06 60 02 00 40 37 FA

**Servo enable:** 01 06 20 09 00 01 93 C8

**Servo disable:** 01 06 20 09 00 00 52 08

# Chapter 10 Order Guidance

## 10.1 Capacity Selection

To determine the capacity of servo system, we must consider the inertia of load, torque of load, the positioning accuracy, the requirement of the highest speed; consider the selection according to the following steps:

### 1) Calculate Inertia of Load and Torque

You can refer to relative information to calculate inertia of load, torque of load, acceleration/deceleration torque as the next step basis.

### 2) Identify Mechanical Gear Ratio

According to the maximum speed and the highest speed of the motor ,you can calculate the maximum of mechanical reduction ratio, by using it and minimum of motor turning unit ,to calculate if they can meet the requirements of the smallest position unit or Not. If the positional precision is high, you can increase the mechanical reduction ratio or select motor with higher capacity.

### 3) Calculate Inertia and Torque

Convert mechanical reduction ratio of the load inertia and load torque to the motor shaft, while the result shall be Not 5 times more than motor inertia. If the requirements can't be matched, you can increase the mechanical reduction ratio (the actual maximum speed reducing) or select larger capacity motor.

## 10.2 Electronic Gear Ratio

In position control mode, the actual speed = command pulse velocity× G ×mechanical reduction ratio.
In position control mode, the actual load minimum displacement = minimum command pulse travel ×G ×mechanical reduction ratio.
【Note】If the electronic gear ratio of G is Not 1, gear ratio division may have the remainder, then there will be position deviation existed, the maximum deviation is the minimum of rotation ( minimum resolution ).

# Appendix Modbus Communication

The Modbus products of EL7 series are based on serial communication bus with Modbus-RTU. Since Modbus is a master/slave protocol, that means only one node is a master and the others are slave node. EL7 AC servo uses the standard RS-485 physical layer, up to 31 servo drives can be connected to one master station.

## A.1 Wiring (CN4&CN5)

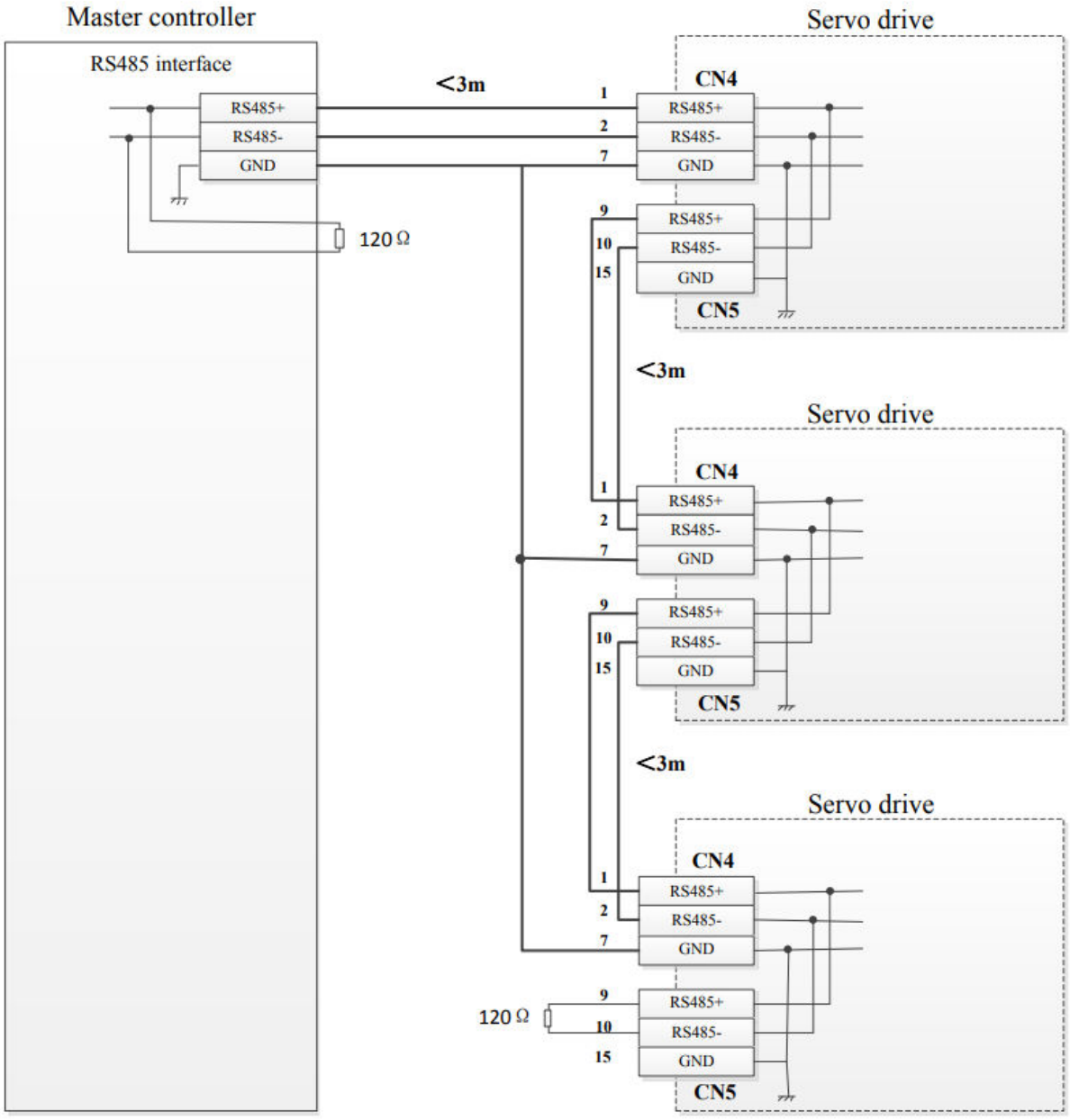
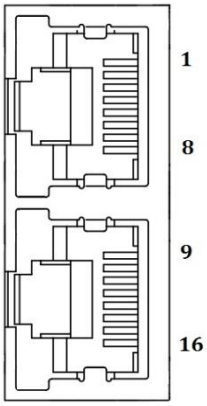



Figure: Multi-drive network connection

Pin layout of connector

| Port | RJ45 | Pin | Signal |
|---|---|---|---|
| CN4<br>CN5 |  | 1，9 | RDO+(RS485+) |
| | | 2，10 | RDO-(RS485-) |
| | | 3，11 | |
| | | 4，12 | |
| | | 5，13 | |
| | | 6，14 | |
| | | 7，15 | GND |
| | | 8，16 | / |
| | | | PE |

Note:

（1）The shorter the connection between each node is the better. The recommend connection should no more than 3m;

（2）Connect one terminal resistor to each end of the node. The recommended resistance value is 120 ohms;

（3）Shielded twisted pair is recommended for RS485 communication wirings;

（4）Connect GND is essential for communication;

（5）When using the shield wire, the two ends of the shield should connect PE, not GND, otherwise the port will be damaged;

（6）In order to reduce interference, RS485 communication cables should installed separately from other cables;

# A.2 Communication Parameters Setting

Communication specifications

| | |
|---|---|
| **Protocol** | Modbus-RTU |
| **Physical layer** | RS485(1:N, Max 31 axis) |
| **Baud rate** | 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps |
| **Data** | 8bit |
| **Parity** | None, even, odd |
| **Start bit** | 1bit |
| **Stop bit** | 1, 2bit |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pr5.29＊** | Name | Modbus communication setting | | | Mode | **P** | **V** | **T** |
| | Range | 0~255 | Unit | — | Default | 5 | | |
| | Data length | 16bit | Access | R/W | Address | 053BH | | |
| | Effective | Power-on again | | | | | | |

| Setup Value | Data bit | Parity-check | Stop bit |
|---|---|---|---|
| 0 | 8 | Even Parity | 2 |
| 1 | 8 | Odd Parity | 2 |
| 2 | 8 | Even Parity | 1 |
| 3 | 8 | Odd Parity | 1 |
| 4 | 8 | None | 1 |
| 5 | 8 | None | 2 |

| Pr5.30＊ | Name | Baud rate setup of Modbus communication | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~6 | Unit | — | Default | 2 | | |
| | Data length | 16bit | Access | R/W | Address | 053DH | | |
| | Effective | Power-on again | | | | | | |

Set up the communication baud rate of RS485.

| Setup value | Baud rate | Setup value | Baud rate |
|---|---|---|---|
| 0 | 2400bps | 4 | 38400bps |
| 1 | 4800bps | 5 | 57600bps |
| 2 | 9600bps | 6 | 115200bps |
| 3 | 19200bps | | |

| Pr5.31＊ | Name | slave axis ID | | | Mode | P | V | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 1~31 | Unit | — | Default | 1 | | |
| | Data length | 16bit | Access | R/W | Address | 053FH | | |
| | Effective | Power-on again | | | | | | |

During communication with the host (e.g. PC) to control multiple drives, the ID being accessed by the host should be unique identified.

Note: when using ~~RS232/~~RS485, the maximum valid value is 31.

# A.3 Modbus Transmission Protocol

## A.3.1 Message Types

Communications are configured as the single master and multiple slaves method. The drive operates as a slave.

The messages sent/received between the master and drive are classified into two types below:

- Send: Messages transferred from the master to the drive.
- Receive: Messages transferred from the drive to the master.

## A.3.2 Function Codes (FC)

The three types of FC below are supported:

| Category | FC | Function |
|---|---|---|
| Data manipulation | 03h (3) | Read out various register |
| | 06h (6) | Write in single register |
| | 10h (16) | Write in various register |

- **FC 03h(Read out various register)**

The function code of read out various register is 0x03. Now take slave ID 1, read 2 register as an example：(H is 8bit high for 16bit, L is 8bit low for 16bit)

| NO | Send frame | | | | Receive frame | | |
|---|---|---|---|---|---|---|---|
| 1 | **ID** | Slave ID | 0x01 | | **ID** | Slave ID | 0x01 |
| 2 | **FC** | Function code | 0x03 | | **FC** | Function code | 0x03 |
| 3 | **ADDR** | Address | H | | **NUM** | Data quantity （Byte） | 0x00(H) |
| 4 | | | L | | | | 0x04(L) |
| 5 | **NUM** | Data quantity (Word) | 0x00(H) | | **DATA1** | Data1 | H |
| 6 | | | 0x02(L) | | | | L |
| 7 | **CRC** | Check code | L | | **DATA2** | Data2 | H |
| 8 | | | H | | | | L |
| 9 | | | | | **CRC** | Check code | L |
| 10 | | | | | | | H |

**Notes：** The number of receive data is twice the number of send data quantity.
1word=2bytes=16bits

The communication data is shown as below：

[Send frame] 01 03 00 04 00 02 85 CA

[Receive frame] 01 03 04 00 00 00 02 7B F2

**Send frame：** The sent frame represents that the master reads the data from slave ID 1, the starting address is 0x0004, the length is 2 Word (16bit). The CRC check code is 0xCA85.

**Receive frame：** The receive frame represents that the receive data is 4 byte (8bit) and the data is 00 00 00 02. The CRC check code is 0xF27B.

- **FC 06h(Write in single register)**

The function code of write in single register is 0x06. Now take slave ID 1, write 1 register as an example：(H is 8bit high for 16bit; L is 8bit low for 16bit)

| NO | Send frame | | | | Receive frame | | |
|---|---|---|---|---|---|---|---|
| 1 | **ID** | Slave ID | 0x01 | | **ID** | Slave ID | 0x01 |
| 2 | **FC** | Function code | 0x06 | | **FC** | Function code | 0x06 |
| 3 | **ADDR** | Address | H | | **ADDR** | Address | H |
| 4 | | | L | | | | L |
| 5 | **DATA** | Data quantity (Word) | H | | **DATA** | Actually written data quantity | H |
| 6 | | | L | | | | L |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | **CRC** | Check code | L | | **CRC** | Check code | L |
| 8 | | | H | | | | H |

**Notes：** The number of receive frame is the same as the send frame.

1word=2bytes=16bits

The communication data is shown as below：

[Send frame] 01 06 00 04 00 02 49 CA

[Receive frame] 01 06 00 04 00 02 49 CA

**Send：** The send frame represents that the master write the data into slave ID 1, the starting address is 0x0004 , the length is 2 Word (16bit). The data is 0x0002. The CRC check code is 0xCA49.

**Receive：** The receive frame represents that write data into slave ID 1 finished successfully.

- **FC 10h(Write in various register)**

The function code of write various register is 0x10. In this case, 16 bits of multiple register are written. Now take slave ID 1, write 2 register as an example：(H is 8bit high for 16bit; L is 8bit low for 16bit)

| **NO** | **Send frame** | | | | **Receive frame** | | |
|---|---|---|---|---|---|---|---|
| 1 | **ID** | Slave ID | 0x01 | | **ID** | Slave ID | 0x01 |
| 2 | **FC** | Function code | 0x10 | | **FC** | Function code | 0x10 |
| 3 | **ADDR** | Address | H | | **ADDR** | Address | H |
| 4 | | | L | | | | L |
| 5 | **NUM1** | Data quantity (Word) | 0x00（H） | | **NUM** | Actually written data quantity | 0x00（H） |
| 6 | | | 0x02（L） | | | | 0x02（L） |
| 7 | **NUM2** | Data quantity (Byte) | 0x04 （2* NUM1） | | **CRC** | Check code | L |
| | | | | | | | H |
| 8 | **DATA1** | DATA1 | H | | | | |
| 9 | | | L | | | | |
| 10 | **DATA2** | DATA2 | H | | | | |
| 11 | | | L | | | | |
| 12 | **CRC** | Check code | L | | | | |
| 13 | | | H | | | | |

The communication data is shown as below：

[Send frame] 01 10 00 04 00 02 04 01 00 00 00 F3 A0

[Receive frame] 01 10 00 04 00 02 00 09

**Send frame：** The send frame represents that the master write the data into slave ID 1, the starting address is 0x0004, the length is 2 Word (16bit). The data is 0x01000 and 0x0000. The CRC check code is 0xA0F3.

**Receive frame：** The receive frame represents that write data into slave ID 1 finished successfully.

## A.3.3 Error Response

The drive return an error response if it has not succeeded the process specified by a sent frame. The message frame is as follows：

| **NO** | **Error response frame data（Slave-->Master）** | | |
|---|---|---|---|
| **1** | **ID** | Slave ID | 1~31 |

| | | | |
|---|---|---|---|
| **2** | **FC** | Function code | (0x03/0x06/0x10)+0x80 |
| **3** | **Error code** | Error code | 0x01/0x02/0x03/0x08 |
| **4** | **CRC** | Check code | L |
| **5** | | | H |

- **Function code(FC) filed**

  Error responses from slaves are returned as one is set on the MSB of the FC specified by the send frame.

| Function code (Send frame) | Function code (Error response) |
|---|---|
| 0x01 | 0x81 |
| 0x02 | 0x82 |
| 0x03 | 0x83 |
| 0x08 | 0x88 |

The error code and its meaning are as follows：

| Error code | Meaning |
|---|---|
| 0x01 | Incorrect FC (An incorrect FC is specified.) |
| 0x02 | Incorrect address (An incorrect address is specified) |
| 0x03 | Incorrect data (An abnormal value is specified in the information field.) such as write data exceeding the limit |
| 0x08 | CRC check error |

The communication data is shown as below：

[Send] 01 11 00 04 00 02 04 01 00 00 00 F3 A0

[Receive] 01 91 08 4C 56

**Receive：** CRC check error in the send data frame sent by the master station

[Send] 01 11 00 04 00 02 04 01 00 00 00 A2 65

[Receive] 01 91 01 8C 50

**Receive：** Function code error in the send data frame sent by the master station

# A.4 Communication Problems and Solutions

## A.4.1 Troubleshoot Steps

1. Whether the communication parameters are set correctly (Slave ID No. repetition, baud rate is set the same, data format is consistent).
2. Whether the terminal resistance connection is correct?
3. Whether the wiring is standard for anti-interference?
4. PE connection between ground and ground wire.
5. Whether the communication lines are installed separately from other wirings.

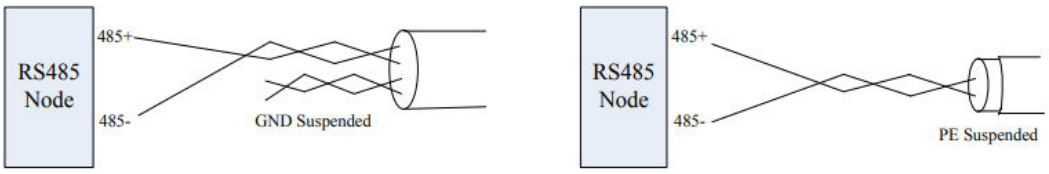
## A.4.2 Frequently Asked Questions

**1. Terminal resistance**

The correct connection of terminal resistance is shown in the above figure, terminal resistors need to be connected to the first and last section of the bus, recommended 120 Ohm resistor.

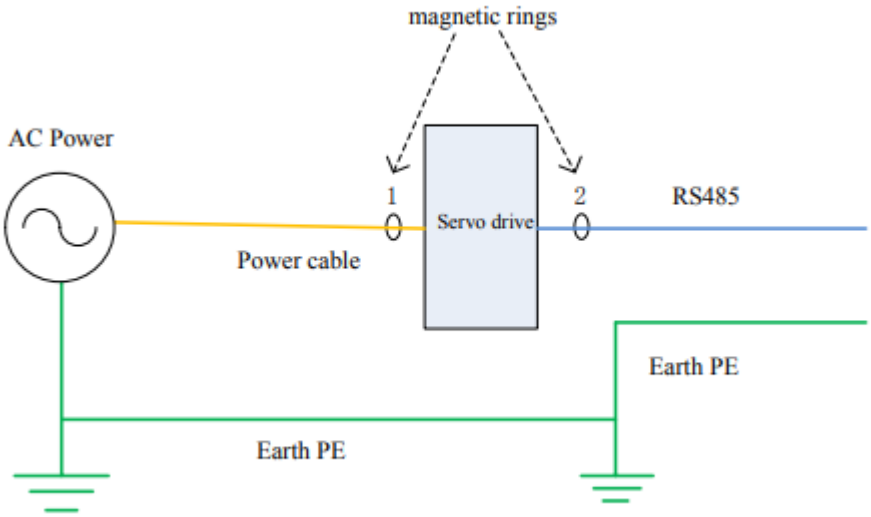
You can measure the resistance value at both ends of the RS485 with a multimeter, the normal value is approximately equal to 60 ohms. If it is much less than 60 ohms, the terminal resistance value is probably wrong. If it is equal to 0 ohms, the bus is short-circuited. If it is much greater than 60 ohms, it is possible that some node bus ports are damaged.

**2. Wiring error**

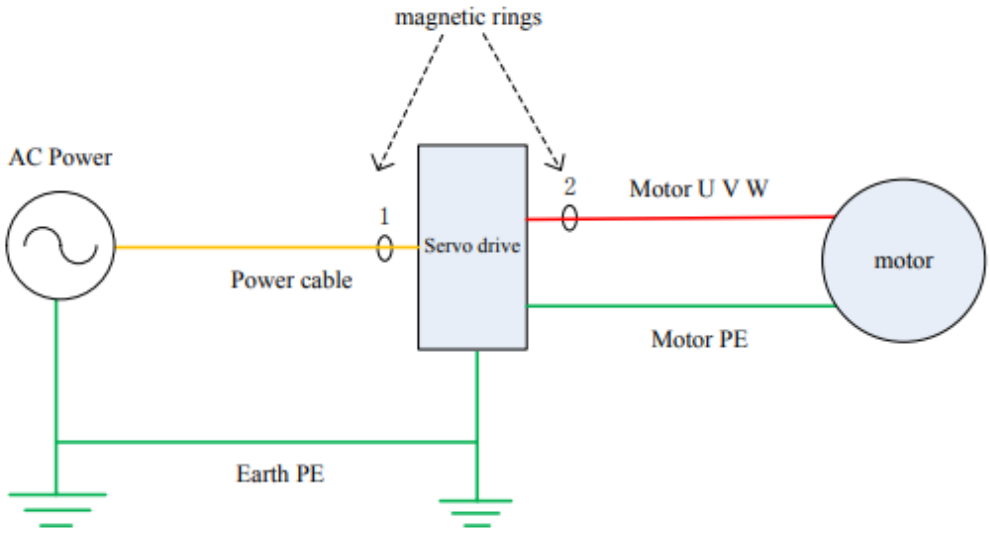



Firstly, confirm that the signal line of RS485 is connected correctly. Secondly, confirm whether the communication reference ground is connected correctly. If the node has no communication reference ground, it will be suspended, as shown in figure above. The shielding PE is connected the same way.

**3. Signal interference**




When there is an external interference signal in communication, magnetic rings can be placed at 1 and 2 in above figure to suppress the incoming external interference signal into the bus.




When there is an internal interference signal in communication, magnetic rings can be placed at 1 and 2 in above figure to suppress the incoming internal interference signal into the bus. Loop the UVW line around the magnetic ring three times. Be careful not to connect PE to the magnetic ring.

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