

# *User Manual Of ELP AC Servo*

Ver1.20



## Introduction

Thanks for purchasing Leadshine ELP-series AC servo drivers, this instruction manual provides knowledge and attention for using this driver.

Contact [tech@leadshine.com](mailto:tech@leadshine.com) if you need more technical service .

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







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

## Safety Items


ELP 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 touch hot heat sink when power on.    |
|  | Protective Earth                                       |

## Safety precautions

|  |
|--|
|  <b>Warning</b>   |
| <ul style="list-style-type: none"> <li>● The design and manufacture of product doesn't use in mechanic and system which have a threat to operator.</li> <li>● The safety protection must be provided in design and manufacture when using this product to prevent incorrect operation or abnormal accident.</li> </ul> |

## Acceptance

|   |
|---|
|  <b>Caution</b>                  |
| <ul style="list-style-type: none"> <li>● The product which is damaged or have fault is forbidden to use.</li> </ul> |

## 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.

## Installation

 **Caution*****Servo Driver 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 Driver:***

- 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.

## 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
- Ground the earth terminal of the motor and driver without fail.
- The wiring should be connected after servo driver and servo motor installed correctly
- After correctly connecting cables, insulate the live parts with insulator.

 **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.
- We mustn't connect capacitors ,inductors or filters between servo motor and servo driver .
- The wire and temperature-resistant object must not be close to radiator of servo driver and motor.
- The freewheel diode which connect in parallel to output signal DC relay mustn't connect reversely.

## Debugging and running

 **Caution**

- Make sure the servo driver 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.

## 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 driver 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.

## Fault Processing



### Warning

- The high voltage also will contain in several minutes even if the servo driver 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 driver is powered on again after momentary interruption(the design of the machine should be assured to avoid danger when restart occurs)

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## *ELP 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  | 6.2 Velocity control                              |
| 3  | Torque control                | Torque control parameter specification, guidance  | 6.3 Torque control                                |
| 4  | Encoder supported             | 5000lines、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  | 6.4 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   | 6.1.3 Position command filter                     |
| 10 | Acceleration and Deceleration | Set the speed command acceleration and deceleration   | 6.2.3 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  | 6.6 Third gain switching                          |
| 12 | Friction torque compensation  | The friction torque and gravity torque are compensated for the load.  | 6.7 Friction torque compensation                  |
| 13 | Alarm processing method       |   | 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                  |   | 8.9.2 Torque limit                                |
| 17 | Speed limit                   |   | 8.9.1 Speed limit                                 |
| 18 | Regenerative resister setting | Support internal brake resistance and external brake resistance, match the resistance through parameter setting   | 6.8 Regenerative resister setting                 |
| 19 | Driver Operating Data Monitor | Driver operating data monitor   | 7.2.2 Driver Operating Data Monitor               |
| 20 | Alarm and Processing          | A variety of alarm code output to protect the servo driver security   | Chapter 6 Alarm and Processing                    |
| 21 | Multi-turn absolute encoder   | The driver 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 2 Product Specification



### Notice

Servo driver must be matched with relevant servo motor, this manual describes Leadshine ELP series servo motor.

Contact [tech@leadshine.com](mailto:tech@leadshine.com) if you need more technical service.

## 2.1 Driver Technical Specification

Table 2.1 Driver Specification A

| Parameter               | ELP-*0400Z   | ELP-*0750Z                              | ELP-*1000Z | ELP-*1500Z | ELP-*2000Z |
|-------------------------|--|---|------------|------------|------------|
| Rated output power      | 400W   | 750W                                    | 1KW        | 1.5KW      | 2KW        |
| Rated output current    | 2  | 3.7                                     | 5          | 7.5        | 10.5       |
| Max output current      | 8.5  | 16                                      | 22         | 25         | 30         |
| Main power              | Single phase or three phase 220V -15%~+10% 50/60HZ   |   |            |            |            |
| Control power           | Single phase 220V -15%~+10%  |   |            |            |            |
| Control mode            | IGBT SVPWM sinusoidal wave control   |   |            |            |            |
| Feedback mode           | 17bit single-turn incremental encoder/23bit multi-turn absolute encoder  |   |            |            |            |
| Input pulse             | 0-500kHz, 5V differential input  |   |            |            |            |
| Adjust speed ratio      | 6000:1   |   |            |            |            |
| Position bandwidth      | 200HZ  |   |            |            |            |
| Electronic gear ratio   | 1~32767/1~32767  |   |            |            |            |
| Analog input            | -10~10Vdc, input resistance 20KΩ, no isolation (Only available for ELP-RS version)   |   |            |            |            |
| Velocity bandwidth      | 500HZ  |   |            |            |            |
| Input signal            | DI: 9 inputs (Support common + and common - two wiring modes)<br>Servo enable, over-travel inhibition, gain switching, command pulse inhibition, speed zero clamp, deviation counter clear, alarm clear  |   |            |            |            |
| Output signal           | DO: 6 outputs (4 single-ended, 2 differential)<br>Alarm output, servo-ready, at-speed, zero-detection, velocity coincidence  |   |            |            |            |
| Encoder signal output   | A phase, B phase, Z phase, long-distance drive mode output   |   |            |            |            |
| Alarm function          | Over-voltage, under-voltage, over-current, over-load, encoder error, position deviation error, brake alarm, limit alarm, over-speed 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, driver type version and address ID value etc.  |   |            |            |            |
| Debug software          | Can adjust the parameters of current loop, velocity loop, position loop, and change the value of input and output signals and the parameter of motor and save the values to the files which can be downloaded and uploaded, monitor the waveform of velocity and position in the ladder. |   |            |            |            |
| Communication interface | USB: Based on Modbus protocol (according to USB2.0 specification)<br>RS485   |   |            |            |            |
| Brake mode              | Built-in brake 50Ω/50W   |   |            |            |            |
| Adapt load inertia      | Less than 5 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 <sup>2</sup> MAX                |            |            |            |
|                         | Storage Temperature  | -20~80℃                                 |            |            |            |
|                         | Installation   | Vertical installation                   |            |            |            |

**Table 2.1 Driver Specification B**

| Servo drive series                      | ELP-D***Z   | ELP-RS***Z  | ELP-EC***Z   |
|---|---|---|--|
| <b>Control mode</b>                     | <ul style="list-style-type: none"> <li>● Position control</li> <li>● JOG</li> </ul> | <ul style="list-style-type: none"> <li>● Position control</li> <li>● Velocity control</li> <li>● Torque control</li> <li>● JOG</li> </ul> | <ul style="list-style-type: none"> <li>● CSP(Cyclic Synchronous Position)</li> <li>● CSV(Cyclic Synchronous Velocity)</li> <li>● CST(Cyclic Synchronous Torque)</li> <li>● PP(Profile Position)</li> <li>● PV(Profile Velocity)</li> <li>● PT(Profile Torque)</li> <li>● HM(Homing)</li> </ul> |
| <b>Encoder output</b>                   | 5V differential,0~500kHz<br>24Vsingle-ended,0~200kHz                                | 5V differential,0~500kHz<br>24Vsingle-ended,0~200kHz  | --   |
| <b>Digital input</b>                    | 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)   |
| <b>Digital output</b>                   | 6 outputs(4 single-ended, 2 differential)   |   |  |
| <b>Analog input</b>                     | --  | 2 analog input:-10~+10Vdc   | --   |
| <b>Network</b>                          | --  | Modbus RTU(RJ45)  | EtherCAT(RJ45)   |
| <b>Maximum frequency of pulse input</b> | 5V differential,0~500kHz<br>24Vsingle-ended,0~200kHz                                | 5V differential,0~500kHz<br>24Vsingle-ended,0~200kHz  | --   |

## 2.2 Accessory selection

1. motor cable  
CABLE-RZ3M0-S1(V3.0)
2. encoder cable  
CABLE-7BM3M0-Z(V3.0)
3. brake cable (if necessary)  
CABLE-SC3M0-S(V3.0)
4. software configuration cable  
CABLE-USB1M5
5. control signal terminal CN1 (44 pin)
6. control signal shell CN1

## Chapter 3 Installation

### 3.1 Storage and Installation Circumstance

**Table 3.1 Servo Driver, Servo Motor Storage Circumstance Requirement**

| Item                    | ELP series driver  | servo motor  |
|-------------------------|--|--|
| Temperature             | -20-80℃  | -25-70℃  |
| Humidity                | Under 90%RH (free from condensation)                                   | Under 80%RH(free from condensation)                                  |
| Atmospheric environment | Indoor(no exposure)no corrosive gas or flammable gas, no oil or dust   | Indoor(no exposure)no corrosive gas or flammable gas, no oil or dust |
| Altitude                | Lower than 1000m   | Lower than 2500m   |
| Vibration               | Less than 0.5G (4.9m/s <sup>2</sup> ) 10-60Hz (non-continuous working) |  |
| Protection level        | IP20(no protection)  | IP54 or IP65   |

**Table 3.2 Servo Driver, Servo Motor Installation Circumstance Requirement**

| Item                    | ELP series driver  | servo motor  |
|-------------------------|--|--|
| Temperature             | 0-55℃  | -25-40℃  |
| Humidity                | Under 90%RH(free from condensation)                                    | Under 90%RH(free from condensation)                                  |
| Atmospheric environment | Indoor(no exposure)no corrosive gas or flammable gas, no oil or dust   | Indoor(no exposure)no corrosive gas or flammable gas, no oil or dust |
| Altitude                | Lower than 1000m   | Lower than 2500m   |
| Vibration               | Less than 0.5G (4.9m/s <sup>2</sup> ) 10-60Hz (non-continuous working) |  |
| Protection level        | IP20(no protection)  | IP54 or IP65   |

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### 3.2 Servo Driver Installation

#### Notice

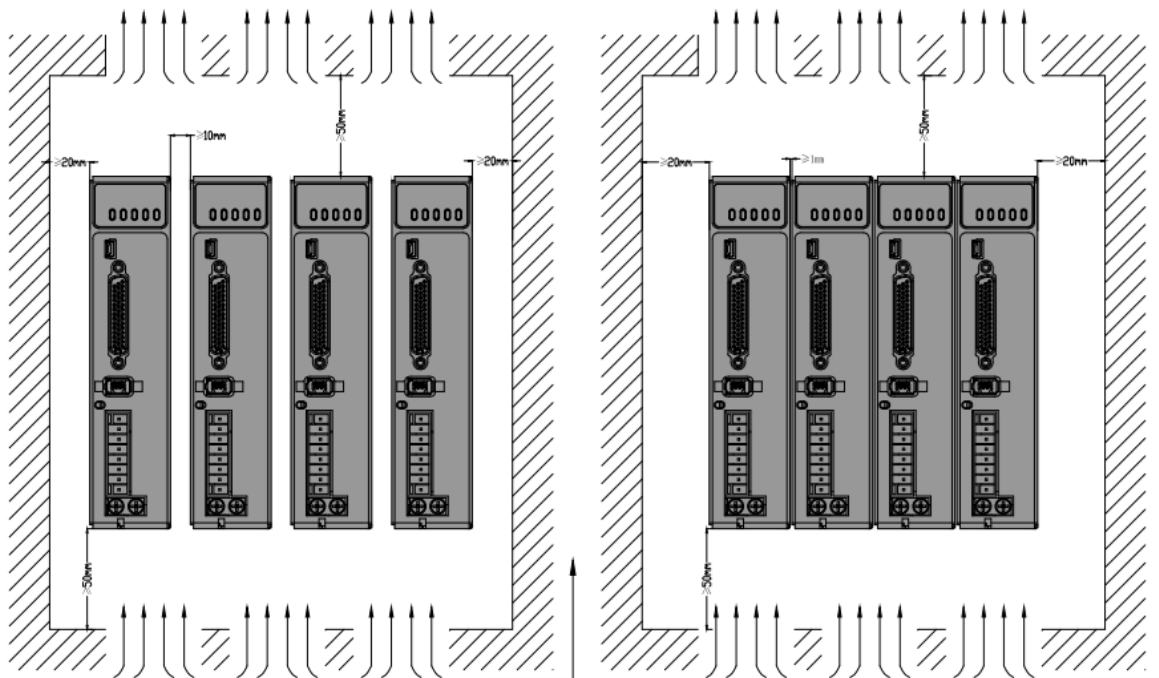
- Must install in control cabinet with sufficient safeguarding grade.
- Must install with specified direction and intervals, and ensure good cooling condition.
- Don't install them on inflammable substance or near it to prevent fire hazard.

Install in vertical position ,and reserve enough space around the servo driver for ventilation.

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.

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

Here is the installation diagram:



### 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.
- Install must be steady, prevent drop from vibrating.

## Chapter 4 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 five minutes.



### Caution

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

Contact [tech@leadshine.com](mailto:tech@leadshine.com) if you need more technical service .

## 4.1 Wiring

### 4.1.1 Wire Gauge

(1) Power supply terminal TB

- Diameter:

**Table 4.1 Power wiring specification**

| Driver     | Wire diameter (mm <sup>2</sup> /AWG) |           |           |           |
|------------|--------------------------------------|-----------|-----------|-----------|
|            | L1.L2.L3                             | P+,BR     | U.V.W     | PE        |
| ELP-*0400Z | 0.81/AWG18                           | 2.1/AWG14 | 1.3/AWG16 | 2.1/AWG14 |
| ELP-*0750Z | 0.81/AWG18                           | 2.1/AWG14 | 1.3/AWG16 | 2.1/AWG14 |
| ELP-*1000Z | 0.81/AWG18                           | 2.1/AWG14 | 2.1/AWG14 | 2.1/AWG14 |
| ELP-*1500Z | 1.3/AWG16                            | 2.6/AWG13 | 2.6/AWG13 | 2.6/AWG13 |
| ELP-*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 driver.
- Install fuse (NFB) promptly to cut off the external power supply if driver error occurs.

(2) The control signal CN1 feedback signal CN2

- Diameter: shielded cable (twisting shield cable is better), the diameter  $\geq 0.14\text{mm}^2$  (AWG24-26), the shield should be connected to FG terminal.
- Length of line: cable length should be as short as possible and control CN1 cable is no more than 3 meters, the CN2 cable length of the feedback signal is no more than 20 meters.
- Wiring: be 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 resistor

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 driver. At this time, the energy feedback is first received by the capacitor in the driver, 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

The recommended regenerative resistance specifications for the ELP series are as follows:

**Table 4.2 Regenerative resistance specification sheet**

| Driver     | Built-in resistor value ( $\Omega$ ) | Built-in resistor power (W) |
|------------|--------------------------------------|-----------------------------|
| ELP-*0400Z | 100                                  | 50                          |
| ELP-*0750Z | 50                                   | 50                          |
| ELP-*1000Z | 50                                   | 100                         |
| ELP-*1500Z | 50                                   | 100                         |
| ELP-*2000Z | 50                                   | 100                         |

Method for determining regenerative resistance specification

- Firstly, use the built-in resistance of the driver to run for a long time to see if it can meet the requirements: ensure that the driver temperature  $d33 < 60^{\circ}\text{C}$ , the braking circuit does not alarm (Regeneration load factor  $d14 < 80$ ), and the driver does not report overvoltage error
- If the driver temperature is high, try to reduce the regenerative energy power, or external resistance of the same specification (in this case, cancel the built-in resistance).
- If the brake resistance burns out, try to reduce the regenerative energy power, or put an external resistance of the same specification or even more power (in this case, cancel the built-in resistance).
- If  $d14$  is too large or accumulates too fast, it means that the regenerative energy is too large, and the built-in resistance cannot consume the generated energy, the regenerative energy power will be reduced, or the external resistance with higher resistance value or power will be reduced.
- If an overvoltage error is reported by the driver, the regenerative energy power is reduced, or a resistance with a smaller external resistance, or a parallel resistance.



### 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

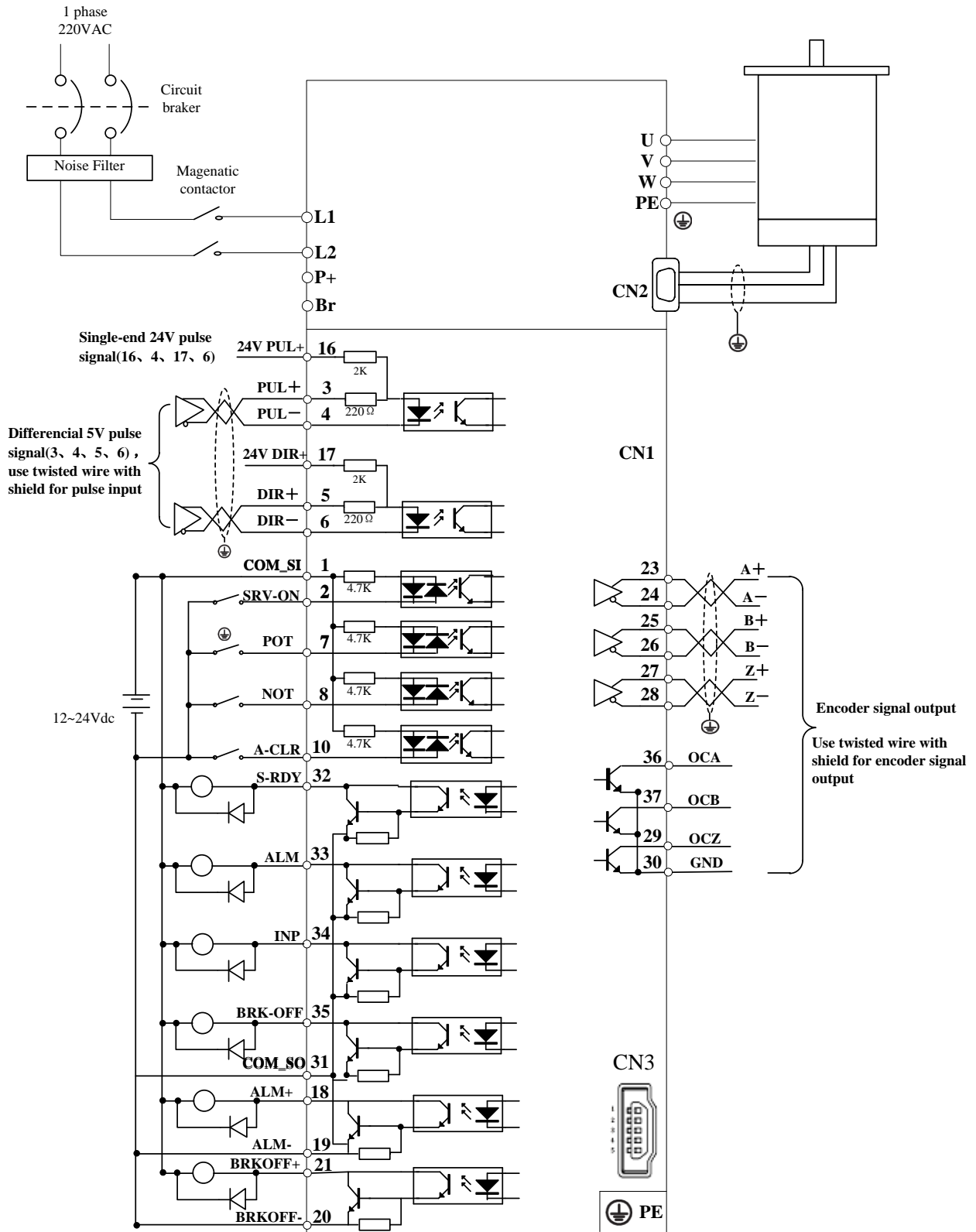


Figure 4-1 Positional Control Mode Wiring

Note:

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

### 4.1.3 Torque /Velocity Control Mode

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

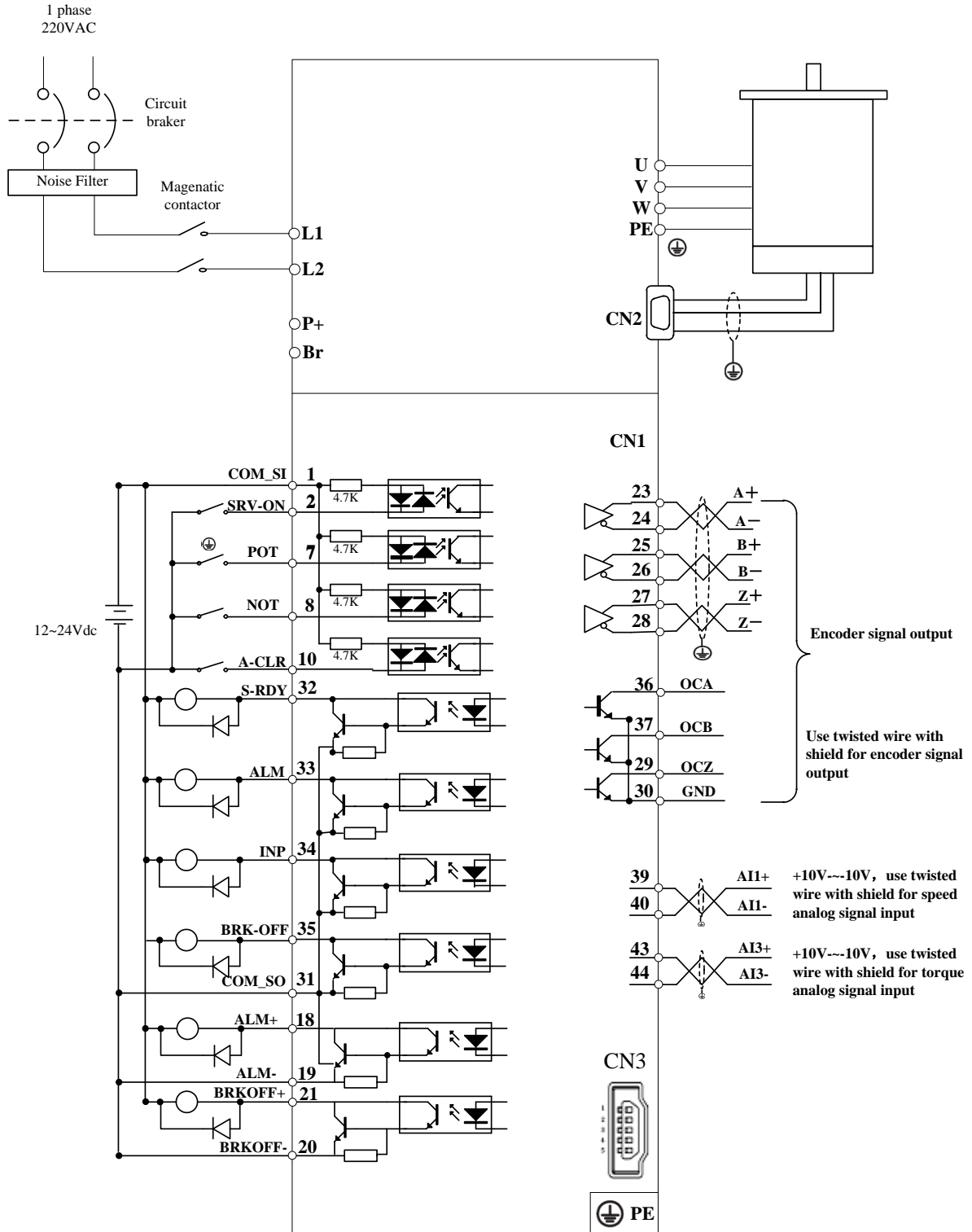


Figure 4-2 Torque/Velocity Control Mode Wiring

**Note:**

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

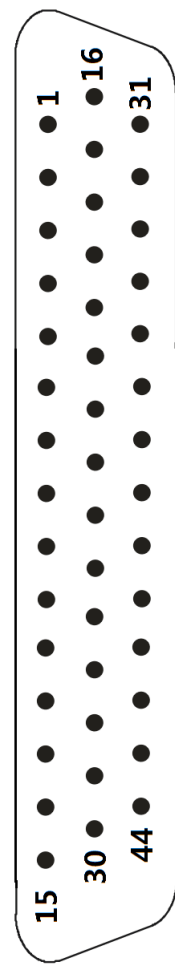
## 4.2 Driver Terminals Function

**Table 4.3 Functions of driver port**

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

### 4.2.1 Control Signal Port-CN1 Terminal

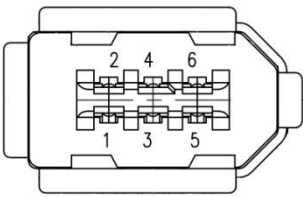
**Table 4.4 Signal Explanation of Control Signal Port-CN1**

| Port |  | Pin    | Signal                                  | I/O    | Name  | Explanation  |   |
|------|--|--------|---|--------|---|--|---|
| CN1  |  | 1      | COM_SI                                  | input  | Digital input common terminal, Com+/Com-, 12VDC~24VDC | Two-way digital input with common terminal, function can be configured. 12VDC ~ 24VDC  |   |
|      |  | 2      | SI1                                     | input  | Digital input 1                                       |  |   |
|      |  | 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                                       | Low resistor output in default . OC, the maximum voltage/current is no more than 30V, 50mA . Recommend the voltage : 12 V-24V. Current :10mA |   |
|      |  | 31     | COM_SO                                  | output | Digital output common- terminal                       |  |   |
|      |  | 33     | SO1 +                                   | output | Digital output 1                                      |  |   |
|      |  | 32     | SO2 +                                   | output | Digital output 2                                      |  |   |
|      |  | 34     | SO3 +                                   | output | Digital output 3                                      | Differential Digital output , the maximum voltage/current is no more than 30V/50mA . Recommended voltage : 12 -24V. Current :10mA            |   |
|      |  | 35     | SO4 +                                   | output | Digital output 4                                      |  |   |
|      |  | 18     | SO5 +                                   | output | Differential Digital output 5                         | Differential Digital output 5  | Differential output, High >= 2.5vdc, low <= 0.5vdc, maximum current ±20mA |
|      |  | 19     | SO5-                                    | output |   |  |   |
|      |  | 20     | SO6-                                    | output | Differential Digital output 6                         | Differential Digital output 6  |   |
|      |  | 21     | SO6 +                                   | output |   |  |   |
|      |  | 23     | A +                                     | output | Differential output terminal of motor encoder A phase | Differential output terminal of motor encoder A phase  | Differential output, High >= 2.5vdc, low <= 0.5vdc, maximum current ±20mA |
|      |  | 24     | A -                                     | output |   |  |   |
|      |  | 25     | B +                                     | output | Differential output terminal of motor encoder B phase | Differential output terminal of motor encoder B phase  |   |
|      |  | 26     | B -                                     | output |   |  |   |
|      |  | 27     | Z +                                     | output | Differential output terminal of motor encoder Z phase | Differential output terminal of motor encoder Z phase  |   |
|      |  | 28     | Z -                                     | output |   |  |   |
|      |  | 36     | OCA                                     | output | OC output terminal of motor encoder A phase           |  |   |
|      |  | 37     | OCB                                     | output | OC output terminal of motor encoder B phase           |  |   |
|      |  | 29     | OCZ                                     | output | OC output terminal of motor encoder Z phase           |  |   |
| 30   | GND  | output | OC output GND terminal of motor encoder |        |   |  |   |
| 3    | PUL +  | input  | Pulse input ,                           |        |   |  |   |
| 4    | PUL -  | input  | PUL+ and PUL- : 5V differential input   |        |   |  |   |

|       |                    |           |               |   |
|-------|--------------------|-----------|---------------|---|
|       | 16                 | PUL + _24 | input         | PUL+_24 and PUL- : 24V differential input   |
|       | 5                  | DIR +     | input         | Direction input ,<br>DIR+ and DIR- : 5V differential input  |
|       | 6                  | DIR -     | input         |   |
|       | 17                 | DIR + _24 | input         | DIR+_24 and DIR- : 24V differential input   |
|       | 39                 | A11+      | input         | Analog input 1, voltage input range : -10VDC~+10VDC , input resistor 20KΩ. <b>Mainly for velocity mode (Analog input)</b> |
|       | 40                 | A11-      | input         |   |
|       | 41                 | AGND      | input         |   |
|       | 43                 | AI3 +     | input         | Analog input 3, voltage input range : -10VDC~+10VDC , input resistor 20KΩ. <b>Mainly for torque mode (Analog input)</b>   |
|       | 44                 | AI3 -     | input         |   |
|       | 15.22.38.<br>40.42 | NC        | /             | Not connection  |
| Shell | FG                 |           | Shield ground |   |

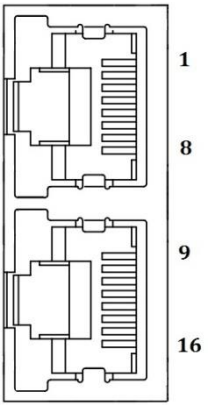
### 4.2.2 Encoder Input Port-CN2 Terminal

**Table 4.5 Encoder Input Port-CN2 Terminal Signal Explain**

| Port |  | Pin | Signal |
|------|--|-----|--------|
| CN2  |  | 1   | VCC5V  |
|      |  | 2   | GND    |
|      |  | 3   | BAT+   |
|      |  | 4   | BAT-   |
|      |  | 5   | SD+    |
|      |  | 6   | SD-    |
|      |  |     | PE     |

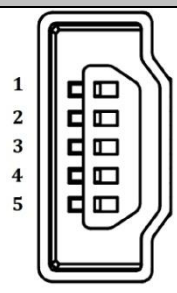
### 4.2.3 RS232/RS48 Communication Port

**Table 4.6 signal explanation of driver interconnection interface-CN4 CN5**

| Port       |   | Pin    | Signal      |
|------------|---|--------|-------------|
| CN4<br>CN5 |  | 1 , 9  | RDO+(RS485) |
|            |   | 2 , 10 | RDO-(RS485) |
|            |   | 3 , 11 | /           |
|            |   | 4 , 12 | TXD(RS232)  |
|            |   | 5 , 13 | RXD(RS232)  |
|            |   | 6 , 14 | VCC5V       |
|            |   | 7 , 15 | GND         |
|            |   | 8 , 16 | /           |
|            |   | PE     |             |

## 4.2.4 USB Communication Port

**Table 4.7 USB Communication Port –CN3**

| Port |   | Pin | Signal  |
|------|---|-----|---------|
| CN3  |  | 1   | VCC5V   |
|      |   | 2   | D+      |
|      |   | 3   | D-      |
|      |   | 4   |         |
|      |   | 5   | GND     |
|      |   |     | USB_GND |

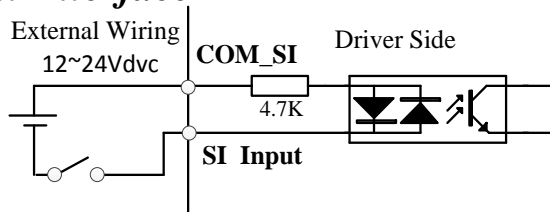
## 4.2.5 Power Port

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

| Port    | Pin   | Signal                                  | Detail  |        |                       |             |         |           |     |
|---------|---|---|---|--------|-----------------------|-------------|---------|-----------|-----|
| X1      | L1  | For single phase 220V                   | For single phase 220V , +15 ~ -15% , 50/60Hz                              |        |                       |             |         |           |     |
|         | L2  | For single phase 220V                   |   |        |                       |             |         |           |     |
| 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 driver fails. |   |   |        |                       |             |         |           |     |
| Port    | Pin   | Signal                                  | Detail  |        |                       |             |         |           |     |
| X1      | P +   | Dc bus + terminal                       | ① Driver 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 : <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Driver</th> <th>Resistor ( <math>\Omega</math> )</th> <th>Power ( W )</th> </tr> </thead> <tbody> <tr> <td>ELP-400</td> <td><math>\geq 40</math></td> <td>100</td> </tr> </tbody> </table>                             |   |   | Driver | Resistor ( $\Omega$ ) | Power ( W ) | ELP-400 | $\geq 40$ | 100 |
| Driver  | Resistor ( $\Omega$ )   | Power ( W )                             |   |        |                       |             |         |           |     |
| ELP-400 | $\geq 40$   | 100                                     |   |        |                       |             |         |           |     |
| Port    | Pin   | Signal                                  | Detail  |        |                       |             |         |           |     |
| X1      | U   | U                                       | 3 phase motor power input   |        |                       |             |         |           |     |
|         | V   | V                                       |   |        |                       |             |         |           |     |
|         | W   | W                                       |   |        |                       |             |         |           |     |
|         | PE  | PE                                      | Frame ground  |        |                       |             |         |           |     |
| Notes   | ① Connect the driver to the ground end (PE) of the motor and connect it to the earth  |   |   |        |                       |             |         |           |     |

## 4.3 I/O Interface Principle

### 4.3.1 Switch Input Interface



**Figure 4-3 Switch Input Interface**

1. The user provide power supply, DC 12-24V, current $\geq$ 100mA
2. **Notice:** if current polar connect reversely, servo driver doesn't run.

| Pr4.00* | Input selection SI1 | Range       | unit | default | Related control mode |   |   |
|---------|---------------------|-------------|------|---------|----------------------|---|---|
|         |                     | 0-00FFFFFFh | -    |         |                      | P | S |
| Pr4.01* | Input selection SI2 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.02* | Input selection SI3 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.03* | Input selection SI4 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.04* | Input selection SI5 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.05* | Input selection SI6 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.06* | Input selection SI7 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.07* | Input selection SI8 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.08* | Input selection SI9 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |

S Set SI1 input function allocation.

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

00- - - \* \* h: position control

00- \* \* - - h: velocity control

00\* \* - - - h: torque control

Please at [\*\*] partition set up function number

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

| Signal name                                     | symbol | Set value |              |
|---|--------|-----------|--------------|
|   |        | a-contact | b- contact   |
| Invalid   | -      | 00h       | Do not setup |
| Positive direction over-travel inhibition input | POT    | 01h       | 81h          |
| negative direction over-travel inhibition input | 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:

1. a-contact means input signal comes from external controller or component ,for example: PLC .
2. b-contact means input signal comes from driver internally.
3. Don't setup to a value other than that specified in the table .
4. 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** related input setup as below:

| Signal name             | symbol | Input       |              |
|-------------------------|--------|-------------|--------------|
|                         |        | Normal open | Normal close |
| 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          |
| Forward limit           | PL     | 25h         | A5h          |
| Reverse limit           | 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          |

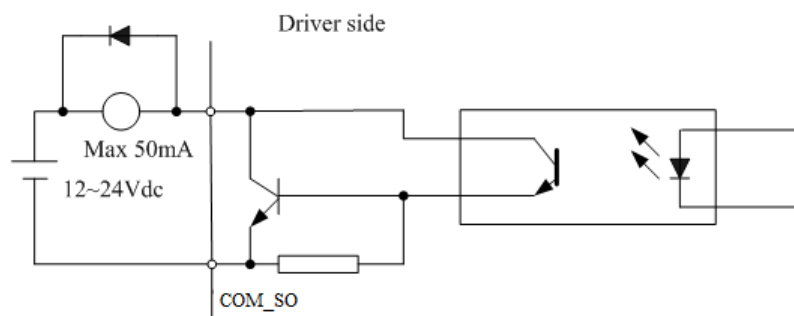
NOTE: CTRG,HOME is edge triggered, but the valid level must be last more than 1ms.

I/O input digital filtering

|                |                    |       |       |         |                      |   |   |
|----------------|--------------------|-------|-------|---------|----------------------|---|---|
| <b>Pr5.15*</b> | I/F reading filter | Range | unit  | default | Related control mode |   |   |
|                |                    | 0-255 | 0.1ms | 0       | P                    | S | T |

I/O input digital filtering; higher setup will arise control delay.

### 4.3.2 Switch Output Interface



**Figure 4.4 Switch Output Interface**

- (1) The user provide the external power supply . However, if current polarity connects reversely, servo driver 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* | Output selection SO1 | Range       | unit | default | Related control mode |   |   |
|---------|----------------------|-------------|------|---------|----------------------|---|---|
|         |                      | 0-00FFFFFFh | -    |         |                      | P | S |
| Pr4.11* | Output selection SO2 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.12* | Output selection SO3 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.13* | Output selection SO4 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.14* | Output selection SO5 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh |      |         | P                    | S | T |
| Pr4.15* | Output selection SO6 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh |      |         | P                    | S | T |

Assign functions to SO1 outputs.

This parameter use 16 binary system do setup, as following :

00- - - \* \* h: position control

00- - \* \* - - h: velocity control

00\* \* - - - h: torque control

Please at [\*\*] partition set up function number.

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 related output setup as below;

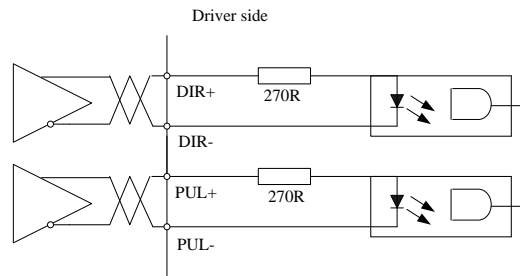
| output                |         |             |              |
|-----------------------|---------|-------------|--------------|
| Signal name           | symbol  | Set value   |              |
|                       |         | Normal open | Normal close |
| Command complete      | CMD-OK  | 20h         | 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.

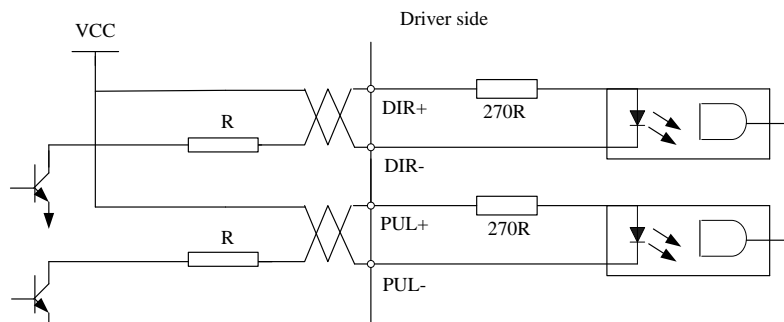
MC-OK indicates command complete and the motor in-position.

\*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)**



$V_{cc} = 12V, R = 1K, 0.25W; \quad V_{cc} = 24V, R = 2K, 0.25W$

**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:**

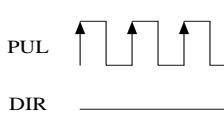
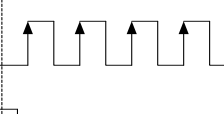
$V_{CC} = 24V, R = 1.3 \text{ to } 2K\Omega;$

$V_{CC} = 12V, R = 510 \sim 820\Omega;$

$V_{CC} = 5V, R = 82 \sim 120\Omega.$

- (4) The user provide external power supply for single-ended drive. However, if current polarity connect reversely, servo driver is damaged.
- (5) The form of pulse input is the following form 3.7 below, while the arrows 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 3.8 below. The 4 times pulse frequency  $\leq 500kHz$  if 2-phase input form is used.

**Table 4.10 the parameters of pulse input time sequence**

| parameter | Differential drive input | Single-ended drive input |
|-----------|--------------------------|--------------------------|
| $t_{ck}$  | $> 2\mu s$               | $> 5\mu s$               |
| $t_h$     | $> 1\mu s$               | $> 2.5\mu s$             |
| $t_l$     | $> 1\mu s$               | $> 2.5\mu s$             |
| $t_{rh}$  | $< 0.2\mu s$             | $< 0.3\mu s$             |
| $t_{rl}$  | $< 0.2\mu s$             | $< 0.3\mu s$             |

|           |              |              |
|-----------|--------------|--------------|
| $t_s$     | $> 1\mu s$   | $> 2.5\mu s$ |
| $t_{qck}$ | $> 8\mu s$   | $> 10\mu s$  |
| $t_{qhh}$ | $> 4\mu s$   | $> 5\mu s$   |
| $t_{qhl}$ | $> 4\mu s$   | $> 5\mu s$   |
| $t_{qrh}$ | $< 0.2\mu s$ | $< 0.3\mu s$ |
| $t_{qrl}$ | $< 0.2\mu s$ | $< 0.3\mu s$ |
| $t_{qs}$  | $> 1\mu s$   | $> 2.5\mu s$ |

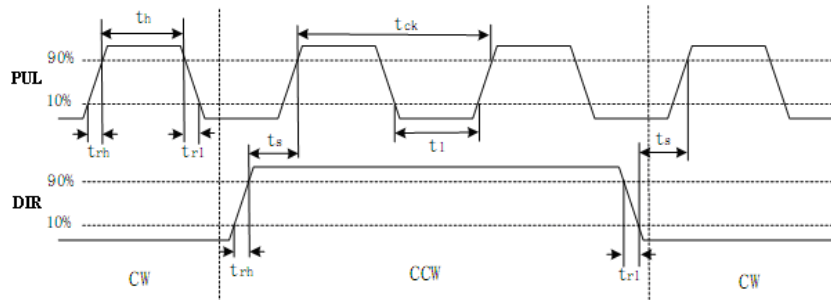
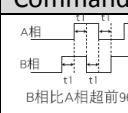
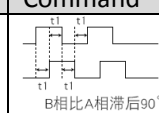
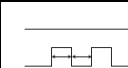
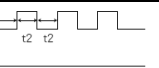
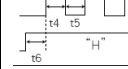


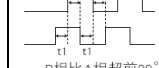
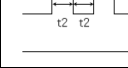
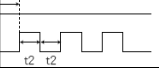

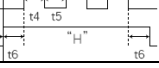


Figure 4.6 pulse + direction input interface timing (the maximum of pulse frequency : 500KHZ)

|         |  |       |      |         |                      |  |
|---------|--|-------|------|---------|----------------------|--|
| Pr0.06* | Command Pulse Rotational Direction Setup | Range | unit | default | Related control mode |  |
|         |  | 0-1   | -    | 0       | P                    |  |

Set command pulse input rotate direction, command pulse input type

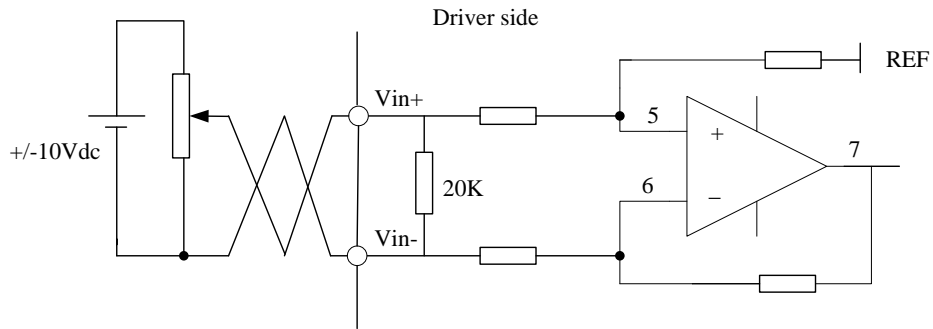
|         |                                |       |      |         |                      |  |
|---------|--------------------------------|-------|------|---------|----------------------|--|
| Pr0.07* | Command Pulse Input Mode Setup | Range | unit | default | Related control mode |  |
|         |                                | 0-3   | -    | 3       | P                    |  |

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

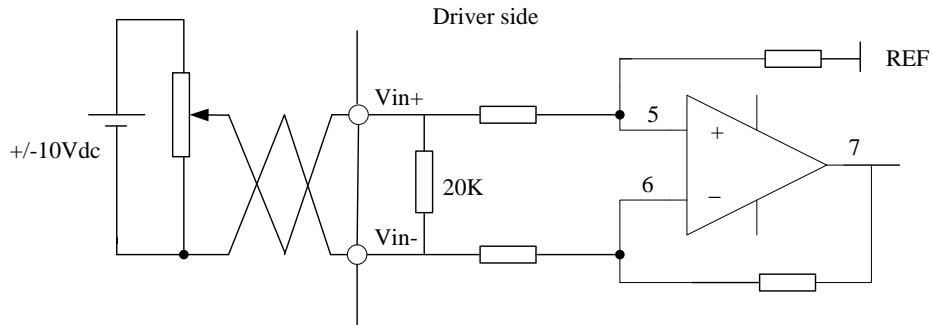
Command pulse input signal allow largest frequency and smallest time width

| 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

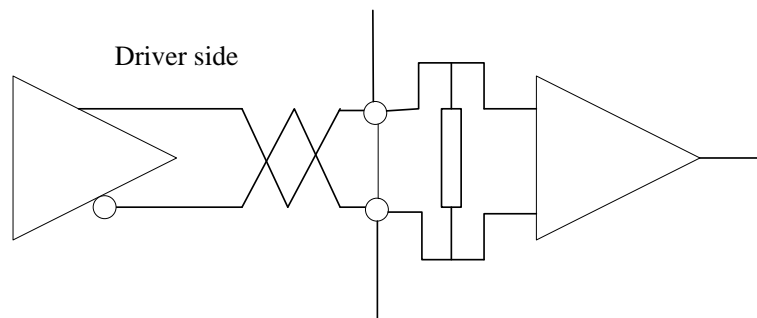


**Figure 4-7 Analog AI1 Input Interface**



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

### 4.3.5 Servo Motor Encoder Input Interface



**Figure 4-9 Servo Motor optical-electrical Encoder Input Interface**

## Chapter 5 Parameter

### 5.1 Parameter List

Notes: The parameters like PA\_001\*, which contain '\*' means that the new value of this parameters will valid after power is restarted !

| Mode |   |   | Parameter Number                |   | Name   | Panel Display |
|------|---|---|---------------------------------|---|--|---------------|
| P    | S | T | Classify                        | Number                                      |  |               |
| P    | S | T | 【Class 0】<br>Basic setting      | 00  | MFC function   | PA_000        |
| P    | S | T |                                 | 01  | control mode setup   | PA_001*       |
| P    | S | T |                                 | 02  | real-time auto-gain tuning                                   | PA_002        |
| P    | S | T |                                 | 03  | selection of machine stiffness at real-time auto-gain tuning | PA_003        |
| P    | S | T |                                 | 04  | Inertia ratio  | PA_004        |
| P    |   |   |                                 | 06  | command pulse rotational direction setup                     | PA_006*       |
| P    |   |   |                                 | 07  | command pulse input mode setup                               | PA_007*       |
|      |   |   |                                 | 08  | Command pulse per one motor revolution                       | PA_008*       |
| P    |   |   |                                 | 09  | 1st numerator of electronic gear                             | PA_009        |
| P    |   |   |                                 | 10  | denominator of electronic gear                               | PA_010        |
| P    | S | T |                                 | 11  | output pulse counts per one motor revolution                 | PA_011*       |
| P    | S | T |                                 | 12  | reversal of pulse output logic                               | PA_012*       |
| P    | S | T |                                 | 13  | 1st torque limit   | PA_013        |
| P    |   |   |                                 | 14  | position deviation excess setup                              | PA_014        |
| P    | S | T |                                 | 15  | Absolute encoder setup                                       | PA_015        |
| P    | S | T |                                 | 16  | External regenerative discharge resistor setup               | PA_016*       |
| P    | S | T |                                 | 17  | External regenerative discharge power value                  | PA_017*       |
| P    |   |   | 【Class 1】<br>Gain Adjust        | 00  | 1st gain of position loop                                    | PA_100        |
| P    | S | T |                                 | 01  | 1st gain of velocity loop                                    | PA_101        |
| P    | S | T |                                 | 02  | 1st time constant of velocity loop integration               | PA_102        |
| P    | S | T |                                 | 03  | 1st filter of velocity detection                             | PA_103        |
| P    | S | T |                                 | 04  | 1st time constant of torque filter                           | PA_104        |
| P    |   |   |                                 | 05  | 2nd gain of position loop                                    | PA_105        |
| P    | S | T |                                 | 06  | 2nd gain of velocity loop                                    | PA_106        |
| P    | S | T |                                 | 07  | 2nd time constant of velocity loop integration               | PA_107        |
| P    | S | T |                                 | 08  | 2nd filter of velocity detection                             | PA_108        |
| P    | S | T |                                 | 09  | 2nd time constant of torque filter                           | PA_109        |
| P    |   |   |                                 | 10  | Velocity feed forward gain                                   | PA_110        |
| P    |   |   |                                 | 11  | Velocity feed forward filter                                 | PA_111        |
| P    | S |   |                                 | 12  | Torque feed forward gain                                     | PA_112        |
| P    | S |   |                                 | 13  | Torque feed forward filter                                   | PA_113        |
| P    | S | T |                                 | 14  | 2nd gain setup   | PA_114        |
| P    |   |   |                                 | 15  | Control switching mode                                       | PA_115        |
| P    |   |   |                                 | 17  | Control switching level                                      | PA_117        |
| P    |   |   | 18                              | Control switch hysteresis                   | PA_118   |               |
| P    |   |   | 19                              | Gain switching time                         | PA_119   |               |
| P    |   |   | 35                              | Positional command filter setup             | PA_135*  |               |
| P    | S | T | 36                              | Encoder feedback pulse digital filter setup | PA_136*  |               |
| P    | S | T | 37                              | Special register                            | PA_137   |               |
| P    | S |   | 【Class 2】<br>Vibration Restrain | 00  | adaptive filter mode setup                                   | PA_200        |
| P    | S | T |                                 | 01  | 1st notch frequency  | PA_201        |
| P    | S | T |                                 | 02  | 1st notch width selection                                    | PA_202        |

|   |   |   |                                     |  |  |  |
|---|---|---|-------------------------------------|--|--|--|
| P | S | T | Function                            | 03                                       | 1st notch depth selection                    | PA_203                                     |
| P | S | T |                                     | 04                                       | 2nd notch frequency                          | PA_204                                     |
| P | S | T |                                     | 05                                       | 2nd notch width selection                    | PA_205                                     |
| P | S | T |                                     | 06                                       | 2nd notch depth selection                    | PA_206                                     |
| P | S | T |                                     | 07                                       | 3rd notch frequency                          | PA_207                                     |
| P | S | T |                                     | 08                                       | 3rd notch width selection                    | PA_208                                     |
| P | S | T |                                     | 09                                       | 3rd notch depth selection                    | PA_209                                     |
| P |   |   |                                     | 14                                       | 1st damping frequency                        | PA_214                                     |
| P |   |   |                                     | 15                                       | 1st damping filter setup                     | PA_215                                     |
| P |   |   |                                     | 16                                       | 2nd damping frequency                        | PA_216                                     |
| P |   |   |                                     | 17                                       | 2nd damping filter setup                     | PA_217                                     |
| P |   |   |                                     | 22                                       | Positional command smooth filter             | PA_222*                                    |
| P |   |   |                                     | 23                                       | Positional command FIR filter                | PA_223*                                    |
|   | S |   |                                     | 【Class 3】<br>Speed,<br>Torque<br>Control | 00   | Velocity setup internal/external switching |
|   | S |   | 01                                  |  | Speed command rotational direction selection | PA_301                                     |
|   | S | T | 02                                  |  | Speed command input gain                     | PA_302                                     |
|   | S |   | 03                                  |  | Speed command reversal input                 | PA_303                                     |
|   | S |   | 04                                  |  | 1st speed setup                              | PA_304                                     |
|   | S |   | 05                                  |  | 2nd speed setup                              | PA_305                                     |
|   | S |   | 06                                  |  | 3rd speed setup                              | PA_306                                     |
|   | S |   | 07                                  |  | 4th speed setup                              | PA_307                                     |
|   | S |   | 08                                  |  | 5th speed setup                              | PA_308                                     |
|   | S |   | 09                                  |  | 6th speed setup                              | PA_309                                     |
|   | S |   | 10                                  |  | 7th speed setup                              | PA_310                                     |
|   | S |   | 11                                  |  | 8th speed setup                              | PA_311                                     |
|   | S |   | 12                                  |  | time setup acceleration                      | PA_312                                     |
|   | S |   | 13                                  |  | time setup deceleration                      | PA_313                                     |
|   | S |   | 14                                  |  | Sigmoid acceleration/deceleration time setup | PA_314*                                    |
|   |   |   | 15                                  |  | Speed zero-clamp function selection          | PA_315                                     |
|   | S | T | 16                                  |  | Speed zero-clamp level                       | PA_316                                     |
|   |   |   | 17                                  |  | Torque command selection                     | PA_317                                     |
|   |   | T | 18                                  |  | Torque command direction selection           | PA_318                                     |
|   |   | T | 19                                  |  | Torque command input gain                    | PA_319                                     |
|   |   | T | 20                                  |  | Torque command input reversal                | PA_320                                     |
|   |   | T | 21                                  |  | Speed limit value 1                          | PA_321                                     |
|   |   |   | 22                                  |  | 2nd torque limit                             | PA_322                                     |
| P | S | T |                                     |  | 24   | maximum speed of motor rotation            |
| P | S | T |                                     | 28                                       | Synchronous parameter setting of gantry      | PA_328                                     |
| P | S | T | 【Class 4】<br>I/F Monitor<br>Setting | 00                                       | input selection SI1                          | PA_400*                                    |
| P | S | T |                                     | 01                                       | input selection SI2                          | PA_401*                                    |
| P | S | T |                                     | 02                                       | input selection SI3                          | PA_402*                                    |
| P | S | T |                                     | 03                                       | input selection SI4                          | PA_403*                                    |
| P | S | T |                                     | 04                                       | input selection SI5                          | PA_404*                                    |
| P | S | T |                                     | 05                                       | input selection SI6                          | PA_405*                                    |
| P | S | T |                                     | 06                                       | input selection SI7                          | PA_406*                                    |
| P | S | T |                                     | 07                                       | input selection SI8                          | PA_407*                                    |
| P | S | T |                                     | 08                                       | input selection SI9                          | PA_408*                                    |
| P | S | T |                                     | 09                                       | input selection SI10                         | PA_409*                                    |
| P | S | T |                                     | 10                                       | output selection SO1                         | PA_410*                                    |
| P | S | T |                                     | 11                                       | output selection SO2                         | PA_411*                                    |
| P | S | T |                                     | 12                                       | output selection SO3                         | PA_412*                                    |
| P | S | T | 13                                  | output selection SO4                     | PA_413*                                      |  |

|   |   |   |   |    |   |         |
|---|---|---|---|----|---|---------|
| P | S | T |   | 14 | output selection SO5                        | PA_414* |
| P | S | T |   | 15 | output selection SO6                        | PA_415* |
|   | S | T |   | 22 | Analog input 1(AI 1) offset setup           | PA_422  |
|   | S | T |   | 23 | Analog input 1(AI 1) filter                 | PA_423  |
|   | S | T |   | 24 | Analog input 1(AI 1) over-voltage setup     | PA_424  |
|   | S | T |   | 28 | Analog input 3(AI 3) offset setup           | PA_428  |
|   | S | T |   | 29 | Analog input 3(AI 3) filter                 | PA_429  |
|   |   | T |   | 30 | Analog input 3(AI 3) over-voltage setup     | PA_430  |
| P |   |   |   | 31 | Positioning complete range                  | PA_431  |
| P |   |   |   | 32 | Positioning complete output setup           | PA_432  |
| P |   |   |   | 33 | INP hold time                               | PA_433  |
| P | S | T |   | 34 | Zero-speed                                  | PA_434  |
|   | S |   |   | 35 | Speed coincidence range                     | PA_435  |
|   | S |   |   | 36 | At-speed                                    | PA_436  |
| P | S | T |   | 37 | Mechanical brake action at stalling setup   | PA_437  |
| P | S | T |   | 38 | Mechanical brake action at running setup    | PA_438  |
| P | S | T |   | 39 | Brake action at running setup               | PA_439  |
| P | S | T |   | 43 | E-stop function active                      | PA_443  |
| P | S | T |   | 44 | Input selection SI11                        | PA_444  |
| P | S | T |   | 45 | Input selection SI12                        | PA_445  |
| P | S | T |   | 46 | Input selection SI13                        | PA_446  |
| P | S | T |   | 47 | Input selection SI14                        | PA_447  |
| P |   |   | <b>【Class 5】<br/>Extended<br/>Setup</b> | 00 | 2nd numerator of electronic gear            | PA_500  |
| P |   |   |   | 01 | 3rd numerator of electronic gear            | PA_501  |
| P |   |   |   | 02 | 4th numerator of electronic gear            | PA_502  |
| P | S | T |   | 03 | Denominator of pulse output division        | PA_503* |
| P | S | T |   | 04 | Drive inhibit input setup                   | PA_504  |
| P | S | T |   | 06 | Sequence at servo-off                       | PA_506  |
| P | S | T |   | 08 | Main power off LV trip selection            | PA_508  |
| P | S | T |   | 09 | Main power off detection time               | PA_509  |
|   |   |   |   | 10 | Dynamic braking mode                        | PA_510* |
| P | S | T |   | 11 | Torque setup for emergency stop             | PA_511  |
| P | S | T |   | 12 | Over-load level setup                       | PA_512  |
| P | S | T |   | 13 | Over-speed level setup                      | PA_513  |
| P | S | T |   | 15 | I/F reading filter                          | PA_515* |
| P |   |   |   | 17 | Counter clear up input mode                 | PA_517  |
| P |   |   |   | 18 | Invalidation of command pulse inhibit input | PA_518  |
| P |   |   |   | 20 | Position setup unit select                  | PA_520* |
| P | S | T |   | 21 | Selection of torque limit                   | PA_521  |
| P | S | T |   | 22 | 2nd torque limit                            | PA_522  |
|   |   |   |   | 23 | Torque limit switching setup 1              | PA_523  |
|   |   |   |   | 24 | Torque limit switching setup 2              | PA_524  |
| P | S | T |   | 28 | LED initial status                          | PA_528* |
| P | S | T |   | 29 | RS485 mode selection                        | PA_529* |
| P | S | T |   | 30 | RS485 baud rate setup                       | PA_530* |
| P | S | T |   | 31 | RS485 slave axis address                    | PA_531* |
| P |   |   |   | 32 | Command pulse input maximum setup           | PA_532  |
| P | S | T |   | 34 | Upper monitor communication port select     | PA_534  |
| P | S | T |   | 35 | Front panel lock setup                      | PA_535  |
| P | S | T |   | 36 | Password for opening group 7 parameter      | PA_536  |
| P | S | T | <b>【Class 6】</b>                        | 01 | Encoder zero position compensation          | PA_601* |

|   |   |   |               |           |  |                       |        |
|---|---|---|---------------|-----------|--|-----------------------|--------|
| P | S | T | Special Setup | 03        | JOG trial run command torque                 | PA_603                |        |
| P |   |   |               | 04        | JOG trial run command speed                  | PA_604                |        |
| p |   |   |               | 05        | Position 3rd gain valid time                 | PA_605                |        |
| p |   |   |               | 06        | Position 3rd gain scale factor               | PA_606                |        |
| P | S | T |               | 07        | Torque command additional value              | PA_607                |        |
| P | S | T |               | 08        | Positive direction torque compensation value | PA_608                |        |
| P | S | T |               | 09        | Negative direction torque compensation value | PA_609                |        |
| P | S | T |               | 13        | 2nd inertia ratio                            | PA_613                |        |
| P | S | T |               | 14        | Emergency stop time at alarm                 | PA_614                |        |
| P |   |   |               | 20        | distance of trial running                    | PA_620                |        |
| P |   |   |               | 21        | waiting time of trial running                | PA_621                |        |
| P |   |   |               | 22        | cycling times of trial running               | PA_622                |        |
| P | S |   |               | 25        | Acceleration of trial running                | PA_6.25               |        |
| P | S |   |               | 26        | Mode of trial running                        | PA_6.26               |        |
| P | S | T |               | 【Class 7】 | 19   | Weak magnetic current | PA_719 |

## 5.2 Parameter Function

Here is the explanation of parameters ,you can check them or modify the value using software Protuner or the front panel of driver.

Contact [tech@leadshine.com](mailto:tech@leadshine.com) if you need more technical service .

### 5.2.1 【Class 0】 Basic Setting

|        |                |         |       |         |                      |   |   |
|--------|----------------|---------|-------|---------|----------------------|---|---|
| Pr0.00 | Mode loop gain | Range   | unit  | default | Related control mode |   |   |
|        |                | 0 -2000 | 0.1Hz | 0       | P                    | S | T |

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 , run more smooth and steady . It is very useful for multi-axis synchronous movement and interpolation, the performance will be better.

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

- Choose the right control mode : Pr001 = 0
- Set up the inertia of ratio : Pr004
- Set up the rigidity : Pr003
- Set up the Pr000 :
  - If no multi-axis synchronous movement , set Pr000 as 1 or more than 10 ;
  - If multi-axis synchronous movement needed , set Pr000 as the same for all the axes .
  - If Pr000 is more than 10 , start with 100 , or 150 , 200 , 250 , .... .

**Caution:**

- Set up the right control mode , the right inertia of ratio and rigidity firstly .
- Don't change the value of Pr000 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

|                |                           |              |             |                |                             |   |   |
|----------------|---------------------------|--------------|-------------|----------------|-----------------------------|---|---|
| <b>Pr0.01*</b> | <b>Control Mode Setup</b> | <b>Range</b> | <b>unit</b> | <b>default</b> | <b>Related control mode</b> |   |   |
|                |                           | 0-10         | -           | 0              | P                           | S | T |

Set using control mode

| Setup value | Content  |          |
|-------------|----------|----------|
|             | 1st mode | 2nd mode |
| 0           | Position | -        |
| 1           | Velocity | -        |
| 2           | Torque   | -        |
| 3           | Position | Velocity |
| 4           | Position | Torque   |
| 5           | Velocity | Torque   |
| 6           | Pr-Mode  |          |
| 7~10        | Reserved |          |

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 open, the 1st mode will be selected.  
When C-MODE is shorted, the 2nd mode will be selected.

|               |                                   |              |             |                |                             |   |   |
|---------------|-----------------------------------|--------------|-------------|----------------|-----------------------------|---|---|
| <b>Pr0.02</b> | <b>Real-time Auto-gain Tuning</b> | <b>Range</b> | <b>unit</b> | <b>default</b> | <b>Related control mode</b> |   |   |
|               |                                   | 0-2          | -           | 0              | P                           | S | T |

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 driver itself.

|               |   |              |             |                |                             |   |   |
|---------------|---|--------------|-------------|----------------|-----------------------------|---|---|
| <b>Pr0.03</b> | <b>Selection of machine stiffness at real-time auto-gain tuning</b> | <b>Range</b> | <b>unit</b> | <b>default</b> | <b>Related control mode</b> |   |   |
|               |   | 50-81        | -           | 70             | P                           | S | T |

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

Low → Machine stiffness → High

Low → Servo gain → High

81.80.....70.69.68.....51.50

Low → Response → High

**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 | Inertia ratio | Range   | unit | default | Related control mode |   |   |
|        |               | 0-10000 | %    | 250     | P                    | S | T |

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

$$\text{Pr0.04} = (\text{load inertia} / \text{rotor inertia}) \times 100\%$$

**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* | Command Pulse Rotational Direction Setup | Range | unit | default | Related control mode |  |  |
|         |  | 0-1   | -    | 0       | P                    |  |  |

Set command pulse input rotate direction, command pulse input type

|         |                                |       |      |         |                      |  |  |
|---------|--------------------------------|-------|------|---------|----------------------|--|--|
| Pr0.07* | Command Pulse Input Mode Setup | Range | unit | default | Related control mode |  |  |
|         |                                | 0-3   | -    | 3       | P                    |  |  |

| Pr0.06 | Pr0.07 | Command Pulse Format                                | Signal     | Positive Direction Command | Negative Direction Command |
|--------|--------|---|------------|----------------------------|----------------------------|
| 0      | 0 or 2 | 90 phase difference 2-phase pulse(A phase +B phase) | Pulse sign |                            |                            |
|        | 1      | Positive direction pulse + negative direction pulse | Pulse sign |                            |                            |
|        | 3      | Pulse + sign  | Pulse sign |                            |                            |
| 1      | 0 or 2 | 90 phase difference 2 phase pulse(A phase +B phase) | 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 | Command pulse counts per one motor revolution | Range         | unit  | default | Related control mode |   |   |
|        |   | 0-8388<br>608 | pulse | 0       | P                    | S | T |

Set the command pulse that causes single turn of the motor shaft.

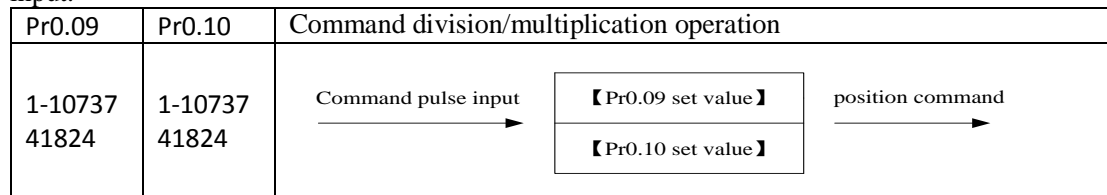
- 1) If Pr008 ≠ 0 , the actual turns = pulse number / Pr008
- 2) If Pr008 = 0 , Pr0.09 1<sup>st</sup> numerator of electronic gear and Pr0.10 Denominator of electronic Gear become valid.

|               |                                  |                  |      |         |                      |  |  |
|---------------|----------------------------------|------------------|------|---------|----------------------|--|--|
| <b>Pr0.09</b> | 1st numerator of electronic gear | Range            | unit | default | Related control mode |  |  |
|               |                                  | 1-10737<br>41824 | -    | 1       | P                    |  |  |

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

|               |                                |                  |      |         |                      |  |  |
|---------------|--------------------------------|------------------|------|---------|----------------------|--|--|
| <b>Pr0.10</b> | denominator of electronic gear | Range            | unit | default | Related control mode |  |  |
|               |                                | 1-10737<br>41824 | -    | 1       | P                    |  |  |

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



1. Settings:

- 1)The driver 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:

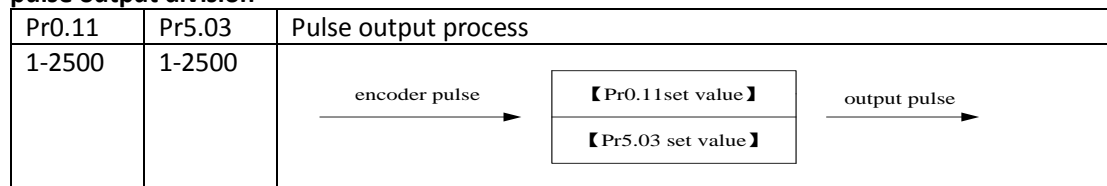
- 1) $Y = X * Pr0.09 / Pr0.10$
- 2)17Bit encoder:  $Z = 2^{17} = 131072$   
23Bit encoder:  $Z = 2^{23} = 8388608$

|                |  |        |      |         |                      |   |   |
|----------------|--|--------|------|---------|----------------------|---|---|
| <b>Pr0.11*</b> | Output pulse counts per one motor revolution | Range  | unit | default | Related control mode |   |   |
|                |  | 1-2500 | P/r  | 2500    | P                    | S | T |

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

|                |                                      |        |      |         |                      |   |   |
|----------------|--------------------------------------|--------|------|---------|----------------------|---|---|
| <b>Pr5.03*</b> | denominator of pulse output division | Range  | unit | default | Related control mode |   |   |
|                |                                      | 1-2500 | -    | 2500    | P                    | S | T |

**Combination of Pr0.11 Output pulse counts per one motor revolution and Pr5.03 Denominator of pulse output division**



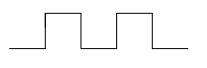
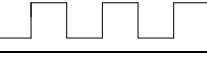





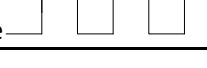
Pulse output resolution after dividing double frequency 4 times

$$\text{Pulse output resolution} = \text{encoder} \times 4 \times \frac{\text{Pr0.11}(\text{pulse output divide frequency molecule})}{\text{Pr5.03}(\text{pulse output divide frequency denominator})}$$

|                |                                |       |      |         |                      |   |   |
|----------------|--------------------------------|-------|------|---------|----------------------|---|---|
| <b>Pr0.12*</b> | reversal of pulse output logic | Range | unit | default | Related control mode |   |   |
|                |                                | 0-1   | -    | 0       | P                    | S | T |

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

**< reversal of pulse output logic >**

| Pr0.12 | B-phase Logic | CCW Direction Rotation   | CW Direction Rotation  |
|--------|---------------|--|--|
| 0      | Non-Reversal  | A phase <br>B phase  | A phase <br>B phase  |
| 1      | Reversal      | A phase <br>B phase  | A phase <br>B phase  |

| Pr0.13 | 1st Torque Limit | Range  | unit | default | Related control mode |   |   |
|--------|------------------|--------|------|---------|----------------------|---|---|
|        |                  | 0 -500 | %    | 300     | P                    | S | T |

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 | Position Deviation Excess Setup | Range  | unit    | default | Related control mode |  |  |
|--------|---------------------------------|--------|---------|---------|----------------------|--|--|
|        |                                 | 0 -500 | 0.1 rev | 200     | P                    |  |  |

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 | Absolute Encoder Setup | Range | unit    | default | Related control mode |   |   |
|--------|------------------------|-------|---------|---------|----------------------|---|---|
|        |                        | 0 -15 | 0.1 rev | 0       | P                    | S | T |

Bit description;

| Bit     | Description   |
|---------|---|
| Bit0    | 0:close absolute value<br>1: open absolute value  |
| Bit1    | Default : 0,do not use  |
| Bit2    | 0: no action<br>1: clean up absolute alarm, automatically become 0 when clean success           |
| Bit3    | 0: no action<br>1: multi-turn position, clean up and reset automatically become 0 after success |
| Bit4-15 | Default 0,do not use  |

How to use:

**0:** close multi-turn absolute function, multi-turn position invalid;

**1:** open multi-turn absolute function;

**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:** 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.

| Pr0.16 | External regenerative resistance | Range | unit | default | Related control mode |   |   |
|--------|----------------------------------|-------|------|---------|----------------------|---|---|
|        |                                  | 10-50 | Ω    | 50      | P                    | S | T |

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 | External regenerative resistor power value | Range    | unit | default | Related control mode |   |   |
|        |  | 0 -10000 | W    | 50      | P                    | S | T |

Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current.

### 5.2.2 【Class 1】 Gain Adjust

|        |                           |          |       |         |                      |  |  |
|--------|---------------------------|----------|-------|---------|----------------------|--|--|
| Pr1.00 | 1st gain of position loop | Range    | unit  | default | Related control mode |  |  |
|        |                           | 0 -30000 | 0.1/s | 320     | P                    |  |  |

You can determine the response of the positional control system. Higher the gain of position loop you set, faster the positioning time you can obtain. Note that too high setup may cause oscillation.

|        |                           |          |       |         |                      |   |   |
|--------|---------------------------|----------|-------|---------|----------------------|---|---|
| Pr1.01 | 1st gain of velocity loop | Range    | unit  | default | Related control mode |   |   |
|        |                           | 0 -32767 | 0.1Hz | 180     | P                    | S | T |

You can determine the response of the velocity loop. 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 | 1st Time Constant of Velocity Loop Integration | Range    | unit  | default | Related control mode |   |   |
|        |  | 0 -10000 | 0.1ms | 310     | P                    | S | T |

You can set up the integration time constant of velocity loop, Smaller the set up, 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 | 1st Filter of Velocity Detection | Range | unit | default | Related control mode |   |   |
|        |                                  | 0 -31 | -    | 15      | P                    | S | T |

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) |
|-----------|--|-----------|--|
| 0         | 2500   | 16        | 750  |
| 1         | 2250   | 17        | 700  |
| 2         | 2100   | 18        | 650  |
| 3         | 2000   | 19        | 600  |
| 4         | 1800   | 20        | 550  |
| 5         | 1600   | 21        | 500  |
| 6         | 1500   | 22        | 450  |
| 7         | 1400   | 23        | 400  |
| 8         | 1300   | 24        | 350  |
| 9         | 1200   | 25        | 300  |
| 10        | 1100   | 26        | 250  |
| 11        | 1000   | 27        | 200  |
| 12        | 950  | 28        | 175  |
| 13        | 900  | 29        | 150  |
| 14        | 850  | 30        | 125  |
| 15        | 800  | 31        | 100  |

|   |  |          |        |         |                      |   |   |
|---|--|----------|--------|---------|----------------------|---|---|
| Pr1.04  | 2nd Time Constant of torque filter             | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -2500  | 0.01ms | 126     | P                    | S | T |
| Pr1.05  | 2nd gain of position loop                      | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -30000 | 0.1/s  | 380     | P                    |   |   |
| Pr1.06  | 2nd gain of velocity loop                      | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -32767 | 0.1Hz  | 180     | P                    | S | T |
| Pr1.07  | 2nd Time Constant of Velocity Loop Integration | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -10000 | 0.1ms  | 10000   | P                    | S | T |
| Pr1.08  | 2nd Filter of Velocity Detection               | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -31    | -      | 15      | P                    | S | T |
| Pr1.09  | 2nd Time Constant of torque filter             | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -2500  | 0.01ms | 126     | P                    | S | T |
| Position loop, velocity loop, velocity detection filter, torque command filter have their 2 pairs of gain or time constant(1st and 2nd).  |  |          |        |         |                      |   |   |
| Pr1.10  | Velocity feed forward gain                     | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -1000  | 0.1%   | 300     | P                    |   |   |
| Multiply the velocity control command calculated according to the internal positional command by the ratio of this parameter and add the result to the speed command resulting from the positional control process. |  |          |        |         |                      |   |   |

|   |                              |         |        |         |                      |  |  |
|---|------------------------------|---------|--------|---------|----------------------|--|--|
| Pr1.11  | Velocity feed forward filter | Range   | unit   | default | Related control mode |  |  |
|   |                              | 0 -6400 | 0.01ms | 50      | P                    |  |  |
| Set the time constant of 1st delay filter which affects the input of speed feed forward.<br><b>(usage example of velocity feed forward)</b><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.<br>Position deviation [ unit of command]=command speed [ unit of command /s]/position loop gain[1/s]×(100-speed feed forward gain[%]/100 |                              |         |        |         |                      |  |  |

|  |                          |         |      |         |                      |   |  |
|--|--------------------------|---------|------|---------|----------------------|---|--|
| Pr1.12   | Torque feed forward gain | Range   | unit | default | Related control mode |   |  |
|  |                          | 0 -1000 | 0.1% | 0       | P                    | S |  |
| <ul style="list-style-type: none"> <li>● Multiply the torque control command calculated according to the velocity control command by the ratio of this parameter and add the result to the torque command resulting from the velocity control process.</li> <li>● 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.</li> <li>● 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.</li> </ul> |                          |         |      |         |                      |   |  |

|   |                            |         |        |         |                      |   |  |
|---|----------------------------|---------|--------|---------|----------------------|---|--|
| Pr1.13  | Torque feed forward filter | Range   | unit   | default | Related control mode |   |  |
|   |                            | 0 -6400 | 0.01ms | 0       | P                    | S |  |
| 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.

| Pr1.14      | 2nd gain setup  | Range | unit | default | Related control mode |   |   |
|-------------|---|-------|------|---------|----------------------|---|---|
|             |   | 0 -1  | -    | 1       | P                    | S | T |
| Setup value | Gain selection / switching  |       |      |         |                      |   |   |
| 0           | 1st gain is fixed at a value, by using the gain switching input (GAIN), change the velocity loop operation from PI to P<br>GAIN input off, PI operation<br>GAIN input on, P operation<br>Remark: the above description applies when the logical setting of GAIN input is a-contact. ON/OFF of photo-coupler is reversed when b-contact. |       |      |         |                      |   |   |
| 1           | Enable gain switching of the 1st gain(Pr0.00—Pr1.04), and 2nd gain (Pr1.05—Pr1.09)  |       |      |         |                      |   |   |

| Pr1.15        | Mode of position control switching | Range  | unit | default | Related control mode |  |  |
|---------------|------------------------------------|--|------|---------|----------------------|--|--|
|               |                                    | 0 -10  | -    | 0       | P                    |  |  |
| Setting 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          | <ul style="list-style-type: none"> <li>● 1st gain when the gain switching input is open.</li> <li>● 2nd gain when the gain switching input is connected to com- .</li> <li>◇ If no input signal is allocated to the gain switching input, the 1st gain is fixed.</li> </ul>  |      |         |                      |  |  |
| 3             | Torque command is large            | <ul style="list-style-type: none"> <li>● Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis)[%]previously with the 1st gain.</li> <li>● 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.</li> </ul>   |      |         |                      |  |  |
| 4             | reserve                            | reserve  |      |         |                      |  |  |
| 5             | Speed command is large             | <ul style="list-style-type: none"> <li>● Valid for position and speed controls.</li> <li>● Shift to the 2nd gain when the absolute value of the speed command exceeded (level + hysteresis)[r/min]previously with the 1st gain.</li> <li>● Return to the 1st gain when the absolute value of the speed command was kept below (level + hysteresis) [r/min] previously during delay time with the 2nd gain.</li> </ul>  |      |         |                      |  |  |
| 6             | Position deviation is large        | <ul style="list-style-type: none"> <li>● Valid for position control.</li> <li>● Shift to the 2nd gain when the absolute value of the positional deviation exceeded (level + hysteresis)[pulse] previously with the 1st gain.</li> <li>● Return to the 1st gain when the absolute value of the positional deviation was kept below (level + hysteresis)[r/min]previously during delay time with the 2nd gain.</li> <li>◇ Unit of level and hysteresis [pulse] is set as the encoder resolution for positional control.</li> </ul> |      |         |                      |  |  |
| 7             | position command exists            | <ul style="list-style-type: none"> <li>● Valid for position control.</li> <li>● Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain.</li> <li>● Return to the 1st gain when the positional command was kept 0 previously during delay time with the 2nd gain.</li> </ul>  |      |         |                      |  |  |
| 8             | Not in positioning complete        | <ul style="list-style-type: none"> <li>● Valid for position control.</li> <li>● Shift to the 2nd gain when the positioning was not completed</li> </ul>  |      |         |                      |  |  |

|    |                                     |  |
|----|-------------------------------------|--|
|    |                                     | previously with the 1st gain.<br>● Return to the 1st gain when the positioning was kept in completed condition previously during delay time with the 2nd gain.   |
| 9  | Actual speed is large               | ● Valid for position control.<br>● Shift to the 2nd gain when the absolute value of the actual speed exceeded (level + hysteresis) (r/min) previously with the 1st gain.<br>● Return to the 1st gain when the absolute value of the actual speed was kept below (level - hysteresis) (r/min) previously during delay time with the 2nd gain. |
| 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.    |

In position control mode, setup Pr1.15=3,5,6,9,10;  
 In speed control mode, setup Pr1.15=3,5,9;

| Pr1.17 | Level of position control switching | Range    | unit           | default | Related control mode |  |
|--------|-------------------------------------|----------|----------------|---------|----------------------|--|
|        |                                     | 0 -20000 | Mode dependent | 50      | P                    |  |

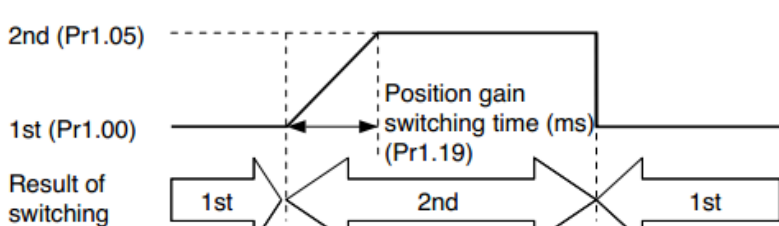
Unit of setting varies with switching mode.  
 switching condition: position :encoder pulse number ; speed : r/min ; torque : % .  
**Notice:** set the level equal to or higher than the hysteresis.

| Pr1.18 | Hysteresis at position control switching | Range    | unit           | default | Related control mode |  |
|--------|--|----------|----------------|---------|----------------------|--|
|        |  | 0 -20000 | Mode dependent | 33      | P                    |  |

Combining Pr1.17(control switching level)setup  
**Notice:** when level< hysteresis, the hysteresis is internally adjusted so that it is equal to level.

| Pr1.19 | position gain switching time | Range    | unit  | default | Related control mode |  |
|--------|------------------------------|----------|-------|---------|----------------------|--|
|        |                              | 0 -10000 | 0.1ms | 33      | P                    |  |

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*   | positional command filter setup                | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -200   | 0.05us | 0       | P                    |   |   |
| 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.  |  |          |        |         |                      |   |   |
| Pr1.36*   | pulse digital filter of encoder feedback setup | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -10000 | 0.05ms | 33      | P                    |   |   |
| Do filtering for pulse of encoder feedback, eliminate the interference of the narrow pulse, over-large setup will influence the performance of motor in large speed, and influence the control performance of motor causing by large time-delayed.  |  |          |        |         |                      |   |   |
| Pr1.37  | Special register                               | Range    | unit   | default | Related control mode |   |   |
|   |  | 0 -32767 | -      | 0       | P                    | S | T |
| 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) |  |          |        |         |                      |   |   |

### 5.2.3 【Class 2】 Vibration Suppression

|   |                            |   |      |   |                      |   |  |
|---|----------------------------|---|------|---|----------------------|---|--|
| Pr2.00  | Adaptive filter mode setup | Range   | unit | default   | Related control mode |   |  |
|   |                            | 0 -4  | -    | 0   | P                    | S |  |
| Set up the resonance frequency to be estimated by the adaptive filter and the special the operation after estimation. |                            |   |      |   |                      |   |  |
| Setup value   |                            | content   |      |   |                      |   |  |
| 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   |      | Non-professional forbidden to use   |                      |   |  |

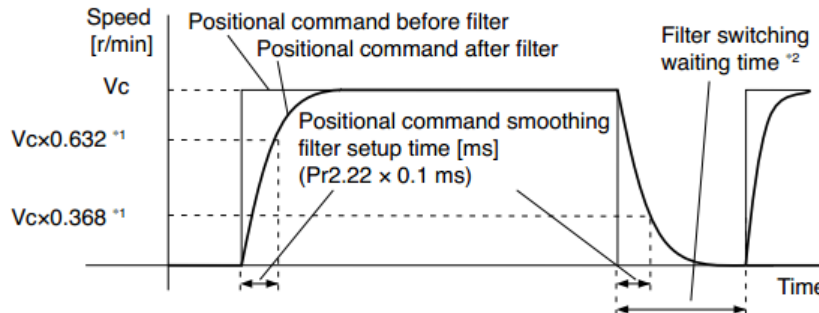
|  |                     |          |      |         |                      |   |   |
|--|---------------------|----------|------|---------|----------------------|---|---|
| Pr2.01   | 1st notch frequency | Range    | unit | default | Related control mode |   |   |
|  |                     | 50 -2000 | HZ   | 2000    | P                    | S | T |
| Set the center frequency of the 1st notch filter<br><b>Notice:</b> the notch filter function will be invalidated by setting up this parameter to “2000”. |                     |          |      |         |                      |   |   |

|   |                           |         |       |         |                      |   |   |
|---|---------------------------|---------|-------|---------|----------------------|---|---|
| Pr2.02  | 1st notch width selection | Range   | unit  | default | Related control mode |   |   |
|   |                           | 0-20    | -     | 2       | P                    | S | T |
| Set the width of notch at the center frequency of the 1st notch filter.<br><b>Notice:</b> Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.  |                           |         |       |         |                      |   |   |
| Pr2.03  | 1st notch depth selection | Range   | unit  | default | Related control mode |   |   |
|   |                           | 0-99    | -     | 0       | P                    | S | T |
| Set the depth of notch at the center frequency of the 1st notch filter.<br><b>Notice:</b> Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.   |                           |         |       |         |                      |   |   |
| Pr2.04  | 2nd notch frequency       | Range   | unit  | default | Related control mode |   |   |
|   |                           | 50-2000 | HZ    | 2000    | P                    | S | T |
| Set the center frequency of the 2nd notch filter<br><b>Notice:</b> the notch filter function will be invalidated by setting up this parameter to “2000”.  |                           |         |       |         |                      |   |   |
| Pr2.05  | 2nd notch width selection | Range   | unit  | default | Related control mode |   |   |
|   |                           | 0-20    | -     | 2       | P                    | S | T |
| Set the width of notch at the center frequency of the 2nd notch filter.<br><b>Notice:</b> Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.  |                           |         |       |         |                      |   |   |
| Pr2.06  | 2nd notch depth selection | Range   | unit  | default | Related control mode |   |   |
|   |                           | 0-99    | -     | 0       | P                    | S | T |
| Set the depth of notch at the center frequency of the 2nd notch filter.<br><b>Notice:</b> Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.   |                           |         |       |         |                      |   |   |
| Pr2.07  | 3rd notch frequency       | Range   | unit  | default | Related control mode |   |   |
|   |                           | 50-2000 | Hz    | 2000    | P                    | S | T |
| Set the center frequency of the 3rd notch filter<br><b>Notice:</b> the notch filter function will be invalidated by setting up this parameter to “2000”.<br>Setup invalid after opening self-adaptation function.                                       |                           |         |       |         |                      |   |   |
| Pr2.08  | 3rd notch width selection | Range   | unit  | default | Related control mode |   |   |
|   |                           | 0-20    | -     | 2       | P                    | S | T |
| Set the width of notch at the center frequency of the 3rd notch filter.<br><b>Notice:</b> Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.<br>Setup invalid after opening self-adaptation function. |                           |         |       |         |                      |   |   |
| Pr2.09  | 3rd notch depth selection | Range   | unit  | default | Related control mode |   |   |
|   |                           | 0-99    | -     | 0       | P                    | S | T |
| Set the depth of notch at the center frequency of the 3rd notch filter.<br><b>Notice:</b> Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.<br>Setup invalid after opening self-adaptation function.              |                           |         |       |         |                      |   |   |
| Pr2.14*   | 1st damping frequency     | Range   | unit  | default | Related control mode |   |   |
|   |                           | 10-2000 | 0.1Hz | 0       | P                    |   |   |
| 0: close<br>Setup damping frequency, to suppress vibration at the load edge.  |                           |         |       |         |                      |   |   |
| Pr2.16*   | 1nd damping frequency     | Range   | unit  | default | Related control mode |   |   |
|   |                           | 10-2000 | 0.1Hz | 0       | P                    |   |   |

0: close  
Setup damping frequency, to suppress vibration at the load edge.

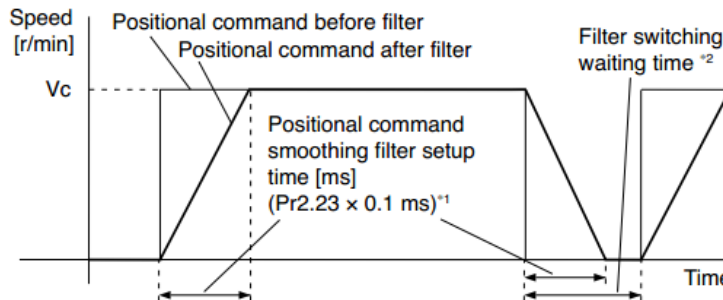
|               |                                     |          |       |         |                      |  |
|---------------|-------------------------------------|----------|-------|---------|----------------------|--|
| <b>Pr2.22</b> | positional command smoothing filter | Range    | unit  | default | Related control mode |  |
|               |                                     | 0 -32767 | 0.1ms | 0       | P                    |  |

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



|               |                               |          |       |         |                      |  |
|---------------|-------------------------------|----------|-------|---------|----------------------|--|
| <b>Pr2.23</b> | positional command FIR filter | Range    | unit  | default | Related control mode |  |
|               |                               | 0 -10000 | 0.1ms | 0       | P                    |  |

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



**Note:** For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.

### 5.2.4 【Class 3】 Velocity/ Torque Control

|               |   |       |      |         |                      |  |
|---------------|---|-------|------|---------|----------------------|--|
| <b>Pr3.00</b> | Speed setup, Internal /External switching | Range | unit | default | Related control mode |  |
|               |   | 0 -3  | -    | 0       | S                    |  |

This driver 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 | selection 1 of internal command | selection 2 of internal command speed | selection 3 of internal command | selection of Speed |
|-------------|---------------------------------|---------------------------------------|---------------------------------|--------------------|

|   | speed(INTSPD1)         | (INTSPD2) | speed (INTSPD3) | 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            |

| Pr3.01 | Speed command rotational direction selection | Range | unit | default | Related control mode |  |
|--------|--|-------|------|---------|----------------------|--|
|        |  | 0-1   | -    | 0       | S                    |  |

Select the Positive /Negative direction specifying method

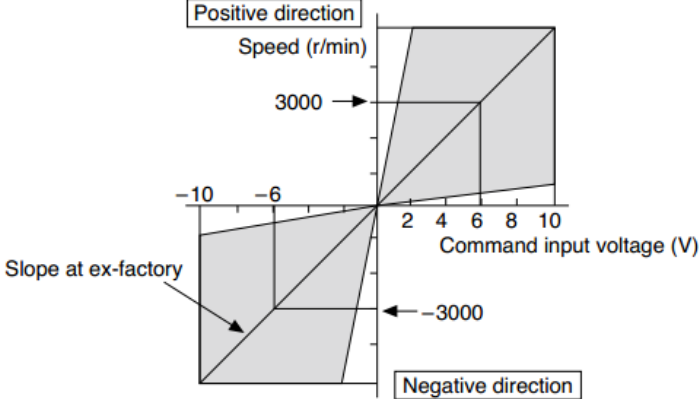
| Setup value | Select speed command sign (1st to 8th speed) | Speed command direction (VC-SIGN) | Position command direction |
|-------------|--|-----------------------------------|----------------------------|
| 0           | +  | No effect                         | Positive direction         |
|             | -  | No effect                         | Negative direction         |
| 1           | Sign has no effect                           | OFF                               | Positive direction         |
|             | Sign has no effect                           | ON                                | Negative direction         |

| Pr3.02 | Input gain of speed command | Range   | unit      | default | Related control mode |   |
|--------|-----------------------------|---------|-----------|---------|----------------------|---|
|        |                             | 10-2000 | (r/min)/v | 500     | S                    | T |

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:**

- Do not apply more than  $\pm 10V$  to the speed command input (SPR).
- When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
- Pay an extra attention to oscillation caused by larger setup of Pr3.02.



| Pr3.03 | Reversal of speed command input | Range | unit | default | Related control mode |
|--------|---------------------------------|-------|------|---------|----------------------|
|        |                                 | 0 -1  | -    | 0       | S                    |

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

| Setup value | Motor rotating direction |  |
|-------------|--------------------------|--|
| 0           | Non-reversal             | [+ voltage] → [+ direction] [- voltage] → [-direction] |
| 1           | reversal                 | [+ voltage] → [- direction] [- voltage] → [+direction] |

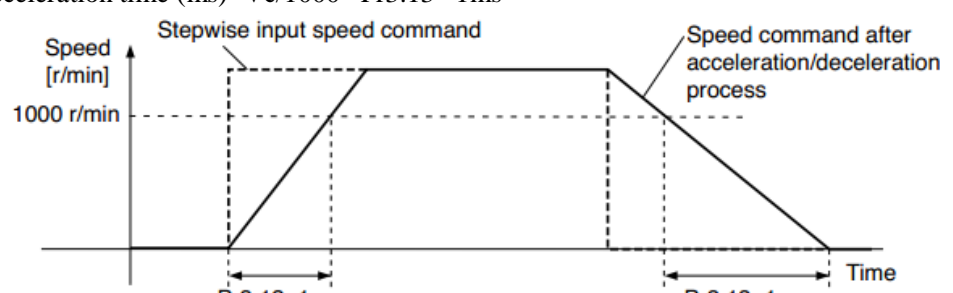
**Caution:** When you compose the servo drive system with this driver set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup does not match.

| Pr3.04 | 1st speed of speed setup | Range         | unit  | default | Related control mode |
|--------|--------------------------|---------------|-------|---------|----------------------|
|        |                          | -20000 -20000 | r/min | 0       | S                    |
| Pr3.05 | 2nd speed of speed setup | Range         | unit  | default | Related control mode |
|        |                          | -20000 -20000 | r/min | 0       | S                    |
| Pr3.06 | 3rd speed of speed setup | Range         | unit  | default | Related control mode |
|        |                          | -20000 -20000 | r/min | 0       | S                    |
| Pr3.07 | 4th speed of speed setup | Range         | unit  | default | Related control mode |
|        |                          | -20000 -20000 | r/min | 0       | S                    |
| Pr3.08 | 5th speed of speed setup | Range         | unit  | default | Related control mode |
|        |                          | -20000 -20000 | r/min | 0       | S                    |
| Pr3.09 | 6th speed of speed setup | Range         | unit  | default | Related control mode |
|        |                          | -20000 -20000 | r/min | 0       | S                    |
| Pr3.10 | 7th speed of speed setup | Range         | unit  | default | Related control mode |
|        |                          | -20000 -20000 | r/min | 0       | S                    |
| Pr3.11 | 8th speed of speed setup | Range         | unit  | default | Related control mode |
|        |                          | -20000 -20000 | r/min | 0       | S                    |

Set up internal command speeds, 1st to 8th

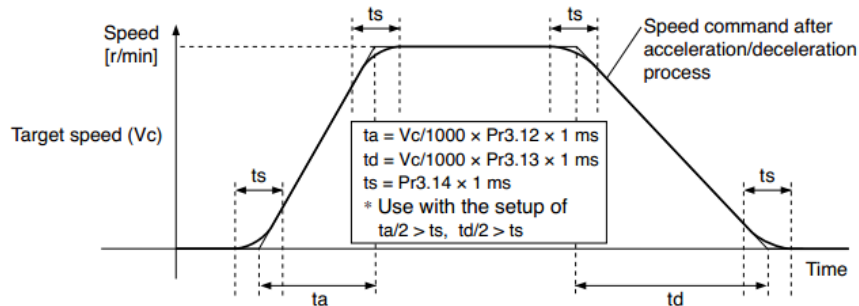
| Pr3.12 | time setup acceleration | Range    | unit          | default | Related control mode |
|--------|-------------------------|----------|---------------|---------|----------------------|
|        |                         | 0 -10000 | Ms(1000r/min) | 100     | S                    |
| Pr3.13 | time setup deceleration | Range    | unit          | default | Related control mode |
|        |                         | 0 -10000 | Ms(1000r/min) | 100     | S                    |

**Set up acceleration/deceleration processing time in response to the speed command.**  
 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  $V_c$ (r/min), the time required for acceleration/deceleration can be computed from the formula shown below.  
 Acceleration time (ms)= $V_c/1000 * Pr3.12 * 1ms$   
 Deceleration time (ms)= $V_c/1000 * Pr3.13 * 1ms$



|               |  |        |      |         |                          |                                       |
|---------------|--|--------|------|---------|--------------------------|---------------------------------------|
| <b>Pr3.14</b> | Sigmoid acceleration/deceleration time setup | Range  | unit | default | Related control mode     |                                       |
|               |  | 0-1000 | ms   | 0       | <input type="checkbox"/> | <input checked="" type="checkbox"/> S |

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.



|               |                                     |       |      |         |                          |                                       |
|---------------|-------------------------------------|-------|------|---------|--------------------------|---------------------------------------|
| <b>Pr3.15</b> | Speed zero-clamp function selection | Range | unit | default | Related control mode     |                                       |
|               |                                     | 0-3   | -    | 0       | <input type="checkbox"/> | <input checked="" type="checkbox"/> S |

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.

|               |                        |         |       |         |                          |                                       |
|---------------|------------------------|---------|-------|---------|--------------------------|---------------------------------------|
| <b>Pr3.16</b> | Speed zero-clamp level | Range   | unit  | default | Related control mode     |                                       |
|               |                        | 0-20000 | r/min | 30      | <input type="checkbox"/> | <input checked="" type="checkbox"/> S |

When analog speed given value under speed control mode less than zero speed clamp level setup, speed command will set to 0 strongly.

|               |                             |         |      |         |                          |                                       |
|---------------|-----------------------------|---------|------|---------|--------------------------|---------------------------------------|
| <b>Pr3.17</b> | Selection of torque command | Range   | unit | default | Related control mode     |                                       |
|               |                             | 0/1/2/3 | -    | 0       | <input type="checkbox"/> | <input checked="" type="checkbox"/> T |

| 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                  |

|               |                                    |       |      |         |                          |                                       |
|---------------|------------------------------------|-------|------|---------|--------------------------|---------------------------------------|
| <b>Pr3.18</b> | Torque command direction selection | Range | unit | default | Related control mode     |                                       |
|               |                                    | 0-1   | -    | 0       | <input type="checkbox"/> | <input checked="" type="checkbox"/> T |

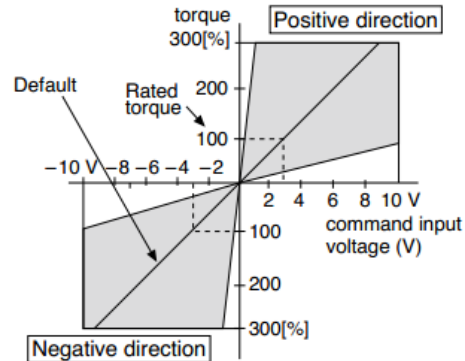
Select the direction positive/negative direction of torque command

| Setup value | designation   |
|-------------|---|
| 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 | Torque command input gain | Range | unit | default | Related control mode |  |   |
|        |                           | 0-1   | -    | 500     |                      |  | T |

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 | Torque command input reversal | Range | unit | default | Related control mode |  |   |
|        |                               | 0-1   | -    | 0       |                      |  | T |

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 | Speed limit value 1 | Range   | unit  | default | Related control mode |  |   |
|        |                     | 0-20000 | r/min | 0       |                      |  | T |

Set up the speed limit used for torque controlling.

During the torque controlling, the speed set by the speed limit value cannot be exceeded.

|        |                |       |      |         |                      |   |   |
|--------|----------------|-------|------|---------|----------------------|---|---|
| Pr3.22 | Torque command | Range | unit | default | Related control mode |   |   |
|        |                | 0-300 | %    | 0       | P                    | S | T |

Set up the speed limit used for torque controlling.

During the torque controlling, the speed set by the speed limit value cannot be exceeded.

**Note:** For parameters which No. have a suffix of “\*”, changed contents will be validated when you turn on the control power.

|         |                                  |        |       |         |                      |   |   |
|---------|----------------------------------|--------|-------|---------|----------------------|---|---|
| Pr3.24* | Motor rotate maximum speed limit | Range  | unit  | default | Related control mode |   |   |
|         |                                  | 0-6000 | r/min | 3000    | P                    | S | T |

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

## 5.2.5 【Class 4】 I/F Monitor Setting

|         |                     |             |      |         |                      |   |   |
|---------|---------------------|-------------|------|---------|----------------------|---|---|
| Pr4.00* | Input selection SI1 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.01* | Input selection SI2 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.02* | Input selection SI2 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.03* | Input selection SI4 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |

|         |                     |             |      |         |                      |   |   |
|---------|---------------------|-------------|------|---------|----------------------|---|---|
| Pr4.04* | Input selection SI5 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.05* | Input selection SI6 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.06* | Input selection SI7 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.07* | Input selection SI8 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |
| Pr4.08* | Input selection SI9 | Range       | unit | default | Related control mode |   |   |
|         |                     | 0-00FFFFFFh | -    |         | P                    | S | T |

Set SI1 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  | Set value |              |
|---|---------|-----------|--------------|
|   |         | a-contact | b- contact   |
| Invalid   | -       | 00h       | Do not setup |
| Positive direction over-travel inhibition input | POT     | 01h       | 81h          |
| Negative direction over-travel inhibition input | 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:

- a-contact means input signal comes from external controller or component ,for example: PLC .
- b-contact means input signal comes from driver internally.
- 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:

| Signal name             | symbol | Input       |              |
|-------------------------|--------|-------------|--------------|
|                         |        | Set value   |              |
|                         |        | Normal open | Normal close |
| 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          |
| Forward limit           | PL     | 25h         | A5h          |
| Reverse limit           | 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.

| Pr4.10* | Output selection SO1 | Range       | unit | default | Related control mode |   |   |
|---------|----------------------|-------------|------|---------|----------------------|---|---|
|         |                      | 0-00FFFFFFh | -    |         |                      | P | S |
| Pr4.11* | Output selection SO2 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh | -    |         |                      | P | S |
| Pr4.12* | Output selection SO3 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh | -    |         |                      | P | S |
| Pr4.13* | Output selection SO4 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh | -    |         |                      | P | S |
| Pr4.14* | Output selection SO5 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh |      |         |                      | P | S |
| Pr4.15* | Output selection SO6 | Range       | unit | default | Related control mode |   |   |
|         |                      | 0-00FFFFFFh |      |         |                      | P | S |

Assign functions to SO1 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   |              |
|                       |         | Normal open | Normal close |
| 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.

| Pr4.22 | Analog input 1 (AI1) offset setup | Range       | unit | default | Related control mode |  |   |
|--------|-----------------------------------|-------------|------|---------|----------------------|--|---|
|        |                                   | -5578 -5578 | -    | 0       |                      |  | S |

Set up the offset correction value applied to the voltage fed to the analog input 1.

|   |  |        |        |         |                      |  |
|---|--|--------|--------|---------|----------------------|--|
| Pr4.23  | Analog input 1 (AI1) filter              | Range  | unit   | default | Related control mode |  |
|   |  | 0-6400 | 0.01ms | 0       | S                    |  |
| 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  | Analog input 1 (AI1) over -voltage setup | Range  | unit   | default | Related control mode |  |
|   |  | 0-100  | 0.1v   | 0       | S                    |  |
| Set up the excessive level of the input voltage of analog input 1 by using the voltage associated with offset.              |  |        |        |         |                      |  |

|   |                                   |       |      |         |                      |   |
|---|-----------------------------------|-------|------|---------|----------------------|---|
| Pr4.28  | Analog input 3 (AI3) offset setup | Range | unit | default | Related control mode |   |
|   |                                   | 0 -1  | -    | 500     |                      | T |
| Set up the offset correction value applied to the voltage fed to the analog input 3.  |                                   |       |      |         |                      |   |
| Pr4.29  | Analog input 3 (AI3) filter       | Range | unit | default | Related control mode |   |
|   |                                   | 0 -1  | -    | 500     |                      | T |
| 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   | Analog input 3 (AI3) overvoltage setup | Range    | unit         | default | Related control mode |   |
|  |  | 0 -1     | -            | 500     |                      | T |
| Set up the excessive level of the input voltage of analog input 3 by using the voltage associated with offset. |  |          |              |         |                      |   |
| Pr4.31   | Positioning complete range             | Range    | unit         | default | Related control mode |   |
|  |  | 0 -10000 | Encoder unit | 10      | P                    |   |
| Set up the timing of positional deviation at which the positioning complete signal (INP1) is output.           |  |          |              |         |                      |   |

|  |  |       |              |         |                      |  |
|--|--|-------|--------------|---------|----------------------|--|
| Pr4.32   | Positioning complete range   | Range | unit         | default | Related control mode |  |
|  |  | 0 -3  | command unit | 10      | P                    |  |
| 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 | INP hold time | Range   | unit | default | Related control mode |  |  |
|--------|---------------|---------|------|---------|----------------------|--|--|
|        |               | 0-30000 | 1ms  | 0       | P                    |  |  |

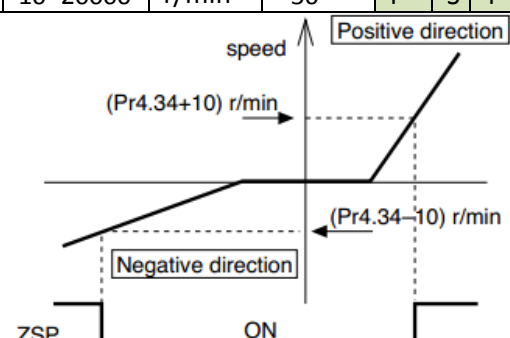
Set up the hold time when Pr 4.32 positioning complete output setup=3.

| 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 | Zero-speed | Range     | unit  | default | Related control mode |   |   |
|--------|------------|-----------|-------|---------|----------------------|---|---|
|        |            | 10 -20000 | r/min | 50      | P                    | S | T |

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].

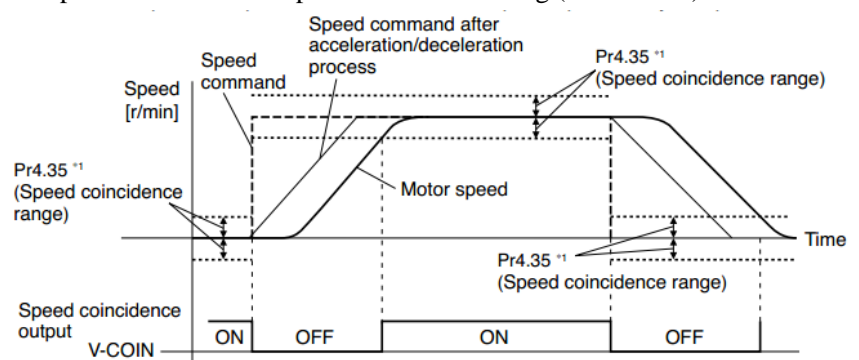


| Pr4.35 | Speed coincidence range | Range     | unit  | default | Related control mode |  |
|--------|-------------------------|-----------|-------|---------|----------------------|--|
|        |                         | 10 -20000 | r/min | 50      | S                    |  |

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.

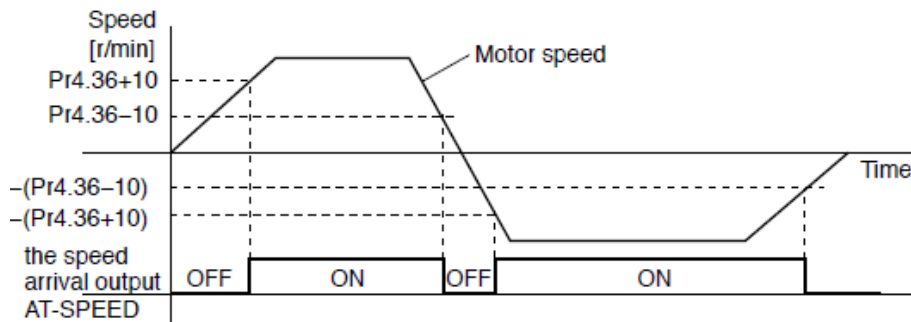
Speed coincidence output OFF -> ON timing (Pr4.35 -10) r/min  
Speed coincidence output ON -> OFF timing (Pr4.35 +10) r/min



| Pr4.36 | At-speed(Speed arrival) | Range    | unit  | default | Related control mode |  |
|--------|-------------------------|----------|-------|---------|----------------------|--|
|        |                         | 10-20000 | r/min | 1000    | S                    |  |

Set the detection timing of the speed arrival output (AT-SPEED).

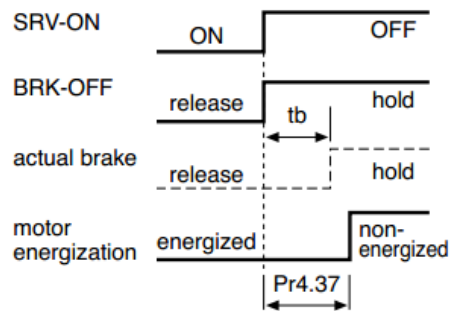
When the motor speed exceeds this setup value, the speed arrive output (AT-SPEED) is output. Detection is associated with 10r/min hysteresis .



| Pr4.37 | Mechanical brake action at stalling setup | Range   | unit | default | Related control mode |   |   |
|--------|---|---------|------|---------|----------------------|---|---|
|        |   | 0-10000 | 1ms  | 0       | P                    | S | T |

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

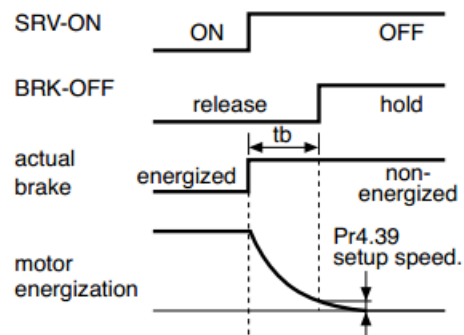
- Set up to prevent a micro-travel/drop of the motor (work) due to the action delay time( $t_b$ ) of the brake.
- After setting up  $Pr4.37 \geq t_b$ , then compose the sequence so as the driver turns to servo-off after the brake is actually activated.



| Pr4.38 | Mechanical brake action at running setup | Range   | unit | default | Related control mode |   |   |
|--------|--|---------|------|---------|----------------------|---|---|
|        |  | 0-10000 | 1ms  | 0       | P                    | S | T |

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 ,  $t_b$  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 | Brake release speed setup | Range   | unit | default | Related control mode |   |   |
|--------|---------------------------|---------|------|---------|----------------------|---|---|
|        |                           | 30-3000 | 1ms  | 30      | P                    | S | T |

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  | 2nd numerator of electronic gear     | Range   | unit | default | Related control mode |   |   |
|---------|--------------------------------------|---------|------|---------|----------------------|---|---|
|         |                                      | 1-32767 | -    | 1       | P                    | S | T |
| Pr5.01  | 3rd numerator of electronic gear     | Range   | unit | default | Related control mode |   |   |
|         |                                      | 1-32767 | -    | 1       | P                    | S | T |
| Pr5.02  | 4th numerator of electronic gear     | Range   | unit | default | Related control mode |   |   |
|         |                                      | 1-32767 | -    | 1       | P                    | S | T |
| Pr5.03* | Denominator of pulse output division | Range   | unit | default | Related control mode |   |   |
|         |                                      | 1-2500  | -    | 2500    | P                    | S | T |

According to the command pulse input , set the 2nd to 4th numerator of electronic gear

| DIV1 | DIV2 | numerator of electronic gear | denominator of electronic gear |
|------|------|------------------------------|--------------------------------|
| OFF  | OFF  | Pr0.09                       | Pr5.03                         |
| ON   | OFF  | Pr5.00                       | Pr5.03                         |
| OFF  | ON   | Pr5.01                       | Pr5.03                         |
| ON   | ON   | Pr5.02                       | Pr5.03                         |

For details, refer to Pr0.11 .

| Pr5.04 | Over-travel inhibit input setup | Range | unit | default | Related control mode |   |   |
|--------|---------------------------------|-------|------|---------|----------------------|---|---|
|        |                                 | 0/1/2 | 1ms  | 0       | P                    | S | T |

0: positive and negative limit effective, no alarm output;

1: positive and negative limit effective invalid;

2: positive and negative limit effective, alarm output;

| Pr5.06 | Sequence at servo-off | Range | unit | default | Related control mode |   |   |
|--------|-----------------------|-------|------|---------|----------------------|---|---|
|        |                       | 0-1   | -    | 0       | P                    | S | T |

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 | LV trip selection at main power OFF | Range | unit | default | Related control mode |   |   |
|--------|-------------------------------------|-------|------|---------|----------------------|---|---|
|        |                                     | 0-1   | -    | 0       | P                    | S | T |

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 driver turns to Servo-OFF. The driver returns to Servo-On again after the main power resumption. |
| 1           | When the main power is shut off during Servo-On, the driver 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* | The main power-OFF detection time | Range   | unit | default | Related control mode |   |   |
|---------|-----------------------------------|---------|------|---------|----------------------|---|---|
|         |                                   | 70-2000 | 1ms  | 70      | P                    | S | T |

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.

| Pr5.11* | Torque setup for emergency stop | Range | unit | default | Related control mode |   |   |
|---------|---------------------------------|-------|------|---------|----------------------|---|---|
|         |                                 | 0-500 | %    | 0       | P                    | S | T |

Set up the torque limit at emergency stop

When setup value is 0, the torque limit for normal operation is applied.

| Pr5.12 | Over-load level setup | Range | unit | default | Related control mode |   |   |
|--------|-----------------------|-------|------|---------|----------------------|---|---|
|        |                       | 0-115 | %    | 0       | P                    | S | T |

You can set up over-load level. The overload level becomes 115% by setting up this value to 0.

Use this with 0 setup in normal operation, set up other value only when you need to low this over-load level.

The setup value of this parameter is limited by 115% of the motor rating.

| Pr5.13 | Over-speed level setup | Range   | unit  | default | Related control mode |   |   |
|--------|------------------------|---------|-------|---------|----------------------|---|---|
|        |                        | 0-20000 | r/min | 0       | P                    | S | T |

If the motor speed exceeds this setup value, Err1A.0 [over-speed protect] occurs.  
The over-speed level becomes 1.2 times of the motor max. speed by setting up this to 0.

| Pr5.15* | I/F reading filter | Range | unit  | default | Related control mode |   |   |
|---------|--------------------|-------|-------|---------|----------------------|---|---|
|         |                    | 0-255 | 0.1ms | 0       | P                    | S | T |

I/O input digital filtering; higher setup will arise control delay.

| Pr5.17 | Counter clear input mode | Range | unit | default | Related control mode |  |  |
|--------|--------------------------|-------|------|---------|----------------------|--|--|
|        |                          | 0-4   | --   | 3       | P                    |  |  |

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 |

| Pr5.18 | Invalidation of command pulse inhibit input | Range | unit | default | Related control mode |  |  |
|--------|---|-------|------|---------|----------------------|--|--|
|        |   | 0-1   | --   | 1       | P                    |  |  |

Set up the clearing conditions of the counter clear input signal

| Setup value | Clear condition |
|-------------|-----------------|
| 0           | valid           |
| 1           | invalid         |

| Pr5.20 | Position setup unit select | Range | unit | default | Related control mode |  |  |
|--------|----------------------------|-------|------|---------|----------------------|--|--|
|        |                            | 0-2   | -    | 0       | P                    |  |  |

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

| Setup value | unit                    |
|-------------|-------------------------|
| 0           | Encoder unit            |
| 1           | Command unit            |
| 2           | Standard 2500-line unit |

|               |                           |       |      |         |                      |   |   |
|---------------|---------------------------|-------|------|---------|----------------------|---|---|
| <b>Pr5.21</b> | Selection of torque limit | Range | unit | default | Related control mode |   |   |
|               |                           | 0-2   | --   | 0       | P                    | S | T |

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         |

|               |                  |       |      |         |                      |   |   |
|---------------|------------------|-------|------|---------|----------------------|---|---|
| <b>Pr5.22</b> | 2nd torque limit | Range | unit | default | Related control mode |   |   |
|               |                  | 0-500 | %    | 300     | P                    | S | T |

Set up the 2<sup>nd</sup> limit value of the motor torque output

The value of the parameter is limited to the maximum torque of the applicable motor.

|                |                    |       |      |         |                      |   |   |
|----------------|--------------------|-------|------|---------|----------------------|---|---|
| <b>Pr5.28*</b> | LED initial status | Range | unit | default | Related control mode |   |   |
|                |                    | 0-35  | -    | 1       | P                    | S | T |

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          | Driver 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                 |             |  |             |                            |

|                |                                   |       |      |         |                      |   |   |
|----------------|-----------------------------------|-------|------|---------|----------------------|---|---|
| <b>Pr5.29*</b> | mode setup of RS485 communication | Range | unit | default | Related control mode |   |   |
|                |                                   | 0-6   | -    | 5       | P                    | S | T |

| 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        |

|                |  |       |      |         |                      |   |   |
|----------------|--|-------|------|---------|----------------------|---|---|
| <b>Pr5.30*</b> | baud rate setup of RS485 communication | Range | unit | default | Related control mode |   |   |
|                |  | 0-6   | -    | 2       | P                    | S | T |

You can set up the communication speed of RS485.

| Set value | Baud rate | Set value | Baud rate |
|-----------|-----------|-----------|-----------|
| 0         | 2400bps   | 4         | 38400bps  |
| 1         | 4800bps   | 5         | 57600bps  |
| 2         | 9600bps   | 6         | 115200bps |
| 3         | 19200bps  |           |           |

Baud rate error is 2400-38400bps $\pm$ 5% ,57600-115200bps $\pm$ 2%

| Pr5.31* | RS485 slave axis address | Range | unit | default | Related control mode |   |   |
|---------|--------------------------|-------|------|---------|----------------------|---|---|
|         |                          | 0-127 | -    | 1       | P                    | S | T |

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

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

| Pr5.32 | Command pulse input maximum setup | Range  | unit | default | Related control mode |  |  |
|--------|-----------------------------------|--------|------|---------|----------------------|--|--|
|        |                                   | 0-4000 | -KHZ | 0       | P                    |  |  |

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.

| Pr5.34 | Controller communication port select | Range | unit | default | Related control mode |   |   |
|--------|--------------------------------------|-------|------|---------|----------------------|---|---|
|        |                                      | 0,1   | -    | 0       | P                    | S | T |

0: controller communication by RS232

1: controller communication by RS485

| Pr5.35* | Front panel lock setup | Range | unit | default | Related control mode |   |   |
|---------|------------------------|-------|------|---------|----------------------|---|---|
|         |                        | 0-1   | -    | 0       | P                    | S | T |

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 | 7 <sup>th</sup> setting parameters open | Range | unit | default | Related control mode |   |   |
|--------|---|-------|------|---------|----------------------|---|---|
|        |   | 0,102 | -    | 0       | P                    | S | T |

7<sup>th</sup> setting parameters open.

| Setup value | content   |
|-------------|---|
| 0           |   |
| 102         | Open 7 <sup>th</sup> setting parameters modification authority. |

## 5.2.7 【Class 6】 Special Setup

| Pr6.03 | JOG trial run command torque | Range | unit | default | Related control mode |  |   |
|--------|------------------------------|-------|------|---------|----------------------|--|---|
|        |                              | 0-100 | %    | 0       |                      |  | T |

You can set up the command speed used for JOG trial run (torque control).

| Pr6.04 | JOG trial run command speed | Range | unit  | default | Related control mode |   |   |
|--------|-----------------------------|-------|-------|---------|----------------------|---|---|
|        |                             | 0-500 | r/min | 300     | P                    | S | T |

You can set up the command speed used for JOG trial run (velocity control).

| Pr6.05 | Position 3 <sup>rd</sup> gain multiplication | Range   | unit  | default | Related control mode |  |  |
|--------|--|---------|-------|---------|----------------------|--|--|
|        |  | 0--1000 | 0.1ms | 0       | P                    |  |  |

Set up the time at which 3<sup>rd</sup> gain becomes valid.  
 When not using this parameter, set PR6.05=0, PR6.06=100  
 This is valid for only position control/full-closed control.

| Pr6.06 | Position 3 <sup>rd</sup> gain valid time | Range   | unit  | default | Related control mode |  |  |
|--------|--|---------|-------|---------|----------------------|--|--|
|        |  | 0--1000 | 0.1ms | 0       | P                    |  |  |

Set up the 3<sup>rd</sup> gain by multiplying factor of the 1<sup>st</sup> gain  
 3rd gain= 1st gain \* PR6.06/100

| Pr6.07 | JOG trial run command speed | Range    | unit | default | Related control mode |   |   |
|--------|-----------------------------|----------|------|---------|----------------------|---|---|
|        |                             | -100-100 | %    | 0       | P                    | S | T |

| Pr6.08 | JOG trial run command speed | Range    | unit | default | Related control mode |   |   |
|--------|-----------------------------|----------|------|---------|----------------------|---|---|
|        |                             | -100-100 | %    | 0       | P                    | S | T |

| Pr6.09 | JOG trial run command speed | Range    | unit | default | Related control mode |   |   |
|--------|-----------------------------|----------|------|---------|----------------------|---|---|
|        |                             | -100-100 | %    | 0       | P                    | S | T |

This three parameters may apply feed forward torque superposition directly to torque command.

| Pr6.13 | 2 <sup>nd</sup> inertia ratio | Range  | unit | default | Related control mode |   |   |
|--------|-------------------------------|--------|------|---------|----------------------|---|---|
|        |                               | 0-1000 | %    | 0       | P                    | S | T |

Set up 2<sup>nd</sup> inertia ratio  
 Set up the ratio of the load inertia against the rotor of the motor ratio.  
 PR6.13= ( load inertia/ rotor inertia ) \* 100 【%】

| Pr6.14 | Emergency stop time at alarm | Range  | unit | default | Related control mode |   |   |
|--------|------------------------------|--------|------|---------|----------------------|---|---|
|        |                              | 0-1000 | 1ms  | 200     | P                    | S | T |

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

| Pr6.20 | Trial run distance | Range | unit   | default | Related control mode |  |  |
|--------|--------------------|-------|--------|---------|----------------------|--|--|
|        |                    | 0-200 | 0.1rev | 10      | P                    |  |  |

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

| Pr6.21 | Trial run waiting time | Range   | unit | default | Related control mode |  |  |
|--------|------------------------|---------|------|---------|----------------------|--|--|
|        |                        | 0-30000 | Ms   | 1000    | P                    |  |  |

The waiting time after running each time in JOG run(position control)

| Pr6.22 | Trial run cycle times | Range   | unit | default | Related control mode |  |  |
|--------|-----------------------|---------|------|---------|----------------------|--|--|
|        |                       | 0-32767 | -    | 10      | P                    |  |  |

The cycling times of JOG run(position control)

| Pr6.25 | Acceleration of trial running | Range   | unit | default | Related control mode |  |  |
|--------|-------------------------------|---------|------|---------|----------------------|--|--|
|        |                               | 0-32767 | -    | 10      | P                    |  |  |

## Acceleration of trial running

| Pr6.26 | Mode of trial running | Range   | unit | default | Related control mode |  |  |
|--------|-----------------------|---------|------|---------|----------------------|--|--|
|        |                       | 0-32767 | -    | 10      | P                    |  |  |

Mode of trial running

| Pr7.19 | Weak magnetic current | Range | unit | default | Related control mode |   |   |
|--------|-----------------------|-------|------|---------|----------------------|---|---|
|        |                       | 0-100 | %    | 0       | P                    | S | T |

0: automatic operation  
Manual operation, do not set if you are not professional, to avoid motor demagnetization.

## Chapter 6 Alarm and Processing

### 6.1 Alarm List

Protection function is activated when an error occurs, the driver 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  |  | history   | Immediate stop | Can be cleared |
| 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    | Driver over-heat                                   | ●         | ●              |                |
| 10         | 0    | Motor over-load                                    | ●         |                | ●              |
|            | 1    | Driver 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 this error history record

Emergency: error, driver will stop immediately

May remove: may through SI input/panel/software ACH Series remove alarm

## 6.2 Alarm Processing Method

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

|                              |      |       |   |
|------------------------------|------|-------|---|
| <b>Error code</b>            | Main | Extra | <b>Display:</b> “Er 090” -- “Er 09F”                |
|                              | 09   | 0~F   | <b>Content:</b> FPGA communication error            |
| <b>Cause</b>                 |      |       | <b>Confirmation</b>                                 |
| L1,L2 terminal under-voltage |      |       | Check L1,L2 terminal voltage                        |
| Driver internal fault        |      |       | /   |
| <b>Solution</b>              |      |       |   |
| L1,L2 terminal under-voltage |      |       | Make sure voltage of L1,L2 terminal in proper range |
| Driver internal fault        |      |       | replace the driver with a new one                   |

|   |      |       |  |
|---|------|-------|--|
| <b>Error code</b>                                       | Main | Extra | <b>Display:</b> “Er 0A0” -- “Er 0A1”                   |
|   | 0A   | 0~1   | <b>Content:</b> current detection circuit error        |
| <b>Cause</b>  |      |       | <b>Confirmation</b>                                    |
| Wiring error of motor output U,V,W terminal             |      |       | Check wiring of motor output U,V,W terminal            |
| Main voltage L1,L2,L3 terminal voltage whether over-low |      |       | Check main voltage L1,L2,L3 terminal voltage           |
| Driver inner fault                                      |      |       | /  |
| <b>Solution</b>   |      |       |  |
| Wiring error of motor output U,V,W terminal             |      |       | Make sure motor U,V,W terminal wiring correctly        |
| Main voltage L1,L2,L3 terminal voltage whether over-low |      |       | Make sure voltage of L1,L2,L3 terminal in proper range |
| Driver inner fault                                      |      |       | replace the driver with a new one                      |

|                           |      |       |  |
|---------------------------|------|-------|--|
| <b>Error code</b>         | Main | Extra | <b>Display:</b> “Er 0A2”、 “Er 0A4”         |
|                           | 0A   | 2、4   | <b>Content:</b> analog input circuit error |
| <b>Cause</b>              |      |       | <b>Confirmation</b>                        |
| Analog input Wiring error |      |       | Check wiring of analog input               |
| Driver inner fault        |      |       | /  |
| <b>Solution</b>           |      |       |  |
| Analog input Wiring error |      |       | Make sure analog input wiring correctly    |
| Driver inner fault        |      |       | replace the driver with a new one          |

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

|  |      |       |  |
|--|------|-------|--|
| <b>Error code</b>                            | Main | Extra | <b>Display:</b> “Er 0A5”                               |
|  | 0A   | 5     | <b>Content:</b> DC bus circuit error                   |
| <b>Cause</b>                                 |      |       | <b>Confirmation</b>                                    |
| Main voltage L1,L2,L3 terminal under-voltage |      |       | Check L1,L2,L3 terminal voltage                        |
| Driver inner fault                           |      |       | /  |
| <b>Solution</b>                              |      |       |  |
| Main voltage L1,L2,L3 terminal under-voltage |      |       | Make sure voltage of L1,L2,L3 terminal in proper range |
| Driver inner fault                           |      |       | replace the driver with a new one                      |

|                   |      |       |   |
|-------------------|------|-------|---|
| <b>Error code</b> | Main | Extra | <b>Display:</b> “Er 0A6”                            |
|                   | 0A   | 6     | <b>Content:</b> temperature detection circuit error |
| <b>Cause</b>      |      |       | <b>Confirmation</b>                                 |
| L1,L2,L3 terminal |      |       | Check L1,L2,L3 terminal                             |
| <b>Solution</b>   |      |       |   |
| L1,L2,L3 terminal |      |       | Make sure voltage of L1,L2,L3 terminal in           |

|                    |         |                                   |
|--------------------|---------|-----------------------------------|
| under-voltage      | voltage | proper range                      |
| Driver inner fault | /       | replace the driver with a new one |

|                                 |      |                                 |  |
|---------------------------------|------|---------------------------------|--|
| <b>Error code</b>               | Main | Extra                           | <b>Display:</b> “Er 0b0”                               |
|                                 | 0b   | 0                               | <b>Content:</b> control power under-voltage            |
| <b>Cause</b>                    |      | <b>Confirmation</b>             | <b>Solution</b>  |
| L1,L2,L3 terminal under-voltage |      | Check L1,L2,L3 terminal voltage | Make sure voltage of L1,L2,L3 terminal in proper range |
| Driver inner fault              |      | /                               | replace the driver with a new one                      |

|   |      |                                 |                                     |
|---|------|---------------------------------|-------------------------------------|
| <b>Error code</b>                         | Main | Extra                           | <b>Display:</b> “Er 0c0”            |
|   | 0c   | 0                               | <b>Content:</b> DC bus over-voltage |
| <b>Cause</b>                              |      | <b>Confirmation</b>             | <b>Solution</b>                     |
| Main power L1,L2,L3 terminal over-voltage |      | Check L1,L2,L3 terminal voltage | decrease L1,L2,L3 terminal Voltage  |
| Inner brake circuit damaged               |      | /                               | replace the driver with a new one   |
| Driver inner fault                        |      | /                               | replace the driver with a new one   |

|  |      |                                 |                                      |
|--|------|---------------------------------|--------------------------------------|
| <b>Error code</b>                          | Main | Extra                           | <b>Display:</b> “Er 0d0”             |
|  | 0d   | 0                               | <b>Content:</b> DC bus under-voltage |
| <b>Cause</b>                               |      | <b>Confirmation</b>             | <b>Solution</b>                      |
| Main power L1,L2,L3 terminal under-voltage |      | Check L1,L2,L3 terminal voltage | increase L1,L2 terminal Voltage      |
| Driver inner fault                         |      | /                               | replace the driver with a new one    |

|                                       |      |  |  |
|---------------------------------------|------|--|--|
| <b>Error code</b>                     | Main | Extra  | <b>Display:</b> “Er 0E0”   |
|                                       | 0E   | 0  | <b>Content:</b> over-current                                       |
| <b>Cause</b>                          |      | <b>Confirmation</b>  | <b>Solution</b>  |
| Short of driver output wire           |      | Short of driver output wire, whether short circuit to PG ground or not                                 | Assure driver output wire no short circuit, assure motor no damage |
| Abnormal wiring of motor              |      | Check motor wiring order   | Adjust motor wiring sequence                                       |
| Short of IGBT module                  |      | Cut off driver output wiring, make srv_on available and drive motor, check whether over-current exists | replace the driver with a new one                                  |
| abnormal setting of control parameter |      | Modify the parameter   | Adjust parameter to proper range                                   |
| abnormal setting of control command   |      | Check control command whether command changes too violently or not                                     | Adjust control command: open filter function                       |

|                             |      |   |  |
|-----------------------------|------|---|--|
| <b>Error code</b>           | Main | Extra   | <b>Display:</b> “Er 0E1”   |
|                             | 0E   | 1   | <b>Content:</b> IPM over-current                                   |
| <b>Cause</b>                |      | <b>Confirmation</b>   | <b>Solution</b>  |
| Short of driver output wire |      | Short of driver output wire, whether short circuit to PG ground or not  | Assure driver output wire no short circuit, assure motor no damage |
| Abnormal wiring of motor    |      | Check motor wiring order  | Adjust motor wiring sequence                                       |
| Short of IGBT module        |      | Cut off driver output wiring, make srv_on available and drive motor, check whether over-current exists or not | replace the driver with a new one                                  |

|                                       |  |  |
|---------------------------------------|--|--|
| Short of IGBT module                  | /  | replace the driver with a new one            |
| abnormal setting of control parameter | Modify the parameter   | Adjust parameter to proper range             |
| abnormal setting of control command   | Check control command whether command changes too violently or not | Adjust control command: open filter function |

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

|                               |      |   |  |
|-------------------------------|------|---|--|
| <b>Error code</b>             | Main | Extra   | <b>Display:</b> “Er 100”   |
|                               | 10   | 0   | <b>Content:</b> motor over-load  |
| <b>Cause</b>                  |      | <b>Confirmation</b>   | <b>Solution</b>  |
| Load is too heavy             |      | Check actual load if the value of parameter exceed maximum or not | Decrease load, adjust limit parameter  |
| Oscillation of machine        |      | Check the machine if oscillation exists or not                    | Modify the parameter of control loop; enlarge acceleration/deceleration time |
| wiring error of motor         |      | Check wiring if error occurs or not, if line breaks or not        | Adjust wiring or replace encoder/motor for a new one                         |
| electromagnetic brake engaged |      | Check brake terminal voltage                                      | Cut off brake  |

|                                  |      |  |  |
|----------------------------------|------|--|--|
| <b>Error code</b>                | Main | Extra  | <b>Display:</b> “Er 101”   |
|                                  | 10   | 1  | <b>Content:</b> Driver over-load                                 |
| <b>Cause</b>                     |      | <b>Confirmation</b>  | <b>Solution</b>  |
| 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 |
| Motor dosen't match the driver   |      | Driver over-current  | Motor current exceed driver current                              |

|  |      |  |  |
|--|------|--|--|
| <b>Error code</b>  | Main | Extra  | <b>Display:</b> “Er 120”   |
|  | 12   | 0  | <b>Content:</b> Resistance discharge circuit over-load   |
| <b>Cause</b>   |      | <b>Confirmation</b>  | <b>Solution</b>  |
| 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 driver and motor |
| Resistance discharge circuit damage                                      |      | /  | Increase external regenerative resistor, replace the driver with a new one   |

|                        |      |                                |                               |
|------------------------|------|--------------------------------|-------------------------------|
| <b>Error code</b>      | Main | Extra                          | <b>Display:</b> “Er 121”      |
|                        | 12   | 1                              | <b>Content:</b> braking error |
| <b>Cause</b>           |      | <b>Confirmation</b>            | <b>Solution</b>               |
| Braking circuit damage |      | Braking resistor short circuit | Change a new braking resistor |
|                        |      | Braking IGBT damaged           | Repair IGBT                   |

|                                   |      |  |                                    |
|-----------------------------------|------|--|------------------------------------|
| <b>Error code</b>                 | Main | Extra  | <b>Display:</b> “Er 150”           |
|                                   | 15   | 0  | <b>Content:</b> encoder line broke |
| <b>Cause</b>                      |      | <b>Confirmation</b>                          | <b>Solution</b>                    |
| Encoder line disconnected         |      | check wiring if it steady or not             | Make encoder wiring steady         |
| Encoder wiring error              |      | Check encoder wiring if it is correct or not | Reconnect encoder wiring           |
| Encoder damaged                   |      | /  | replace the motor with a new one   |
| Encoder measuring circuit damaged |      | /  | replace the driver with a new one  |
| <b>Error code</b>                 | Main | Extra  | <b>Display:</b> “Er 151”           |
|                                   | 15   | 1  | <b>Content:</b> encoder data error |
| <b>Cause</b>                      |      | <b>Confirmation</b>                          | <b>Solution</b>                    |
| Encoder data error                |      | Check for interference                       | Anti-interference treatment        |

|                                   |      |   |  |
|-----------------------------------|------|---|--|
| <b>Error code</b>                 | Main | Extra   | <b>Display:</b> “Er 152”   |
|                                   | 15   | 2   | <b>Content:</b> initialized position of encoder error  |
| <b>Cause</b>                      |      | <b>Confirmation</b>   | <b>Solution</b>  |
| Communication data abnormal       |      | Check encoder power voltage if it is $DC5V \pm 5\%$ 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 |
| Encoder damaged                   |      | /   | replace the motor with a new one   |
| Encoder measuring circuit damaged |      | /   | replace the driver with a new one  |

|                                       |      |                     |   |
|---------------------------------------|------|---------------------|---|
| <b>Error code</b>                     | Main | Extra               | <b>Display:</b> “Er 153”                        |
|                                       | 15   | 3                   | <b>Content:</b> encoder battery under voltage   |
| <b>Cause</b>                          |      | <b>Confirmation</b> | <b>Solution</b>                                 |
| Multi-turn absolute encoder power off |      | Check battery       | Change a battery                                |
|                                       |      | /Check motor        | Motor damaged, replace the motor with a new one |
|                                       |      | /Clear drive alarm  | Clear alarm after changing battery              |

|                                   |      |  |  |
|-----------------------------------|------|--|--|
| <b>Error code</b>                 | Main | Extra  | <b>Display:</b> “Er 170”   |
|                                   | 17   | 0  | <b>Content:</b> encoder data error   |
| <b>Cause</b>                      |      | <b>Confirmation</b>  | <b>Solution</b>  |
| Communication data abnormal       |      | Check encoder power voltage if it is $DC5V \pm 5\%$ 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 |
| Encoder damaged                   |      | /  | replace the motor with a new one   |
| Encoder measuring circuit damaged |      | /  | replace the driver with a new one  |

|              |      |       |                          |
|--------------|------|-------|--------------------------|
| <b>Error</b> | Main | Extra | <b>Display:</b> “Er 171” |
|--------------|------|-------|--------------------------|

|                        |                     |   |   |
|------------------------|---------------------|---|---|
| <b>code</b>            | 17                  | 1 | <b>Content:</b> motor parameters error  |
| <b>Cause</b>           | <b>Confirmation</b> |   | <b>Solution</b>   |
| Motor parameters error |                     |   | Input motor parameters to match with driver or replace the motor with a new one |

|  |   |       |  |
|--|---|-------|--|
| <b>Error code</b>                            | Main  | Extra | <b>Display:</b> “Er 180”   |
|  | 18  | 0     | <b>Content:</b> position error over-large error                        |
| <b>Cause</b>                                 | <b>Confirmation</b>   |       | <b>Solution</b>  |
| Unreasonable set of position error parameter | Check parameter PA_014 value if it is too small or not  |       | Enlarge the value of PA_014  |
| Gain set is too small                        | Check parameter PA_100, PA_105 value if it is too small or not  |       | Enlarge the value of PA_100, PA_105                                    |
| Torque limit is too small                    | Check parameter PA_013, PA_522 value whether too small or not   |       | Enlarge the value of PA_103, PA_522                                    |
| 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 |       | Increase acceleration/ deceleration time decrease speed, decrease load |

|   |   |       |  |
|---|---|-------|--|
| <b>Error code</b>   | Main  | Extra | <b>Display:</b> “Er 181”   |
|   | 18  | 1     | <b>Content:</b> velocity error over-large error  |
| <b>Cause</b>  | <b>Confirmation</b>   |       | <b>Solution</b>  |
| The deviation of inner position command velocity is too large with actual speed | Check the value of PA_602 if it is too small or not         |       | Enlarge the value of PA_602, or set the value to 0, make position deviation over-large detection invalid |
| The acceleration/ decelerate time Inner position command velocity is too small  | Check the value of PA_312, PA_313 if it is too small or not |       | Enlarge the value of PA_312, PA_313. adjust gain of velocity control, improve trace performance.         |

|                            |                            |       |                                    |
|----------------------------|----------------------------|-------|------------------------------------|
| <b>Error code</b>          | Main                       | Extra | <b>Display:</b> “Er 190”           |
|                            | 19                         | 0     | <b>Content:</b> motor vibration    |
| <b>Cause</b>               | <b>Confirmation</b>        |       | <b>Solution</b>                    |
| Current vibration          | Current vibration          |       | Cut down the value of Pr003. Pr004 |
| Current loop is too strong | Current loop is too strong |       |                                    |

|   |  |       |   |
|---|--|-------|---|
| <b>Error code</b>                                       | Main   | Extra | <b>Display:</b> “Er 1A0”  |
|   | 1A   | 0     | <b>Content:</b> over-speed 1  |
| <b>Cause</b>  | <b>Confirmation</b>  |       | <b>Solution</b>   |
| Motor speed has exceeded the first speed limit (PA_321) | 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 PA_321 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 PA_321 value, modify command pulse input frequency and division frequency coefficient, assure encoder wiring correctly |

|                       |      |   |   |
|-----------------------|------|---|---|
| <b>Error code</b>     | Main | Extra   | <b>Display:</b> “Er 1A1”  |
|                       | 1A   | 1   | <b>Content:</b> speed out of control  |
| <b>Cause</b>          |      | <b>Confirmation</b>   | <b>Solution</b>   |
| Control maladjustment |      | UVW wrong connection  |   |
| Encoder error         |      | Monitor D30 count increasing  | Anti-interference treatment or change motor   |
| Special application   |      | The rotation direction of the motor is opposite with motor force direction. | The special assessment of practical application, set 0 to 4 for PA137 to shield ERR1A1 alarm. |

|                                       |      |                          |  |
|---------------------------------------|------|--------------------------|--|
| <b>Error code</b>                     | Main | Extra                    | <b>Display:</b> “Er 1b0”   |
|                                       | 1b   | 0                        | <b>Content:</b> input pulse format incorrect or out of frequency |
| <b>Cause</b>                          |      | <b>Confirmation</b>      | <b>Solution</b>  |
| The input pulse frequency is too high |      | Too high pulse frequency | To decrease pulse input frequency, less than 500K                |

|                   |      |   |   |
|-------------------|------|---|---|
| <b>Error code</b> | Main | Extra   | <b>Display:</b> “Er 1b1”                        |
|                   | 1b   | 1   | <b>Content:</b> incorrect electronic gear ratio |
| <b>Cause</b>      |      | <b>Confirmation</b>   | <b>Solution</b>                                 |
| Out of range      |      | Numerator denominator is zero, or setting values out of range | Reduce the number of pulses per revolution      |

|   |      |  |  |
|---|------|--|--|
| <b>Error code</b>   | Main | Extra  | <b>Display:</b> “Er 210”   |
|   | 21   | 0  | <b>Content:</b> I/F input interface allocation error                     |
| <b>Cause</b>  |      | <b>Confirmation</b>  | <b>Solution</b>  |
| The input signal are assigned with two or more functions. |      | Check the value of PA_400, PA_401, PA_402,PA_403,PA_404 if it is proper or not | Assure the value of PA_400, PA_401, PA_402, PA_403, PA_404 set correctly |
| The input signal aren't assigned with any functions.      |      | Check the value of PA_400, PA_401,PA_402,PA_403,PA_404 if it is proper or not  | Assure parameter PA_400, PA_401, PA_402,PA_403,PA_404 set correctly      |

|                         |      |  |  |
|-------------------------|------|--|--|
| <b>Error code</b>       | Main | Extra  | <b>Display:</b> “Er 211”   |
|                         | 21   | 1  | <b>Content:</b> I/F input interface function set error                   |
| <b>Cause</b>            |      | <b>Confirmation</b>  | <b>Solution</b>  |
| Signal allocation error |      | Check the value of PA_400, PA_401, PA_402,PA_403,PA_404 if it is proper or not | Assure the value of PA_400, PA_401, PA_402, PA_403, PA_404 set correctly |

|   |      |   |  |
|---|------|---|--|
| <b>Error code</b>   | Main | Extra   | <b>Display:</b> “Er 212”                               |
|   | 21   | 2   | <b>Content:</b> I/F input interface function set error |
| <b>Cause</b>  |      | <b>Confirmation</b>   | <b>Solution</b>  |
| The input signal are assigned with two or more functions. |      | Check the value of PA_410, PA_411, PA_412, PA_413, if it is | Assure the value of PA_410, PA_411, PA_412,PA_413 set  |

|  |   |  |
|--|---|--|
|  | proper or not   | correctly  |
| The input signal aren't assigned with any functions. | Check the value of PA_410, PA_411, PA_412, PA_413, if it is proper or not | Assure the value of PA_410, PA_411, PA_412, PA_413 set correctly |

|  |      |  |   |
|--|------|--|---|
| <b>Error code</b>  | Main | Extra  | <b>Display:</b> “Er 240”  |
|  | 24   | 0  | <b>Content:</b> CRC verification error when EEPROM parameter is saved |
| <b>Cause</b>   |      | <b>Confirmation</b>  | <b>Solution</b>   |
| L1,L2,L3 terminal under-voltage  |      | Check L1,L2,L3 terminal voltage                              | Assure L1,L2,L3 terminal voltage in proper range                      |
| Driver is damaged  |      | save the parameters again                                    | replace the driver with a new one                                     |
| The setting of driver maybe default setting which isn't suitable for motor . |      | Check the setting of driver if it is suitable for your motor | Download the suitable project file to driver for motor                |

|  |      |   |   |
|--|------|---|---|
| <b>Error code</b>  | Main | Extra   | <b>Display:</b> “Er 260”                                  |
|  | 26   | 0   | <b>Content:</b> positive negative over-travel input valid |
| <b>Cause</b>   |      | <b>Confirmation</b>   | <b>Solution</b>   |
| positive /negative over-travelling input signal has been conducted |      | Check the state of positive negative over-travel input signal | /   |

|                           |      |                     |   |
|---------------------------|------|---------------------|---|
| <b>Error code</b>         | Main | Extra               | <b>Display:</b> “Er 270~ Er 272”                |
|                           | 27   | 0~2                 | <b>Content:</b> analog input out of range       |
| <b>Cause</b>              |      | <b>Confirmation</b> | <b>Solution</b>                                 |
| Analog input out of range |      |                     | Try to adjust analog input within limited range |

|  |      |                                 |  |
|--|------|---------------------------------|--|
| <b>Error code</b>                            | Main | Extra                           | <b>Display:</b> “ Er 570”                |
|  | 57   | 0                               | <b>Content:</b> forced alarm input valid |
| <b>Cause</b>                                 |      | <b>Confirmation</b>             | <b>Solution</b>                          |
| Forced-alarm input signal has been conducted |      | Check forced-alarm input signal | Assure 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

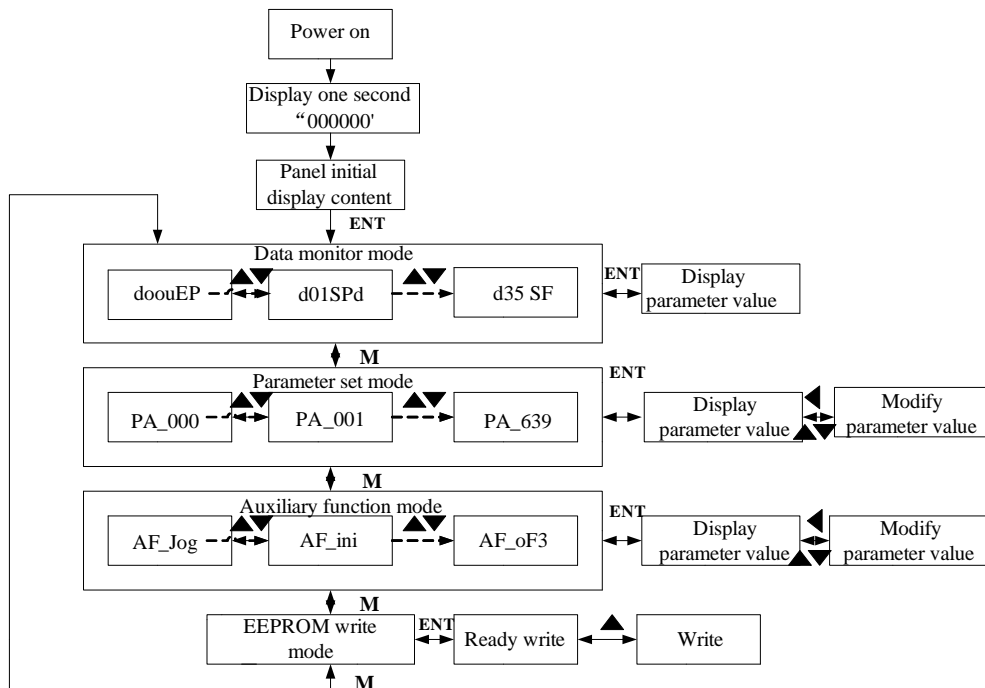
### For alarm can not be cleared:

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



## 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 driver. 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 No, press ▲ or ▼ to change current editing bit of parameters No. Press ENT key to enter the parameter setting mode of corresponding parameters No. 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 No.

### 7.2.2 Driver Operating Data Monitor

**Table 7.2 Function List of Driver 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”<br>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 command               | 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    | /   | d07    | /     | " xxxx"   |
| 8  | d08FP  | External scale feedback pulse sum                         | d08FP  | pulse | Low-bit "L xxxx"<br>High -bit"H xxxx"                                       |
| 9  | d09cn  | Control mode  | d09Cn  | /     | Position:"PoScn"<br>Speed:"SPden"<br>Torque:"trqcn"<br>Composite mode" 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  | Driver 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  | Driver temperature  | d33At  | °C    | "th xxx"  |
| 34 | d34    | /   | d34    | /     | "t xxx"   |



|   |                   |    |  |    |                          |
|---|-------------------|----|--|----|--------------------------|
| 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                   | PA_504=0,POT is open , speed command is positive direction<br>NOT is open , speed command is negative direction |
| 4    | cP 4         | Driver fault                             | /   |
| 5    | cP 5         | The relay inside the driver isn't closed | /   |
| 6    | cP 6         | Pulse input prohibited (INH)             | PA_518=0,INH is open  |
| 8    | cP 8         | CL is valid                              | PA_517=0,deviation counter clear is connected to COM-   |
| 9    | cP 9         | speed zero-clamp is valid                | PA_315=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 panel lock    | AFunL        | 1. press SET to enter operation, display “unL -”。<br>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 | <ol style="list-style-type: none"> <li>1. Press SET once to enter operation, display “Enc_”</li> <li>2. press ▲ once , display “StArt”, indicated start to correct the angle, then display “FiniSh” indicated correction finished</li> </ol>   |
| 8  | AF tUn | Reserved                     | AFtUn |  |
| 9  | AF_GL  | Inertia ratio identification | AF_GL | <ol style="list-style-type: none"> <li>1. Press SET once to enter operation, display “G---”</li> <li>2. Press ◀ once, display “StUon”</li> <li>3. Press ▲, motor running, indicated start to identification</li> <li>4. Finishing, display G xxx, xxx indicated Inertia ratio value</li> </ol> |
| 10 | AFrSt  | Soft reset                   | AFrSt | <ol style="list-style-type: none"> <li>1. Press SET once to enter operation, display “rSt_”</li> <li>2. Press ▲ and hold on, display “StArt” Then, finished</li> </ol>   |

**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 become” 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 driver need to repair.
5. The driver need 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 a 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 driver 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 driver without fail. the PE terminal of driver must be reliably connected with the grounding terminal of equipment.
- The driver 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 Svon signal must be invalid before restarting the driver.
- The high voltage also will contain in several minutes even if the servo driver 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 need to test the driver without load for safety first.

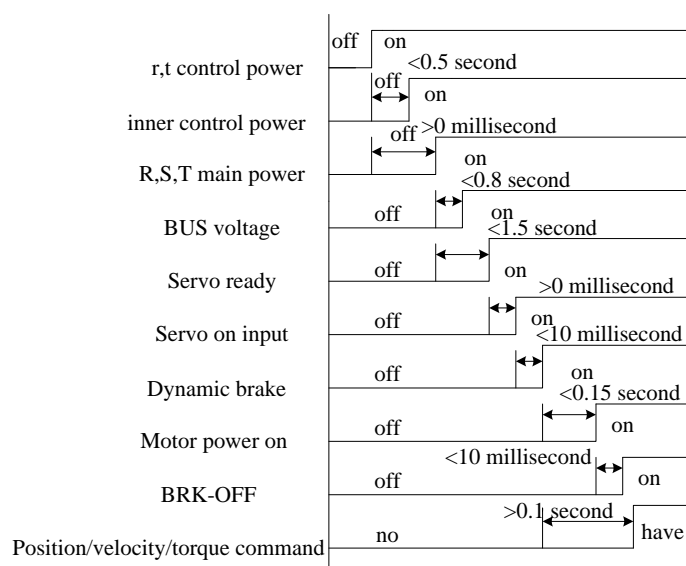
**Contact [tech@leadshine.com](mailto:tech@leadshine.com) if you need more technical service .**

### 7.3.1 Inspection Before trial Run

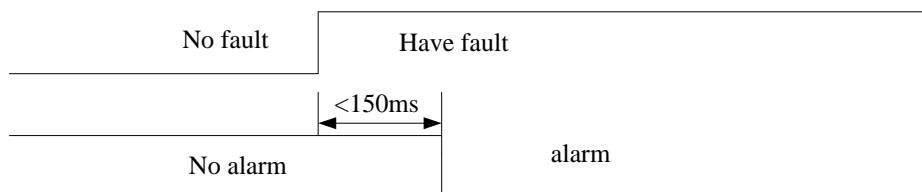
**Table7.6 inspection Item Before Run**

| 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 driver is no more 1.5kw .  |
| 3  | Fixing of position           | the motor and driver must be firmly fixed   |
| 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 enable 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

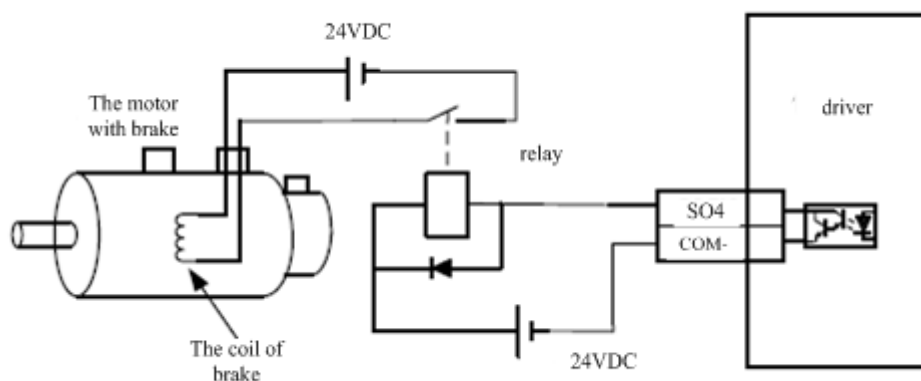
In applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling gravity while the power to the servo is shut off.

**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 driver 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 driver.

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 driver 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  | PA_001    | Control mode setting                         | 1              | /           |
| 2  | PA_312    | Acceleration time setup                      | User-specified | millisecond |
| 3  | PA_313    | Deceleration time setup                      | User-specified | millisecond |
| 4  | PA_314    | Sigmoid acceleration/deceleration time setup | User-specified | millisecond |
| 5  | PA_604    | JOG trial run command speed                  | User-specified | rpm         |

**Table 7.8 Parameter Setup of Position JOG**

| No | parameter | name   | value          | unit         |
|----|-----------|--|----------------|--------------|
| 1  | PA_001    | Control mode setting                         | 0              | /            |
| 2  | PA_312    | Acceleration time setup                      | User-specified | millisecond  |
| 3  | PA_313    | Deceleration time setup                      | User-specified | millisecond  |
| 4  | PA_314    | Sigmoid acceleration/deceleration time setup | 0              | millisecond  |
| 5  | PA_604    | JOG trial run command speed                  | User-specified | rpm          |
| 6  | PA_620    | distance of trial running                    | User-specified | 0.1 rotation |
| 7  | PA_621    | waiting time of trial running                | User-specified | millisecond  |
| 8  | PA_622    | 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 driver 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 **STOP** once, and display " **Srvon** " if no exception occurs; press **STOP** 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 **STOP** once, the motor rotates once (hold **STOP** will make motor rotating to value of Pr6.04 ); press **STOP** once, the motor rotates once (hold **STOP** 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

ELP series AC servo drives 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              | PA_001=0  | The position control is performed based on the positional command (pulse train) from the host controller or the command set in the servo driver. |
| 2  | Velocity mode              | PA_001=1  | The velocity control is performed according to the analog speed command from the host controller or the speed command set in the servo driver.   |
| 3  | Torque mode                | PA_001=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 driver.  |
| 4  | 1st mode:<br>position mode | PA_001=3  | The control mode is switched through external input.   |

|   |  |          |  |
|---|--|----------|--|
|   | 2nd mode:<br>speed mode                                |          |  |
| 5 | 1st mode:<br>position mode<br>2nd Mode:<br>torque mode | PA_001=4 | The control mode is switched through external input. |
| 6 | 1st mode:<br>speed mode<br>2nd Mode:<br>torque mode    | PA_001=5 | The control mode is switched through external input. |

The step of changing the operation mode:

- 1, Switch the driver 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.

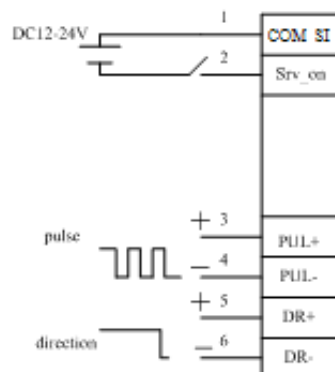
## 8.1 Position Control

**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  | PA_001    | control mode setup                           | /      | 0              | /           |
| 2  | PA_006    | command pulse rotational direction setup     |        | 0              |             |
| 3  | PA_007    | command pulse input mode setup               |        | 0~3            |             |
| 4  | PA_008    | Command pulse per one motor revolution       |        | User-specified | Pulse       |
| 5  | PA_009    | 1st numerator of electronic gear             |        | 1              |             |
| 6  | PA_010    | denominator of electronic gear               |        | 1              |             |
| 7  | PA_312    | Acceleration time setup                      | /      | User-specified | millisecond |
| 8  | PA_313    | Deceleration time setup                      | /      | User-specified | millisecond |
| 9  | PA_314    | Sigmoid acceleration/deceleration time setup | /      | User-specified | millisecond |
| 10 | PA_518    | Command pulse prohibit input invalidation    | /      | 1              | /           |
| 11 | PA_400    | SII input select                             | Srv_on | Hex:0003       | /           |

### ◆ Wiring Diagram



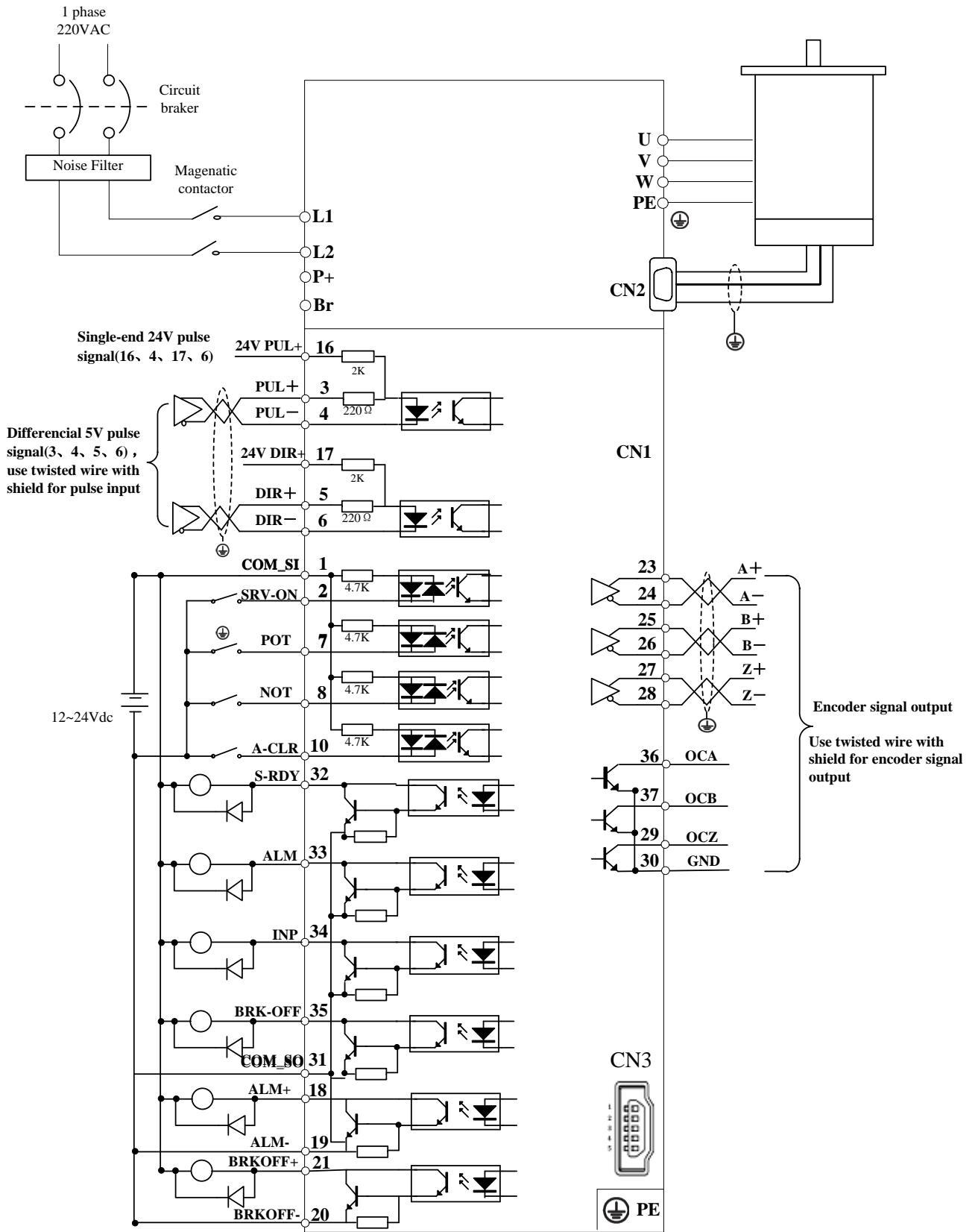
**Figure 8-1 Control Terminal CN1 Signal Wiring in Position Control Mode**

### ◆ Operation Steps

1. connect terminal CN1.
2. Enter the power (DC12V to 24V) to control signal (the COM\_SI + and SII).
3. Enter the power to the driver.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the driver)

- 
5. Connect the Srv\_on input to bring the driver 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 driver is widely used for precise positioning in position control mode.


**Figure 8-2 Position Mode Typical Wiring Diagram**
**Note:**

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

## Relevant parameters setup of position control mode

### 8.1.1 Process of command pulse input

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

- ◆ A, B phase pulse
- ◆ Positive direction pulse/negative direction pulse
- ◆ Pulse + sign

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

| Pr0.06*  |                         | Command Pulse Rotational Direction Setup            | Range               | unit                       | default                    | Related control mode |     |     |
|--|-------------------------|---|---------------------|----------------------------|----------------------------|----------------------|-----|-----|
|  |                         |   | 0 -1                | -                          | 0                          | P                    |     |     |
| Set command pulse input rotate direction, command pulse input type         |                         |   |                     |                            |                            |                      |     |     |
| Pr0.07*  |                         | Command Pulse Input Mode Setup                      | Range               | unit                       | default                    | Related control mode |     |     |
|  |                         |   | 0 -3                | -                          | 3                          | P                    |     |     |
| Pr0.06   | Pr0.07                  | Command Pulse Format                                | Signal              | Positive Direction Command | Negative Direction Command |                      |     |     |
| 0  | 0 or 2                  | 90 phase difference 2-phase pulse(A phase +B phase) | Pulse sign          |                            |                            |                      |     |     |
|  | 1                       | Positive direction pulse + negative direction pulse | Pulse sign          |                            |                            |                      |     |     |
|  | 3                       | Pulse + sign  | Pulse sign          |                            |                            |                      |     |     |
| 1  | 0 or 2                  | 90 phase difference 2 phase pulse(A phase +B phase) | 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 |  | Command pulse counts per one motor revolution | Range         | unit  | default | Related control mode |   |   |
|--------|--|---|---------------|-------|---------|----------------------|---|---|
|        |  |   | 0-8388<br>608 | pulse | 0       | P                    | S | T |

Set the command pulse that causes single turn of the motor shaft.

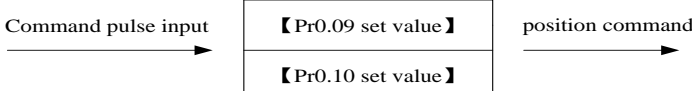
- 1) If  $pr008 \neq 0$ , the actual turns = pulse number / Pr008
- 2) If  $pr008 = 0$ , Pr009 1<sup>st</sup> numerator of electronic gear and Pr0.10 Denominator of electronic Gear become valid.

|               |                                  |                  |      |         |                      |  |
|---------------|----------------------------------|------------------|------|---------|----------------------|--|
| <b>Pr0.09</b> | 1st numerator of electronic gear | Range            | unit | default | Related control mode |  |
|               |                                  | 1-10737<br>41824 | -    | 1       | P                    |  |

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

|               |                                |                  |      |         |                      |  |
|---------------|--------------------------------|------------------|------|---------|----------------------|--|
| <b>Pr0.10</b> | denominator of electronic gear | Range            | unit | default | Related control mode |  |
|               |                                | 1-10737<br>41824 | -    | 1       | P                    |  |

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

| Pr0.09  | Pr0.10  | Command division/multiplication operation  |
|---------|---------|--|
| 1-32767 | 1-32767 |  |

1、 Settings:

- (1)The driver 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:

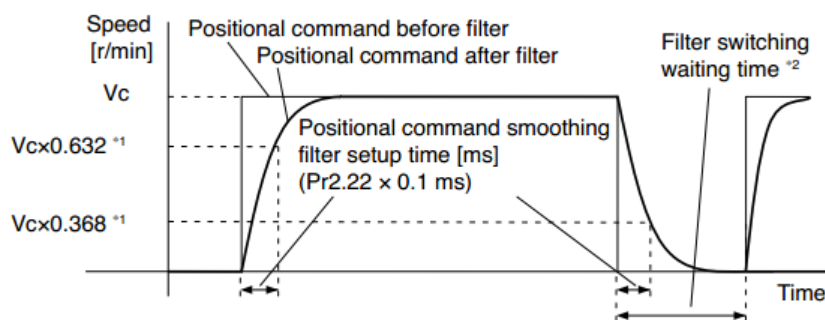
- (1) $Y=X* Pr0.09 / Pr0.10$
- (2)17Bit encoder:  $Z=2^{17} = 131072$
- 23Bit encoder:  $Z=2^{23} = 8388608$

### 8.1.3 Position command filter

To make the positional command divided or multiplied by the electronic gear smooth, set the command filter.

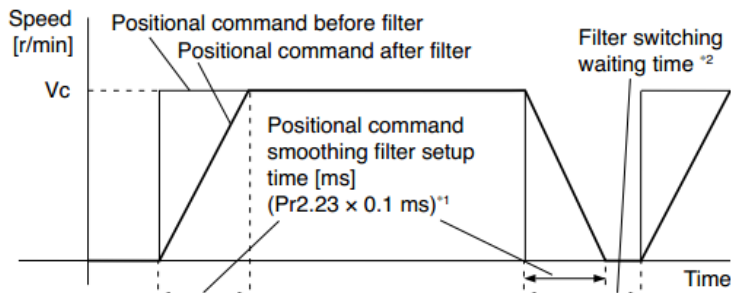
|               |                                     |          |       |         |                      |  |
|---------------|-------------------------------------|----------|-------|---------|----------------------|--|
| <b>Pr2.22</b> | positional command smoothing filter | Range    | unit  | default | Related control mode |  |
|               |                                     | 0 -32767 | 0.1ms | 0       | P                    |  |

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



|               |                               |          |       |         |                      |  |  |
|---------------|-------------------------------|----------|-------|---------|----------------------|--|--|
| <b>Pr2.23</b> | positional command FIR filter | Range    | unit  | default | Related control mode |  |  |
|               |                               | 0 -10000 | 0.1ms | 0       | P                    |  |  |

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



### 8.1.4 Motor encoder pulse output

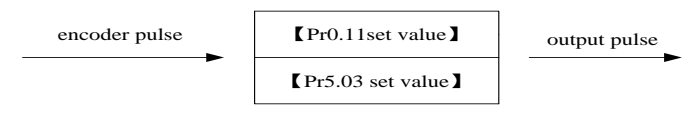
The information on the amount of movement can be sent to the host controller in the form of A and B phase pulses from the servo driver.

|                |  |        |      |         |                      |   |   |
|----------------|--|--------|------|---------|----------------------|---|---|
| <b>Pr0.11*</b> | Output pulse counts per one motor revolution | Range  | unit | default | Related control mode |   |   |
|                |  | 1-2500 | P/r  | 2500    | P                    | S | T |

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

|                |                                      |        |      |         |                      |   |   |
|----------------|--------------------------------------|--------|------|---------|----------------------|---|---|
| <b>Pr5.03*</b> | denominator of pulse output division | Range  | unit | default | Related control mode |   |   |
|                |                                      | 1-2500 | -    | 2500    | P                    | S | T |

**Combination of Pr0.11 Output pulse counts per one motor revolution and Pr5.03 Denominator of pulse output division**

| Pr0.11 | Pr5.03 | Pulse output process   |
|--------|--------|--|
| 1-2500 | 1-2500 |  |


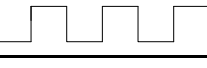
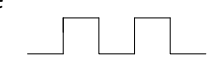
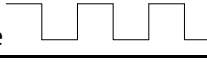
Pulse output resolution after dividing double frequency 4 times


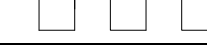
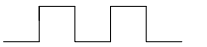

$$\text{Pulse output resolution} = \text{encoder} \times 4 \times \frac{\text{Pr0.11}(\text{pulse output divide frequency molecule})}{\text{Pr5.03}(\text{pulse output divide frequency denominator})}$$

|                |                                |       |      |         |                      |   |   |
|----------------|--------------------------------|-------|------|---------|----------------------|---|---|
| <b>Pr0.12*</b> | reversal of pulse output logic | Range | unit | default | Related control mode |   |   |
|                |                                | 0-1   | -    | 0       | P                    | S | T |

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

< reversal of pulse output logic >

| Pr0.12 | B-phase Logic | CCW Direction Rotation   | CW Direction Rotation  |
|--------|---------------|--|--|
| 0      | Non-Reversal  | A phase <br>B phase  | A phase <br>B phase  |

|   |          |  |  |
|---|----------|--|--|
| 1 | Reversal | A phase <br>B phase  | A phase <br>B phase  |
|---|----------|--|--|

### 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   | Positioning complete range   | Range   | unit         | default | Related control mode |  |
|--|--|---------|--------------|---------|----------------------|--|
|  |  | 0-10000 | Encoder unit | 10      | P                    |  |
| Set up the timing of positional deviation at which the positioning complete signal (INP1) is output. |  |         |              |         |                      |  |
| Pr4.32   | Positioning complete range   | Range   | unit         | default | Related control mode |  |
|  |  | 0-3     | command unit | 10      | P                    |  |
| 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   | INP hold time  | Range   | unit         | default | Related control mode |  |
|  |  | 0-30000 | 1ms          | 0       | P                    |  |
| 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 PA\_410 – PA415.

#### Other setup for SI/SO function

For details of SI input function, refer to PA\_400 – PA409.

For details of SO output function, refer to PA\_410 – PA415.

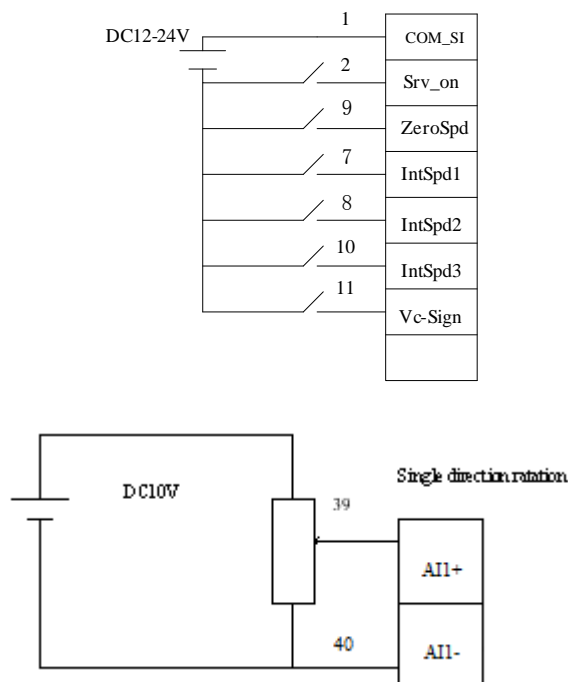
## 8.2 Velocity Control

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

**Table 8.3 Parameter Setup of Velocity Control**

| No | Parameter | Name   | input   | Setup value    | Unit        |
|----|-----------|--|---------|----------------|-------------|
| 1  | PA_001    | Control mode setup                             | /       | 1              | /           |
| 2  | PA_312    | Acceleration time setup                        | /       | User-specified | millisecond |
| 3  | PA_313    | Deceleration time setup                        | /       | User-specified | millisecond |
| 4  | PA_314    | Sigmoid acceleration/deceleration time setup   | /       | User-specified | millisecond |
| 5  | PA_315    | Zero speed clamping function select            | /       | 1              | /           |
| 6  | PA_300    | Velocity setup internal and external switching | /       | User-specified | /           |
| 7  | PA_301    | Speed Command direction selection              | /       | User-specified | /           |
| 8  | PA_302    | Speed command input gain                       | /       | User-specified | Rpm/V       |
| 9  | PA_303    | Speed setting input reversal                   | /       | User-specified | /           |
| 10 | PA_422    | Analog input I(AI1) offset setup               | /       | User-specified | 0.359mv     |
| 11 | PA_423    | Analog input I(AI1) filter                     | /       | User-specified | 0.01ms      |
| 12 | PA_400    | SI1 input selection                            | Srv_on  | hex:0300       | /           |
| 13 | PA_401    | SI2 input selection                            | ZeroSpd | hex:1100       | /           |
| 14 | PA_402    | SI3 input selection                            | IntSpd1 | hex:0E00       | /           |
| 15 | PA_403    | SI4 input selection                            | IntSpd2 | hex:0F00       | /           |
| 16 | PA_404    | SI5 input selection                            | IntSpd3 | hex:1000       | /           |
| 17 | PA_405    | SI6 input selection                            | Vc-Sign | hex:1200       | /           |

### ◆ Wiring Diagram



### ◆ 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 driver.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the driver)
5. Connect the Srv\_on input to bring the driver to servo-on status and energize the motor.
6. apply DC voltage between velocity command input ,AI1 and AGND, and gradually increase from 0V to confirm the motor runs.
7. Check the motor rotational speed at monitor mode , ("d01SP " )
  - Whether rotational speed is as per the setup or not, and
  - Whether the motor stops with zero command or not
  - If the motor does rotate at a micro speed with command voltage of 0.
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 driver 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 driver.

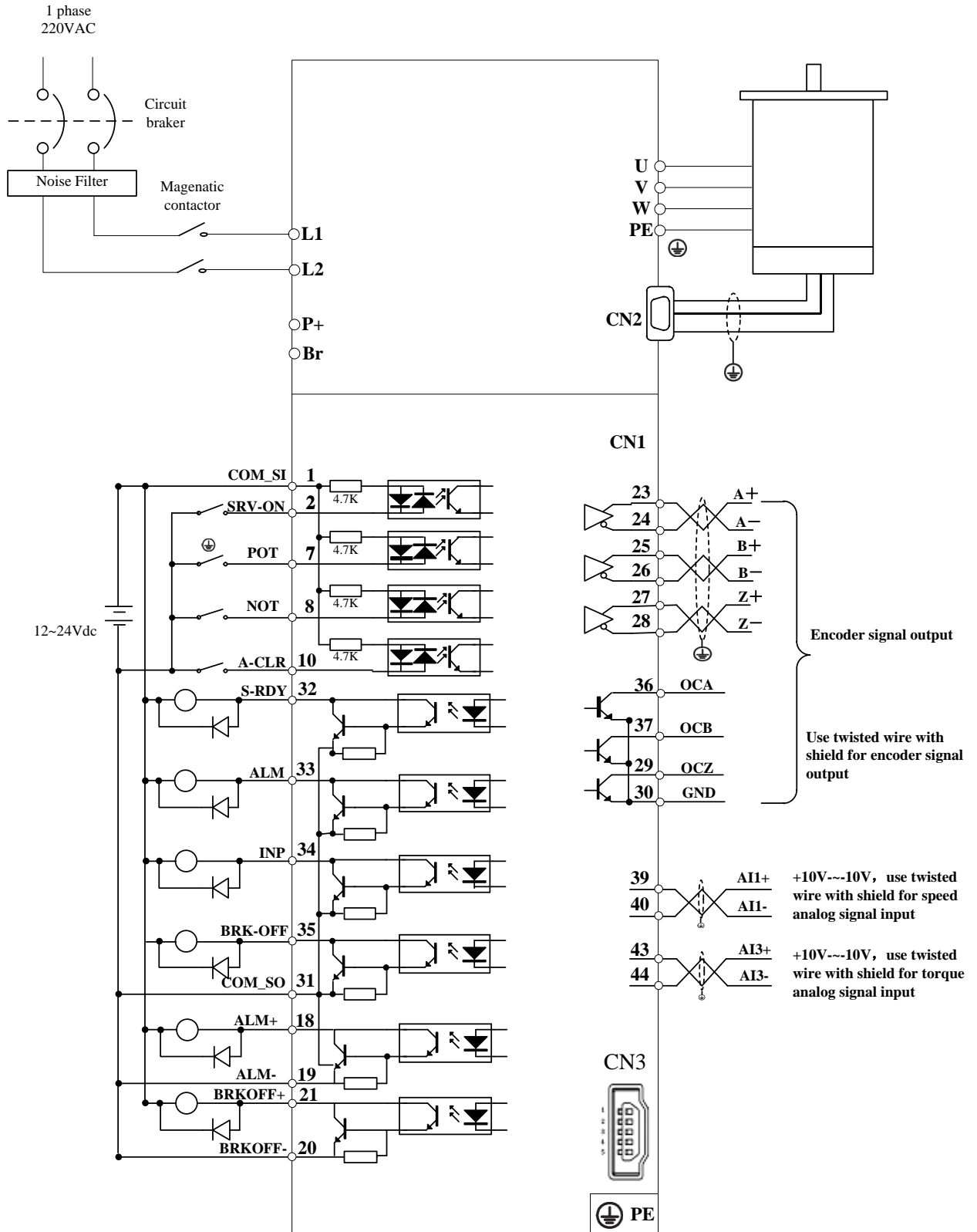


Figure 8-3 Velocity Mode Typical Wiring Diagram

Note:

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

## Relevant parameters setup of velocity control mode

### 8.2.1 Velocity control by analog speed command

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.

|               |   |       |      |         |                      |   |
|---------------|---|-------|------|---------|----------------------|---|
| <b>Pr3.00</b> | Speed setup, Internal /External switching | Range | unit | default | Related control mode |   |
|               |   | 0-3   | -    | 0       |                      | S |

This driver 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),<br>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 | selection 1 of internal command speed(INTSPD1) | selection 2 of internal command speed (INTSPD2) | selection 3 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                  |

|               |  |       |      |         |                      |   |
|---------------|--|-------|------|---------|----------------------|---|
| <b>Pr3.01</b> | Speed command rotational direction selection | Range | unit | default | Related control mode |   |
|               |  | 0-1   | -    | 0       |                      | S |

Select the Positive /Negative direction specifying method

| Setup value | Select speed command sign (1st to 8th speed) | Speed command direction (VC-SIGN) | Position command direction |
|-------------|--|-----------------------------------|----------------------------|
| 0           | +  | No effect                         | Positive direction         |
|             | -  | No effect                         | Negative direction         |
| 1           | Sign has no effect                           | OFF                               | Positive direction         |
|             | Sign has no effect                           | ON                                | Negative direction         |

|               |                             |         |           |         |                      |     |
|---------------|-----------------------------|---------|-----------|---------|----------------------|-----|
| <b>Pr3.02</b> | Input gain of speed command | Range   | unit      | default | Related control mode |     |
|               |                             | 10-2000 | (r/min)/v | 500     |                      | S T |

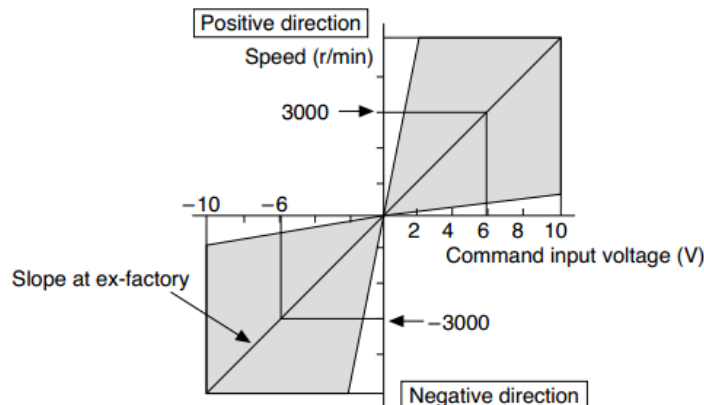
Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.

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:**

- Do not apply more than  $\pm 10V$  to the speed command input(SPR).

2. When you compose a position loop outside of the driver while you use the driver 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 | Reversal of speed command input | Range | unit | default | Related control mode |   |
|--------|---------------------------------|-------|------|---------|----------------------|---|
|        |                                 | 0-1   | -    | 0       |                      | S |

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

| Setup value | Motor rotating direction |  |
|-------------|--------------------------|--|
| 0           | Non-reversal             | [+ voltage] → [+ direction] [- voltage] → [-direction] |
| 1           | reversal                 | [+ voltage] → [- direction] [- voltage] → [+direction] |

**Caution:** When you compose the servo drive system with this driver 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 does not match.

## 8.2.2 Velocity control by internal speed command

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 | Speed setup, Internal /External switching | Range | unit | default | Related control mode |   |
|--------|---|-------|------|---------|----------------------|---|
|        |   | 0-3   | -    | 0       |                      | S |

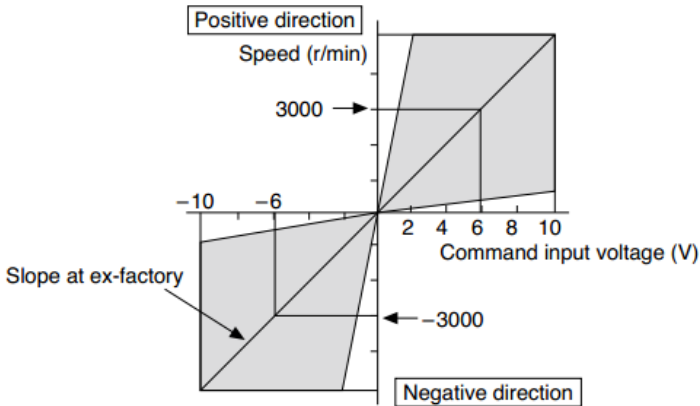
This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.

| 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 | selection 1 of internal command speed (INTSPD1) | selection 2 of internal command speed (INTSPD2) | selection 3 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            |         |                      |   |
| <b>Pr3.01</b>   | Speed command rotational direction selection |                                   | Range                      | unit                 | default | Related control mode |   |
|   |  |                                   | 0-1                        | -                    | 0       |                      | S |
| Select the Positive /Negative direction specifying method |  |                                   |                            |                      |         |                      |   |
| Setup value   | Select speed command sign (1st to 8th speed) | Speed command direction (VC-SIGN) | Position command direction |                      |         |                      |   |
| 0   | +  | No effect                         | Positive direction         |                      |         |                      |   |
|   | -  | No effect                         | Negative direction         |                      |         |                      |   |
| 1   | Sign has no effect                           | OFF                               | Positive direction         |                      |         |                      |   |
|   | Sign has no effect                           | ON                                | Negative direction         |                      |         |                      |   |

|  |                             |         |           |         |                      |     |
|--|-----------------------------|---------|-----------|---------|----------------------|-----|
| <b>Pr3.02</b>  | Input gain of speed command | Range   | unit      | default | Related control mode |     |
|  |                             | 10-2000 | (r/min)/v | 500     |                      | S T |
| <p>Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.</p> <p>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.</p> <p><b>Notice:</b></p> <ol style="list-style-type: none"> <li>1. Do not apply more than <math>\pm 10V</math> to the speed command input(SPR).</li> <li>2. When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.</li> <li>3. Pay an extra attention to oscillation caused by larger setup of Pr3.02.</li> </ol> |                             |         |           |         |                      |     |
|    |                             |         |           |         |                      |     |

|   |                                 |  |      |         |                      |   |
|---|---------------------------------|--|------|---------|----------------------|---|
| <b>Pr3.03</b>   | Reversal of speed command input | Range  | unit | default | Related control mode |   |
|   |                                 | 0-1  | -    | 0       |                      | S |
| Specify the polarity of the voltage applied to the analog speed command (SPR).  |                                 |  |      |         |                      |   |
| Setup value   | Motor rotating direction        |  |      |         |                      |   |
| 0   | Non-reversal                    | [+ voltage] → [+ direction] [- voltage] → [-direction] |      |         |                      |   |
| 1   | reversal                        | [+ voltage] → [- direction] [- voltage] → [+direction] |      |         |                      |   |
| <p><b>Caution:</b> When you compose the servo drive system with this driver 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 does not match.</p> |                                 |  |      |         |                      |   |

| Pr3.04 | 1st speed of speed setup | Range         | unit  | default | Related control mode       |
|--------|--------------------------|---------------|-------|---------|----------------------------|
|        |                          | -20000 -20000 | r/min | 0       | <input type="checkbox"/> S |
| Pr3.05 | 2nd speed of speed setup | Range         | unit  | default | Related control mode       |
|        |                          | -20000 -20000 | r/min | 0       | <input type="checkbox"/> S |
| Pr3.06 | 3rd speed of speed setup | Range         | unit  | default | Related control mode       |
|        |                          | -20000 -20000 | r/min | 0       | <input type="checkbox"/> S |
| Pr3.07 | 4th speed of speed setup | Range         | unit  | default | Related control mode       |
|        |                          | -20000 -20000 | r/min | 0       | <input type="checkbox"/> S |
| Pr3.08 | 5th speed of speed setup | Range         | unit  | default | Related control mode       |
|        |                          | -20000 -20000 | r/min | 0       | <input type="checkbox"/> S |
| Pr3.09 | 6th speed of speed setup | Range         | unit  | default | Related control mode       |
|        |                          | -20000 -20000 | r/min | 0       | <input type="checkbox"/> S |
| Pr3.10 | 7th speed of speed setup | Range         | unit  | default | Related control mode       |
|        |                          | -20000 -20000 | r/min | 0       | <input type="checkbox"/> S |
| Pr3.11 | 8th speed of speed setup | Range         | unit  | default | Related control mode       |
|        |                          | -20000 -20000 | r/min | 0       | <input type="checkbox"/> S |

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

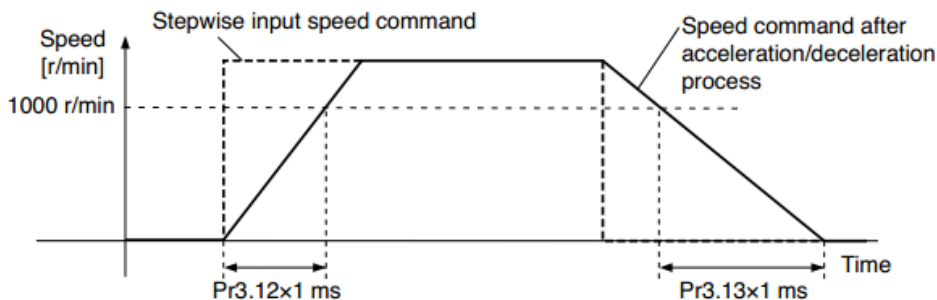
| Pr3.12 | time setup acceleration | Range    | unit          | default | Related control mode       |
|--------|-------------------------|----------|---------------|---------|----------------------------|
|        |                         | 0 -10000 | Ms(1000r/min) | 100     | <input type="checkbox"/> S |
| Pr3.13 | time setup deceleration | Range    | unit          | default | Related control mode       |
|        |                         | 0 -10000 | Ms(1000r/min) | 100     | <input type="checkbox"/> S |

**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  $V_c$ (r/min), the time required for acceleration/deceleration can be computed from the formula shown below.

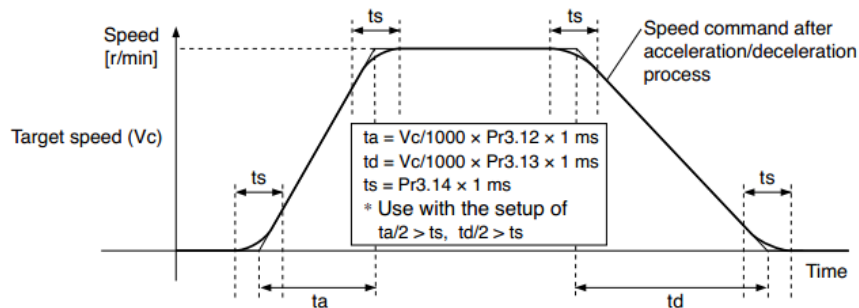
$$\text{Acceleration time (ms)} = V_c / 1000 * \text{Pr3.12} * 1 \text{ms}$$

$$\text{Deceleration time (ms)} = V_c / 1000 * \text{Pr3.13} * 1 \text{ms}$$



| Pr3.14 | Sigmoid acceleration/deceleration time setup | Range   | unit | default | Related control mode       |
|--------|--|---------|------|---------|----------------------------|
|        |  | 0 -1000 | ms   | 0       | <input type="checkbox"/> S |

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.



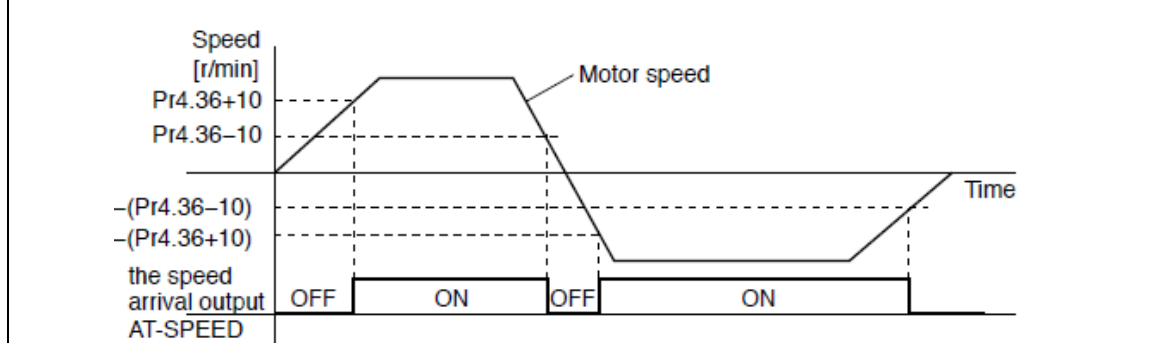
### 8.2.4 Attained Speed signal AT-SPEED output

When the motor speed reaches the speed set by the parameter PA\_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 | At-speed(Speed arrival) | Range    | unit  | default | Related control mode                |   |
|--------|-------------------------|----------|-------|---------|-------------------------------------|---|
|        |                         | 10-20000 | r/min | 1000    | <input checked="" type="checkbox"/> | S |

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 .



Speed [r/min]

Motor speed

Pr4.36+10

Pr4.36-10

-(Pr4.36-10)

-(Pr4.36+10)

Time

the speed arrival output AT-SPEED

OFF ON OFF ON

### 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 driver is within the parameter PA\_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.

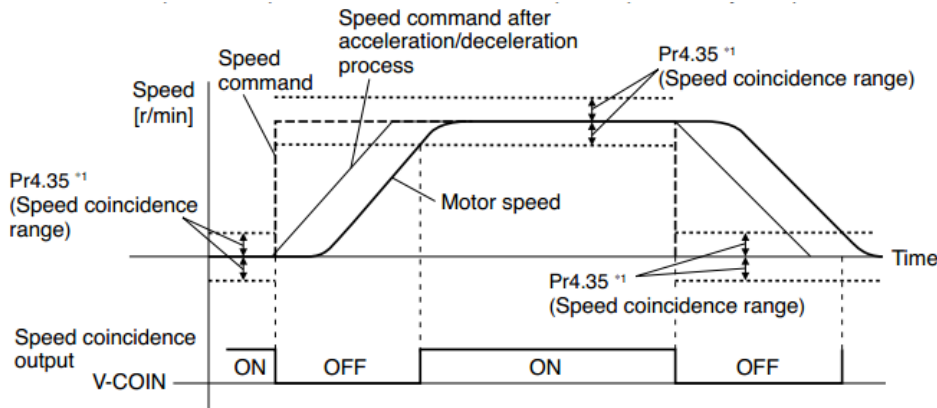
Among them, the in place signal of PV mode is synchronized with the v-coin signal

| Pr4.35 | Speed coincidence range | Range    | unit  | default | Related control mode                |   |
|--------|-------------------------|----------|-------|---------|-------------------------------------|---|
|        |                         | 10-20000 | r/min | 50      | <input checked="" type="checkbox"/> | S |

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 Speed zero clamp (ZEROSPD)

You can forcibly set the speed command to 0 by using the speed zero clamp input.

| Pr3.15  | Speed zero-clamp function selection | Range   | unit  | default | Related control mode |
|---|-------------------------------------|---------|-------|---------|----------------------|
|   |                                     | 0-3     | -     | 0       | S                    |
| 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 .<br>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.<br>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  | Speed zero-clamp level              | Range   | unit  | default | Related control mode |
|   |                                     | 0-20000 | r/min | 30      | S                    |
| When analog speed given value under speed control mode less than zero speed clamp level setup, speed command will set to 0 strongly.  |                                     |         |       |         |                      |

### Other setup for SI/SO function

For details of SI input function, refer to PA\_400 – PA409.

For details of SO output function, refer to PA\_410 – PA415.

## 8.3 Torque Control

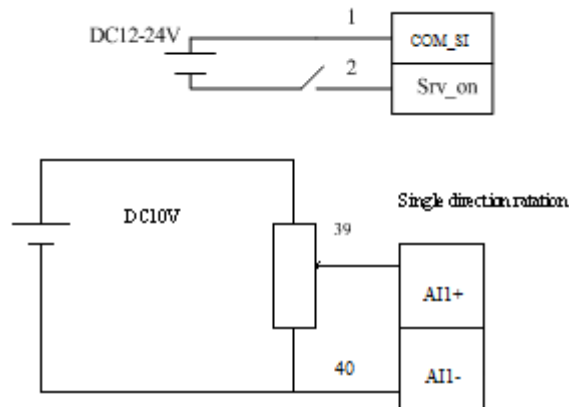
**Notice :** Analog input for Torque/Velocity mode is only available for ELP-RS\*\*\*Z  
 Pls do inspection before velocity control test run.

Table 8.6 Parameter Setup of Torque Control

| No | Parameter | Name   | input | Setup value    | Unit        |
|----|-----------|--|-------|----------------|-------------|
| 1  | PA_001    | Control mode setup                           | /     | 2              | /           |
| 2  | PA_312    | Acceleration time setup                      | /     | User-specified | millisecond |
| 3  | PA_313    | Deceleration time setup                      | /     | User-specified | millisecond |
| 4  | PA_314    | Sigmoid acceleration/deceleration time setup | /     | User-specified | millisecond |
| 5  | PA_315    | Zero-clamp function selection                | /     | 0              | /           |

|    |        |  |        |                |           |
|----|--------|--|--------|----------------|-----------|
| 6  | PA_317 | Torque setup internal/external switching | /      | 0              | /         |
| 7  | PA_319 | Torque command direction input gain      | /      | User-specified | 0.1V/100% |
| 8  | PA_320 | Torque setup input reversal              | /      | User-specified | /         |
| 9  | PA_321 | Speed limit value 1                      | /      | User-specified | R/min     |
| 10 | PA_400 | SI1 input selection                      | Srv_on | hex:030000     | /         |
| 11 | PA_428 | Analog input 3(AI3) offset setup         | /      | User-specified | 0.359mv   |
| 12 | PA_429 | Analog input 3(AI3) filter               | /      | User-specified | 0.01ms    |

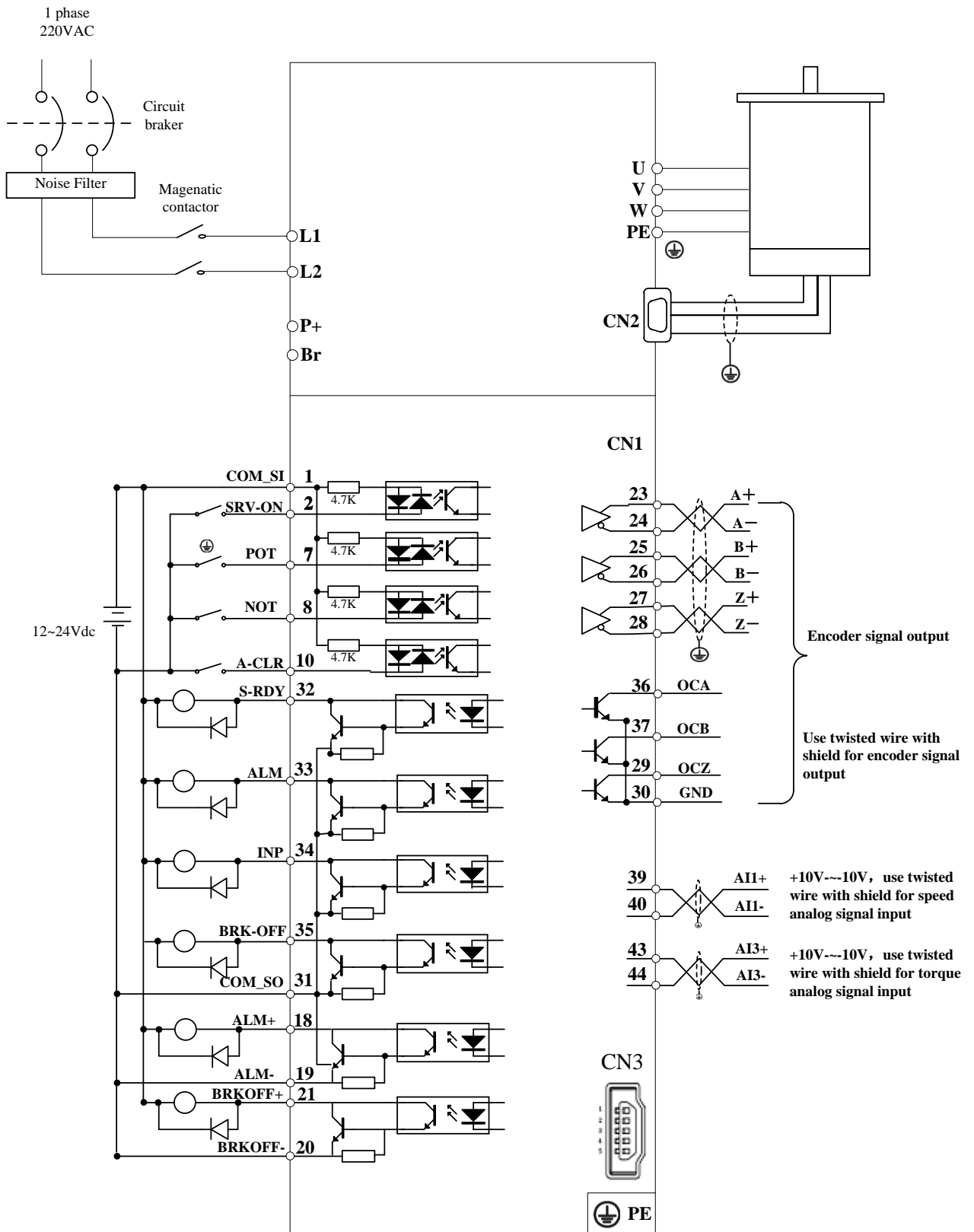
#### ◆ Wiring Diagram



#### ◆ 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 driver.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the driver)
5. Connect the Srv\_on input to bring the driver to servo-on status and energize the motor.
6. apply DC voltage between torque command input ,AI1 and AGND, and gradually increase from 0V to confirm the motor runs.
7. Check the motor torque at monitor mode ("d04tr " ), Whether actual torque is as per the 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 " ).

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.


**Figure 8-4 Torque Mode Typical External Wiring Diagram**
**Note:**

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

## Relevant parameters setup of torque control mode

### 8.3.1 Analog torque 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.

| Pr3.17 | Selection of torque command | Range   | unit | default | Related control mode |  |
|--------|-----------------------------|---------|------|---------|----------------------|--|
|        |                             | 0/1/2/3 | -    | 0       |                      |  |

| 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 | Torque command direction selection | Range | unit | default | Related control mode |  |
|--------|------------------------------------|-------|------|---------|----------------------|--|
|        |                                    | 0-1   | -    | 0       |                      |  |

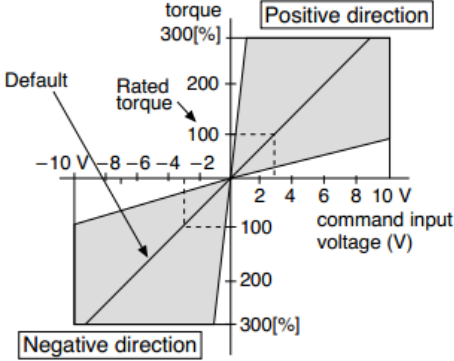
Select the direction positive/negative direction of torque command

| Setup value | designation   |
|-------------|---|
| 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 | Torque command input gain | Range | unit | default | Related control mode |  |
|--------|---------------------------|-------|------|---------|----------------------|--|
|        |                           | 0-1   | -    | 500     |                      |  |

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 | Torque command input reversal | Range | unit | default | Related control mode |  |
|--------|-------------------------------|-------|------|---------|----------------------|--|
|        |                               | 0-1   | -    | 0       |                      |  |

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 | Torque command input reversal | Range | unit | default | Related control mode |  |
|--------|-------------------------------|-------|------|---------|----------------------|--|
|        |                               | 0-1   | -    | 0       |                      |  |

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] |
| <b>Pr3.21</b> | Speed limit value 1 |              |  |
|               | Range               | unit         | default  |
|               | 0 -20000            | r/min        | 0  |
|               |                     |              | Related control mode                                   |
|               |                     |              | T  |

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

#### Other setup for SI/SO function

For details of SI input function, refer to PA\_400 – PA409.

For details of SO output function, refer to PA\_410 – PA415.

## 8.4 Inertia ratio identification

|               |               |          |      |         |                      |   |   |
|---------------|---------------|----------|------|---------|----------------------|---|---|
| <b>Pr0.04</b> | Inertia ratio | Range    | unit | default | Related control mode |   |   |
|               |               | 0 -10000 | %    | 250     | P                    | S | T |

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.

### 8.4.1 On-line inertia ratio identification

The motor is operated by the controller, and the motor speed is above 400rpm. 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 through panel d16. Write the corresponding panel value minus 100 into PA004.

### 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 PA604, and the setting of PA604 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、Write the corresponding panel value minus 100 into PA004.

## 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

|        |                            |       |      |         |                      |   |  |
|--------|----------------------------|-------|------|---------|----------------------|---|--|
| Pr2.00 | Adaptive filter mode setup | Range | unit | default | Related control mode |   |  |
|        |                            | 0 -4  | -    | 0       | P                    | S |  |

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

| Setup value | content   |   |
|-------------|---|---|
| 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   | Non-professional forbidden to use   |

|        |                     |          |      |         |                      |   |   |
|--------|---------------------|----------|------|---------|----------------------|---|---|
| Pr2.01 | 1st notch frequency | Range    | unit | default | Related control mode |   |   |
|        |                     | 50 -2000 | HZ   | 2000    | P                    | S | T |

Set the center frequency of the 1st notch filter

**Notice:** the notch filter function will be invalidated by setting up this parameter to “2000”.

|        |                           |       |      |         |                      |   |   |
|--------|---------------------------|-------|------|---------|----------------------|---|---|
| Pr2.02 | 1st notch width selection | Range | unit | default | Related control mode |   |   |
|        |                           | 0 -20 | -    | 2       | P                    | S | T |

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 | 1st notch depth selection | Range | unit | default | Related control mode |   |   |
|        |                           | 0 -99 | -    | 0       | P                    | S | T |

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 | 2nd notch frequency | Range    | unit | default | Related control mode |   |   |
|        |                     | 50 -2000 | HZ   | 2000    | P                    | S | T |

Set the center frequency of the 2nd notch filter

**Notice:** the notch filter function will be invalidated by setting up this parameter to “2000”.

|        |                           |       |      |         |                      |   |   |
|--------|---------------------------|-------|------|---------|----------------------|---|---|
| Pr2.05 | 2nd notch width selection | Range | unit | default | Related control mode |   |   |
|        |                           | 0 -20 | -    | 2       | P                    | S | T |

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 | 2nd notch depth selection | Range | unit | default | Related control mode |   |   |
|        |                           | 0 -99 | -    | 0       | P                    | S | T |

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.

Check the current command waveform on the upper computer. When the increase of rigidity causes the current command to produce the oscillation motor to scream, obtain its oscillation frequency from the waveform, and set the frequency to the notch frequency to debug the width and depth:

The notch width is described as follows:

| notch width | notch width / notch frequency | notch width | notch width / notch frequency | notch width | notch width / notch frequency |
|-------------|-------------------------------|-------------|-------------------------------|-------------|-------------------------------|
| 0           | 0.50                          | 7           | 1.68                          | 14          | 5.66                          |

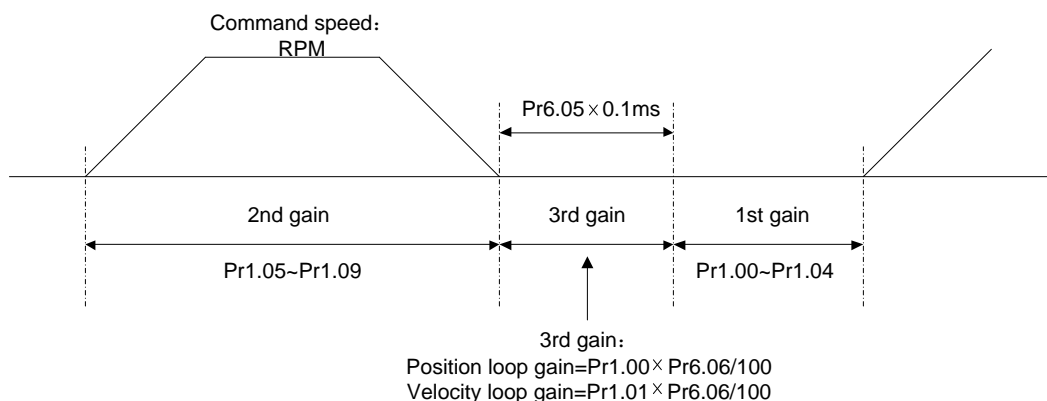
|   |      |    |      |    |       |
|---|------|----|------|----|-------|
| 1 | 0.59 | 8  | 2.00 | 15 | 6.73  |
| 2 | 0.71 | 9  | 2.38 | 16 | 8.00  |
| 3 | 0.84 | 10 | 2.83 | 17 | 9.51  |
| 4 | 1.00 | 11 | 3.36 | 18 | 11.31 |
| 5 | 1.19 | 12 | 4.00 | 19 | 13.45 |
| 6 | 1.41 | 13 | 4.76 | 20 | 16.00 |

## 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  | Position 3 <sup>rd</sup> gain multiplication | Range   | unit  | default | Related control mode |  |  |
|---|--|---------|-------|---------|----------------------|--|--|
|   |  | 0--1000 | 0.1ms | 0       | P                    |  |  |
| Set up the time at which 3 <sup>rd</sup> 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  | Position 3 <sup>rd</sup> gain valid time     | Range   | unit  | default | Related control mode |  |  |
|   |  | 0--1000 | 0.1ms | 0       | P                    |  |  |
| Set up the 3 <sup>rd</sup> gain by multiplying factor of the 1 <sup>st</sup> gain<br><br>$3^{\text{rd}} \text{ gain} = 1^{\text{st}} \text{ gain} * \text{PR6.06}/100$                  |  |         |       |         |                      |  |  |

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 | JOG trial run command speed | Range    | unit | default | Related control mode |   |   |
|--------|-----------------------------|----------|------|---------|----------------------|---|---|
|        |                             | -100-100 | %    | 0       | P                    | S | T |

|        |                             |          |      |         |                      |   |   |
|--------|-----------------------------|----------|------|---------|----------------------|---|---|
| Pr6.08 | JOG trial run command speed | Range    | unit | default | Related control mode |   |   |
|        |                             | -100-100 | %    | 0       | P                    | S | T |
| Pr6.09 | JOG trial run command speed | Range    | unit | default | Related control mode |   |   |
|        |                             | -100-100 | %    | 0       | P                    | S | T |

This 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 (common scenarios such as deceleration, vertical axis descent, etc.), energy will feedback from the load to the driver. At this time, the energy feedback is first received by the capacitor in the driver, 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

|  |  |          |      |         |                      |   |   |
|--|--|----------|------|---------|----------------------|---|---|
| Pr0.16   | External regenerative resistance           | Range    | unit | default | Related control mode |   |   |
|  |  | 10-50    | Ω    | 50      | P                    | S | T |
| 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   | External regenerative resistor power value | Range    | unit | default | Related control mode |   |   |
|  |  | 0 -10000 | W    | 50      | P                    | S | T |
| 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 Security Features

### 8.9.1 Speed limit

|  |                                  |         |       |         |                      |   |   |
|--|----------------------------------|---------|-------|---------|----------------------|---|---|
| Pr3.24*  | Motor rotate maximum speed limit | Range   | unit  | default | Related control mode |   |   |
|  |                                  | 0 -6000 | r/min | 3000    | P                    | S | T |
| 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   | Selection of torque limit | Range          | unit | default | Related control mode |   |   |
|  |                           | 0-2            | --   | 0       | P                    | S | T |
| 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         |      |         |                      |   |   |
| Pr5.22   | 2nd torque limit          | Range          | unit | default | Related control mode |   |   |
|  |                           | 0-500          | %    | 300     | P                    | S | T |
| Set up the 2 <sup>nd</sup> limit value of the motor torque output                    |                           |                |      |         |                      |   |   |
| The value of the parameter is limited to the maximum torque of the applicable motor. |                           |                |      |         |                      |   |   |
| Pr0.13   | 1st Torque Limit          | Range          | unit | default | Related control mode |   |   |
|  |                           | 0 -500         | %    | 300     | P                    | S | T |

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, it needs to move to the home position, and clear the absolute position value of multiple turns through the driver to set the home position. It is unnecessary to return to zero 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   | Absolute Encoder Setup | Range   | unit  | default | Related control mode |   |   |
|--|------------------------|---------|---|---------|----------------------|---|---|
|  |                        | 0-15    | 0.1 rev   | 0       | P                    | S | T |
| Bit description:   |                        |         |   |         |                      |   |   |
|  |                        | Bit     | Description   |         |                      |   |   |
|  |                        | Bit0    | 0: close absolute value<br>1: open absolute value   |         |                      |   |   |
|  |                        | Bit1    | Default : 0,do not use  |         |                      |   |   |
|  |                        | Bit2    | 0: no action<br>1: clean up absolute alarm, automatically become 0 when clean success           |         |                      |   |   |
|  |                        | Bit3    | 0: no action<br>1: multi-turn position, clean up and reset automatically become 0 after success |         |                      |   |   |
|  |                        | Bit4-15 | Default 0,do not use  |         |                      |   |   |
| How to use:  |                        |         |   |         |                      |   |   |
| <b>0:</b> close multi-turn absolute function, multi-turn position invalid;   |                        |         |   |         |                      |   |   |
| <b>1:</b> open multi-turn absolute function;   |                        |         |   |         |                      |   |   |
| <b>5:</b> 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.   |                        |         |   |         |                      |   |   |
| <b>9:</b> 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. |                        |         |   |         |                      |   |   |

### 8.10.2 Read absolute position

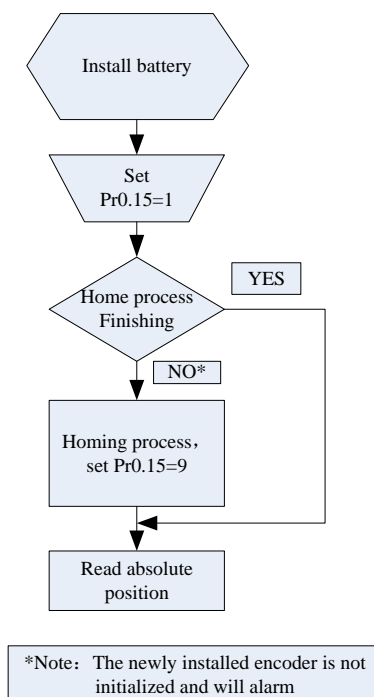
1、Steps:

(1) Firstly, select the multi-turns absolute encoder motor, install the battery, and confirm whether the driver 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 driver 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 driver 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 driver sends an absolute encoder alarm Err153, the main situation is as follows:

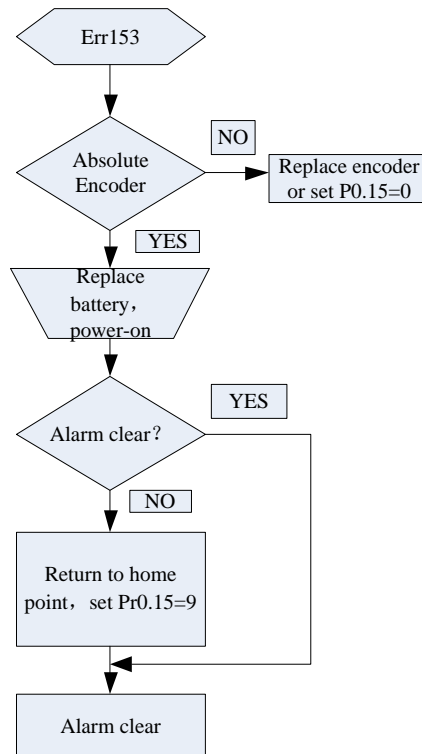
- (1) When the absolute encoder is used for the first time, absolute encoder alarm will be generated due to

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 driver. 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)

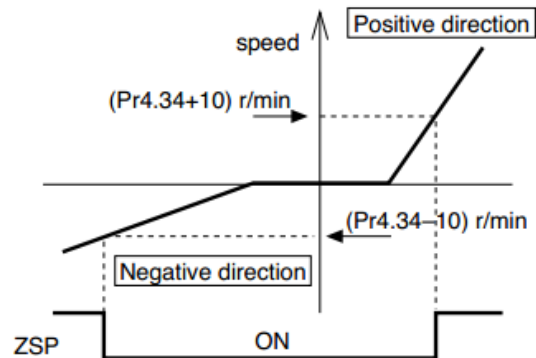
This function can be configured by IO output function parameters, as described in IO Pr4.10 parameters. When the enabling and time meet the setting conditions, the corresponding output IO port set can output ON

| Pr4.34 | Zero-speed | Range     | unit  | default | Related control mode |   |   |
|--------|------------|-----------|-------|---------|----------------------|---|---|
|        |            | 10 -20000 | r/min | 50      | P                    | S | T |
|        |            |           |       |         |                      |   |   |

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].



### 8.11.2 Position deviation cleared (CL)

This function can be configured by IO input function parameters, as described in IO Pr4.00 parameters.

| Pr5.17 | Counter clear input mode | Range | unit | default | Related control mode |  |
|--------|--------------------------|-------|------|---------|----------------------|--|
|        |                          | 0-4   | --   | 3       | P                    |  |

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 | Position setup unit select | Range | unit | default | Related control mode |  |
|--------|----------------------------|-------|------|---------|----------------------|--|
|        |                            | 0-2   | -    | 0       | P                    |  |

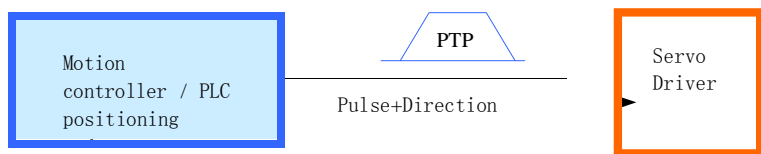
Specify the unit to determine the range of positioning complete and excessive positional deviation

| Setup value | unit                    |
|-------------|-------------------------|
| 0           | Encoder unit            |
| 1           | Command unit            |
| 2           | Standard 2500-line unit |

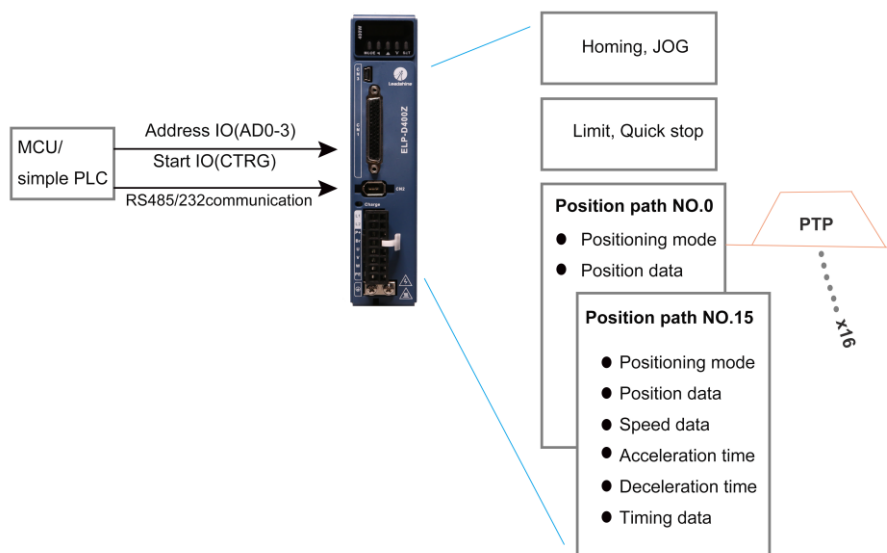
## Chapter 9 Pr-Mode function

### 9.1 Overview

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 positioning motion control system

#### 9.1.1 Main function

Main function as below:

| PR function   | Specification   |
|---------------|---|
| <b>Homing</b> | Through homing process, the machine can find the homing point,<br>Limit signal homing, home signal homing, and manual homing all selectable,<br>Homing direction settable<br>Home deviation position settable.<br>Can be positioned to the specified location after homing.<br>Homing acceleration and deceleration settable<br><b>Remark: Cannot input external pulse during homing!</b> |
| <b>JOG</b>    | Trigger positive/negative point move by I/O, for debugging  |

|                       |  |
|-----------------------|--|
|                       | Positive point move<br>Negative point move<br>JOG speed and acceleration selectable  |
| <b>Position limit</b> | Protect device by limiting move range <ul style="list-style-type: none"> <li>● Positive and negative signal input by IO</li> <li>● Software position limit setting</li> <li>● Position limit deceleration settable</li> </ul> <b>Remark: Software position limit effective after homing accomplish.</b>  |
| <b>E-stop</b>         | Input E-stop signal through I/O, stop positioning operation.   |
| <b>Positioning</b>    | Select location path number by positioning address IO(AD0-3),<br>Then start the location path operation by activate I/O(CTRG) <ul style="list-style-type: none"> <li>● Contains the positioning mode, speed mode and homing mode.</li> <li>● IO rising edge double edge trigger start.</li> <li>● Support continuous positioning</li> <li>● Maximum 16 segment</li> <li>● Position, speed, acceleration settable</li> <li>● Pause/timing time settable</li> </ul> <b>Remark: Double edge trigger only effective for CTRG !</b> |
| <b>485 control</b>    | RS485 communication to trigger Pr-Mode working   |

**Remark: (1) For PR mode, position command adopt unit: 10000P/r .**

**(2) PR only effective under PR position control mode, P0.01=6.**

### 9.1.2 Installation wiring

IO terminal wiring and parameter configuration: Newly added IO of PR on the base of standard IO  
 Relevant 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 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            |
| Positive JOG    | JOG+   | 23h           | A3h            | Torque limit        | TQL     | 06h           | 86h            |

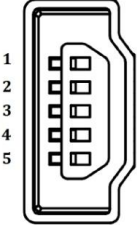
|                |        |     |     |  |  |  |  |
|----------------|--------|-----|-----|--|--|--|--|
| Negative JOG   | JOG-   | 24h | A4h |  |  |  |  |
| Forward limit  | PL     | 25h | A5h |  |  |  |  |
| Reverse limit  | NL     | 26h | A6h |  |  |  |  |
| Home signal    | ORG    | 27h | A7h |  |  |  |  |
| 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.

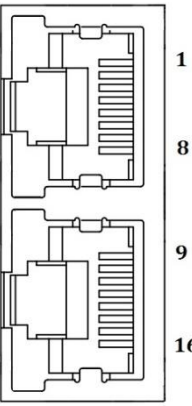
MC\_OK means PR instruction is sent and motor is in place.

CTRG、HOME is edge triggering, but effective level need to last more than 1ms.

232 terminal connection diagram:

| Port |   | Pin | Signal  |
|------|---|-----|---------|
| CN3  |  | 1   | VCC5V   |
|      |   | 2   | D+      |
|      |   | 3   | D-      |
|      |   | 4   |         |
|      |   | 5   | GND     |
|      |   |     | USB_GND |

485 terminal connection diagram:

| Port       |   | Pin   | Signal |
|------------|---|-------|--------|
| CN4<br>CN5 |  | 1, 9  | RDO+   |
|            |   | 2, 10 | RDO-   |
|            |   | 3, 11 | /      |
|            |   | 4, 12 | TXD    |
|            |   | 5, 13 | RXD    |
|            |   | 6, 14 | VCC5V  |
|            |   | 7, 15 | GND    |
|            |   | 8, 16 | /      |
|            |   |       | PE     |

## 9.2 Parameters

Pr parameters contain 8th and 9th parameters, 8th parameters is e-stop and control parameters, 9th parameters is store path table.

### 9.2.1 8th parameters specification

| No.    | Name                      | Data type | Range               | Default Value | Definition   |
|--------|---------------------------|-----------|---------------------|---------------|--|
| Pr8.00 | Pr control setting        | hex       | 0-3                 | 0             | Pr-Mode control function<br>Bit0: =0, CTRG rising edge trigger<br>=1, double edge trigger,<br>Bit1: Software limit effectively, 0 invalid /1valid<br>Bit2: Homing after power on ,0 invalid /1valid<br>Bit3: Absolute position, 0 invalid /1valid  |
| Pr8.01 | Pr path section number    | 16        | 16                  | 0             | Fixed 16 section   |
| Pr8.02 | Control register input    | hex       | 0                   | 0             | Write 0x1P, P section locate 16-31<br>Write 0x20, homing<br>Write 0x21, set current position as zero point<br>Write 0x40, e-stop<br>Read 0x00P, indicate positioning finished, can receive new data<br>Read 0x10P, In operation<br>Read 0x20P, In positioning  |
| Pr8.06 | Positive software limit H | 32        | (+2 <sup>31</sup> ) | 0x7FFF        | Positive software limit, high16bit, during homing, software limit invalid.   |
| Pr8.07 | Positive software limit L |           |                     | 0xFFFF        | Positive software limit, low16bit.   |
| Pr8.08 | Negative software limit H | 32        | (+2 <sup>31</sup> ) | 0x8000        | Negative software limit, high16bit, The precision of software limit is 0.1 round   |
| Pr8.09 | Negative software limit L |           |                     | 0             | Negative software limit, low16bit  |
| Pr8.10 | Homing mode               | hex       |                     | 0             | Homing mode,<br>Bit0: homing direction, 0 reverse/1forward<br>Bit1: Whether go to the set point after homing, 0 No /1Yes<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 point<br>Bit8:<br>=0: homing process without Z signal detect<br>=1: homing process with Z signal detect |
| Pr8.11 | Zero position H           | 32        | (+2 <sup>31</sup> ) | 0             | Zero signal on coordinate axis.<br>Such as take positive limit as homing signal but take negative limit as absolute position 0, then zero position is the distance between positive/negative limit.  |
| Pr8.12 | Zero position L           |           |                     | 0             |  |

|        |  |    |          |     |   |
|--------|--|----|----------|-----|---|
| Pr8.13 | Homing stop positionH                        | 32 | (+~2^31) | 0   | After homing, motor stop after move to appointed position. If homing mode bit1 enable. Then moving to the absolute position after homing. |
| Pr8.14 | Homing stop position L                       |    |          | 0   |   |
| Pr8.15 | Homing high speed                            | 16 | 1-6000   | 200 | Homing high speed   |
| Pr8.16 | Homing low speed                             | 16 | 1-6000   | 50  | Homing creeping speed   |
| Pr8.17 | Homing acceleration                          | 16 | 1-32767  | 100 | Homing acceleration   |
| Pr8.18 | Homing deceleration                          | 16 | 1-32767  | 100 | Homing deceleration   |
| Pr8.19 | Holding time while homing with torque detect | 16 | 0~65535  | 100 |   |
| Pr8.20 | Percentage of homing with torque detect      |    | 0~65535  | 0   |   |
| Pr8.21 | Overpass distance setting while homing       |    | 0~65535  | 0   |   |
| Pr8.22 | Position limit e-stop speed                  | 16 | 1-32767  | 10  | E-stop deceleration, when the limit is encountered  |
| Pr8.23 | e-stop speed                                 | 16 | 1-32767  | 50  | E-stop speed, when the STOP signal is encountered   |
| Pr8.24 | Encoder memory value H                       | 16 | 0~65535  | 0   |   |
| Pr8.25 | Encoder memory value L                       | 16 | 0~65535  | 0   |   |
| Pr8.26 | IO combined trigger mode                     | 16 | 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                        | 16 | 0~65535  | 10  | IO combined filtering time  |
| Pr8.28 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.29 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.30 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.31 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.32 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.33 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.34 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.35 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.36 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.37 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.38 | Reserved                                     | 16 | 0        | 0   |   |
| Pr8.39 | Reserved                                     | 16 | 0        | 0   |   |

|        |                    |              |   |   |   |
|--------|--------------------|--------------|---|---|---|
| Pr8.40 | Reserved           | 16           | 0 | 0 |   |
| Pr8.41 | Reserved           | 16           | 0 | 0 |   |
| Pr8.42 | Command position H | Read only 32 | 0 | 0 | The current position of commands reset to zero after homing |
| Pr8.43 | Command position L | Read only    | 0 | 0 |   |
| Pr8.44 | Motor position H   | Read only 32 | 0 | 0 | Motor real position reset to zero after homing              |
| Pr8.45 | Motor position L   | Read only    | 0 | 0 |   |

### 9.2.2 9th parameters specification

| No.    | Name               | Data type | Range               | Default value | Definition  |
|--------|--------------------|-----------|---------------------|---------------|---|
| Pr9.00 | Path0 Mode         | hex       |                     | 0             | The model of the PR pat, to determine the action property according to motion mode<br><br><b>Bit0-3: TYPE:</b><br>0 No Action<br>1 position running<br>2 speed running<br>3 homing<br>4 stop<br><br><b>Bit4: INS,</b><br>0 do not interrupt<br>1 interrupt (All interrupt now)<br><br><b>Bit5: OVL P,</b><br>0 do not overlap<br>1 overlap<br><br><b>Bit6-7:</b><br>0 absolute position<br>1 relative instruction<br>2 relative to the motor<br><br><b>Bit8-13: 0-15</b> Jump to the corresponding path<br><br><b>Bit14: JUMP:</b><br>0 do not jump<br>1 jump |
| Pr9.01 | Path0 position H   | 16        | (+2 <sup>31</sup> ) | 0             | The position parameter of the path, refer to PR motion type for specific meaning.   |
| Pr9.02 | Path0 position L   | 16        |                     | 0             | Position parameter low 16bit  |
| Pr9.03 | Path0 speed        | 16        | 0+-6000             | 0             | The position parameter of the path, refer to PR motion type for specific meaning.   |
| Pr9.04 | Path0 acceleration | 16        | 1-32767             | 100           | The position parameter of the path, refer to PR motion type for specific meaning.   |
| Pr9.05 | Path0 deceleration | 16        | 1-32767             | 100           | The position parameter of the path, refer to PR motion type for specific meaning.   |

|             |                  |          |          |          |   |
|-------------|------------------|----------|----------|----------|---|
| Pr9.06      | Path0 Pause time | 16       | 0-32767) | 0        | The pause of path, delay time parameter etc, refer to PR motion type for specific meaning.          |
| Pr9.07      | Path0 Reserved   | 16       | 0        | 0        | PR 0 path is mapped to P8.02 parameters<br>Used to trigger actions. Other paths standby is invalid. |
| Pr9.08-15   | Path1            | As above | As above | As above | As above  |
| Pr9.16-23   | Path2            | As above | As above | As above | As above  |
| Pr9.24-31   | Path3            | As above | As above | As above | As above  |
| Pr9.32-39   | Path4            | As above | As above | As above | As above  |
| Pr9.40      | Path5            | As above | As above | As above | As above  |
| Pr9.48      | Path6            | As above | As above | As above | As above  |
| Pr9.56      | Path7            | As above | As above | As above | As above  |
| Pr9.64      | Path8            | As above | As above | As above | As above  |
| Pr9.72      | Path9            | As above | As above | As above | As above  |
| Pr9.80      | Path10           | As above | As above | As above | As above  |
| Pr9.88      | Path11           | As above | As above | As above | As above  |
| Pr9.96      | Path12           | As above | As above | As above | As above  |
| Pr9.104     | Path13           | As above | As above | As above | As above  |
| Pr9.112-119 | Path14           | As above | As above | As above | As above  |
| Pr9.120-127 | Path15           | As above | As above | As above | As above  |

## 9.3 Pr-Mode motion control

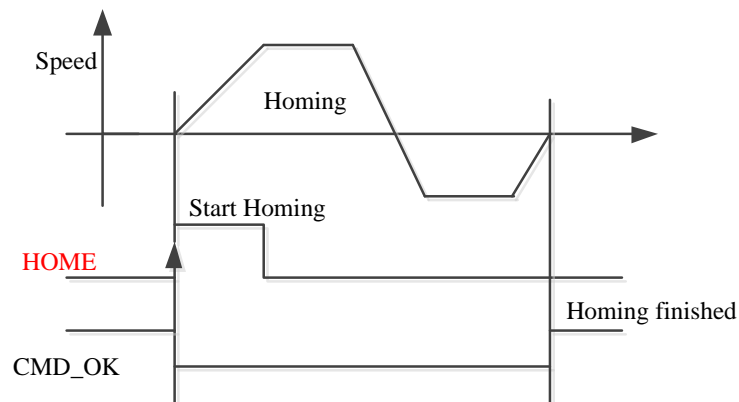
### 9.3.1 Homing

Homing include zero point homing and manual homing. At the same time also includes first time power on active homing.

Relevant parameters:

| Parameter | Name               | Specification  |
|-----------|--------------------|--|
| Pr8.00    | Pr control setting | Pr-Mode control function<br>Bit0: =0, CTRG rising edge trigger<br>=1, double edge trigger<br>Bit1: Software limit effectively, 0 invalid /1valid<br>Bit2: Homing after power on, 0 invalid /1valid<br>Bit3: Absolute position, 0 invalid /1valid |

|               |                          |  |
|---------------|--------------------------|--|
| Pr8.10        | Homing mode              | Homing mode,<br>Bit0: homing direction, 0 backward / 1 forward<br>Bit1: Whether go to the set point after homing, 0 No /1Yes<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 point<br>Bit8:<br>=0: homing process without Z signal detect<br>=1: homing process with Z signal detect |
| Pr8.11-Pr8.12 | Zero point position      | Zero point position on the coordinate axes<br>P811 for high 16bit, P812 for low 16bit.   |
| Pr8.13-Pr8.14 | Homing jump position     | Motor move to the specified location and stop after homing. If homing mode bit1 enable, then move to the absolute position after homing. Pr8.13 is for high 16bit, Pr8.14 is for low 16bit.  |
| Pr8.15        | Homing high speed        | First speed of homing, unit: rpm.  |
| Pr8.16        | Homing low speed         | Second speed of homing, unit: rpm.   |
| Pr8.17        | Homing acceleration time | Homing acceleration, unit: ms/1000rpm  |
| Pr8.18        | Homing deceleration time | Homing deceleration, unit: ms/1000rpm  |



**Remark:** Homing also be done by positioning function, only need to set the path to be homing mode.

*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.

### 9.3.2 Path Motion

Positioning path can make single segment running, also can make continuous running, configurable. There are three types of positioning path: Position location type, Speed running type and homing type, for flexible use.

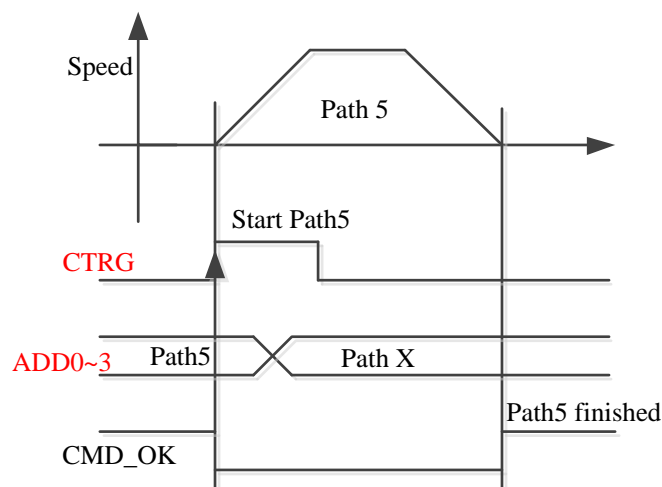
A total of 16Pr path, each path set movement type alone, position method, speed, deceleration and pause time, etc. relevant parameters:

| Parameters    | Name               | Specification  |
|---------------|--------------------|--|
| Pr9.00        | Motion mode path 0 | The mode of the Path motion, to determine the action property according to motion mode<br><b>Bit0-3:</b> TYPE:<br>0 No Action<br>1 position running<br>2 speed running<br>3 homing<br>4 stop<br><b>Bit4:</b> INS,<br>0 do not interrupt<br>1 interrupt (All interrupt now)<br><b>Bit5:</b> OVLP,<br>0 do not overlap<br>1 overlap<br><b>Bit6-7:</b><br>0 absolute position<br>1 relative instruction<br>2 relative to the motor<br><b>Bit8-13:</b> 0-15 Jump to the corresponding path<br><b>Bit14:</b> JUMP:<br>0 do not jump<br>1 jump |
| Pr9.01-Pr9.02 | Position           | Pr9.01 for high 16bit, Pr9.02 for low 16bit.   |
| Pr9.03        | Speed              | running speed, rpm   |
| Pr9.04        | Acceleration time  | Unit: ms/1000rpm   |
| Pr9.05        | Deceleration time  | Unit: ms/1000rpm   |
| Pr9.06        | Pause time         | Pause time after Instruction stop  |
| Pr9.07        | Special Parameters | Path 0 mapped to Pr8.02 directly   |
| And so on     |                    | Each path occupy eight parameters  |

There are several types of path motion:

### 1、Single path motion

CTRG rising edge /double edge trigger the motion(Pr8.00), take CTRG rising edge signal to trigger path5 as example:

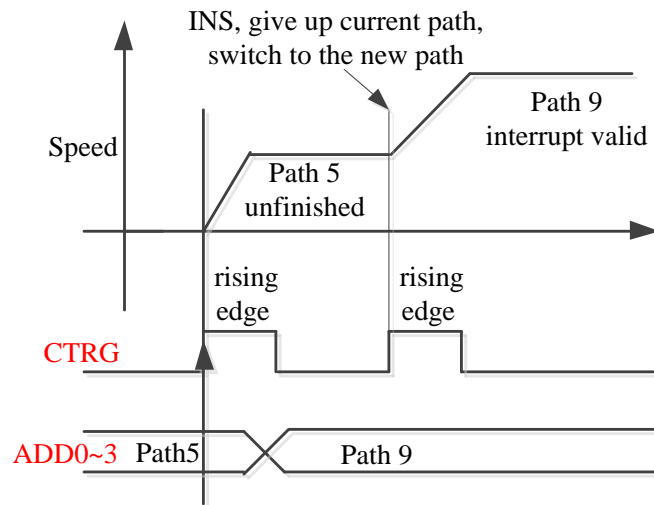


Single path motion

## 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 level of functions.

P9.00 bit4 = 0, interrupt

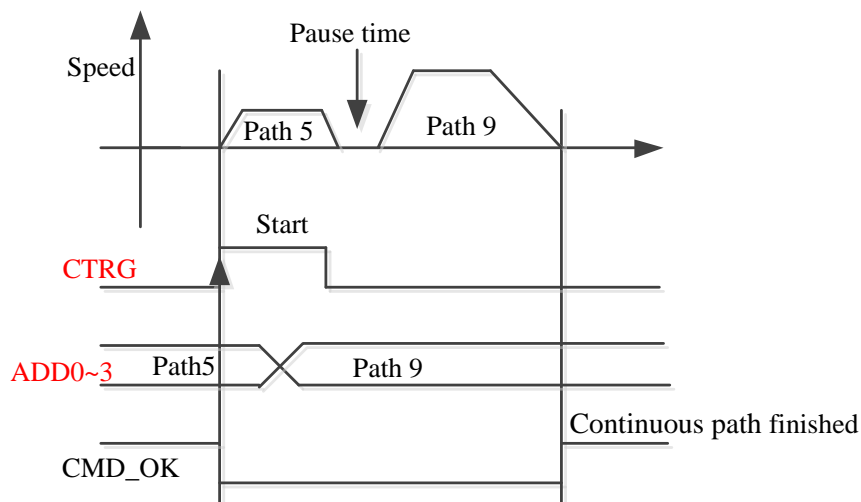


Multi path interrupt motion

## 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

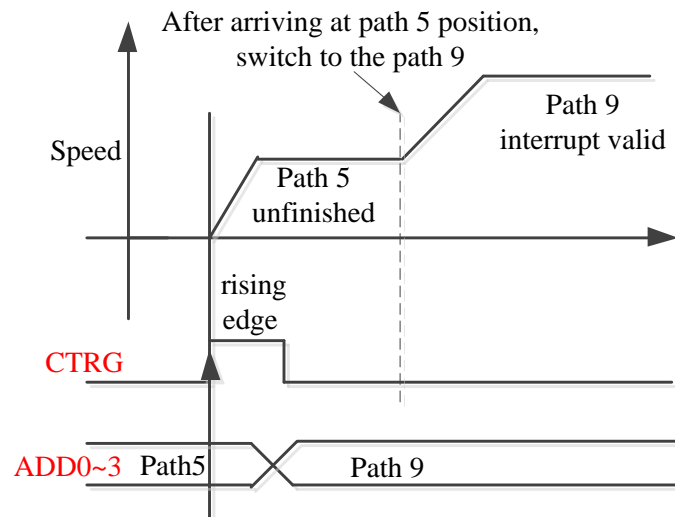


Continuous path motion without overlap

## 4、 Continuous path motion with overlap

After arriving at the first path position, start another path motion automatically without trigger signal.

Pr9.00 bit5 = 1, continuous path motion with overlap



Continuous path motion with overlap

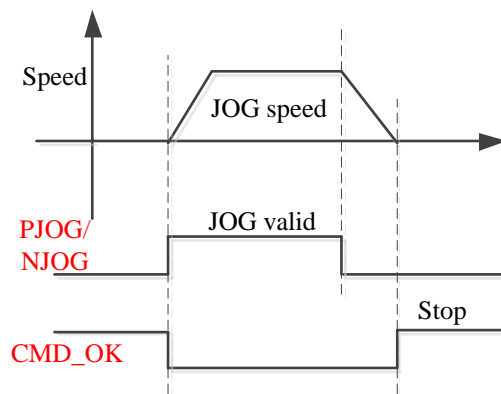
### 9.3.3 Position limit, JOG and E-stop function.

Relevant parameters

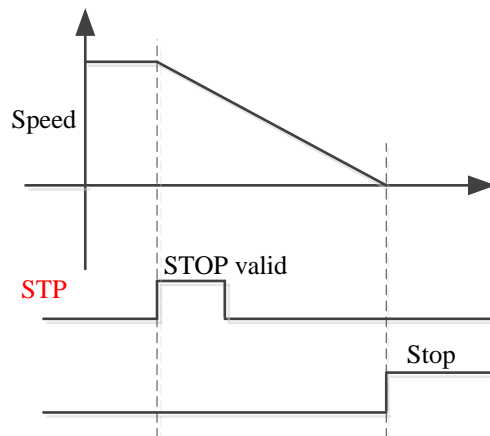
| Parameters    | Name                       | Specification                                  |      |     |
|---------------|----------------------------|--|------|-----|
| Pr8.00        | PR Control parameter       | Bit1: Software limit is valid                  |      |     |
| Pr8.06-Pr8.07 | Positive limit             | Software limit positive position               |      |     |
| Pr8.08-Pr8.09 | Negative limit             | Software limit negative position               |      |     |
| Pr8.22        | Position limit E-stop time | Acceleration deceleration after position limit |      |     |
| Pr8.23        | E-stop time                | Acceleration deceleration after E-stop         |      |     |
| Pr3.12        | JOG Acceleration time      | Unit: ms/1000rpm                               |      |     |
| Pr3.13        | JOG Deceleration time      | Unit: ms/1000rpm                               |      |     |
| Pr6.04        | JOG speed                  | Unit: rpm                                      |      |     |
| SI            | Input terminal             | Forced E-stop                                  | STP  | 22h |
|               |                            | Positive JOG                                   | JOG+ | 23h |
|               |                            | Negative JOG                                   | JOG- | 24h |
|               |                            | Positive position limit                        | PL   | 25h |
|               |                            | Negative position limit                        | NL   | 26h |

#### 1、JOG

Manual point move function



## 2、 Position limit and E-stop

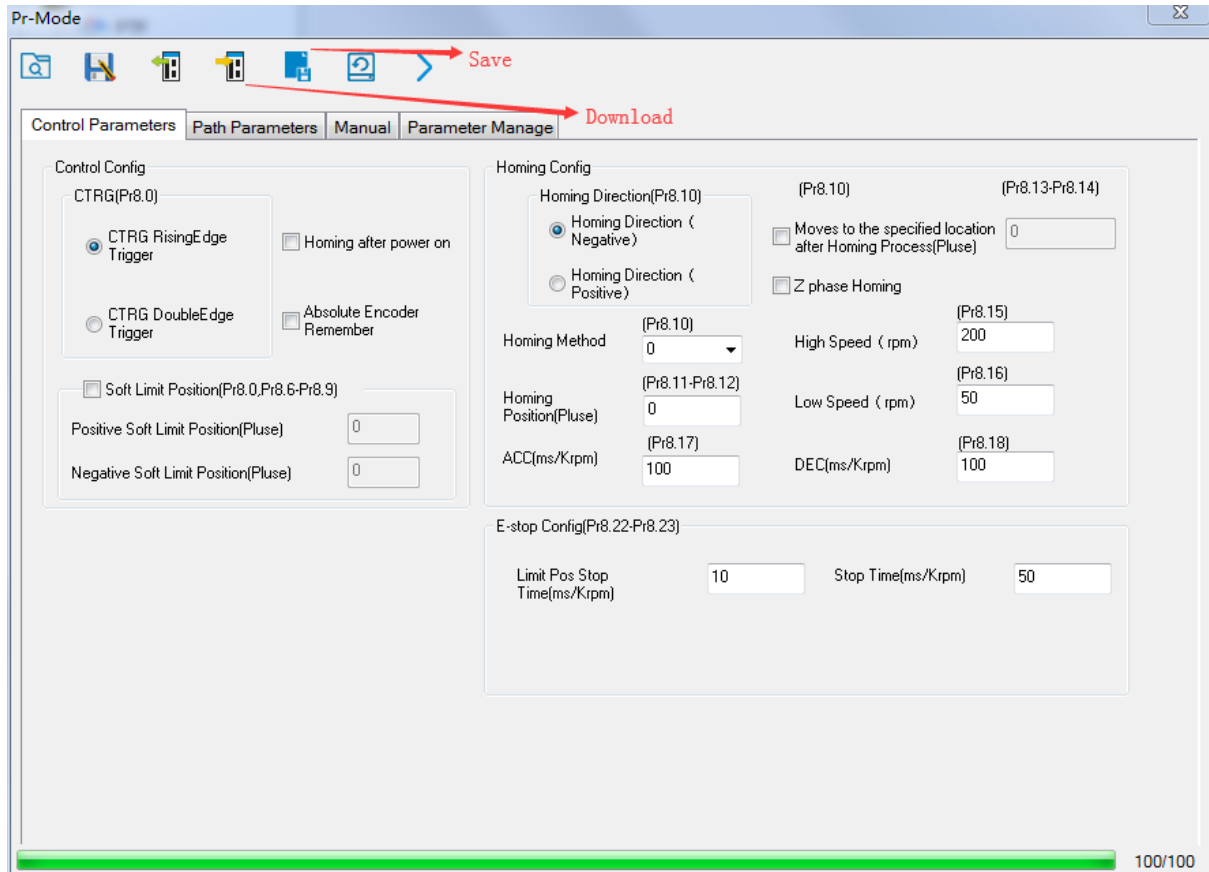


## 9.4 Trigger method of Pr-Mode

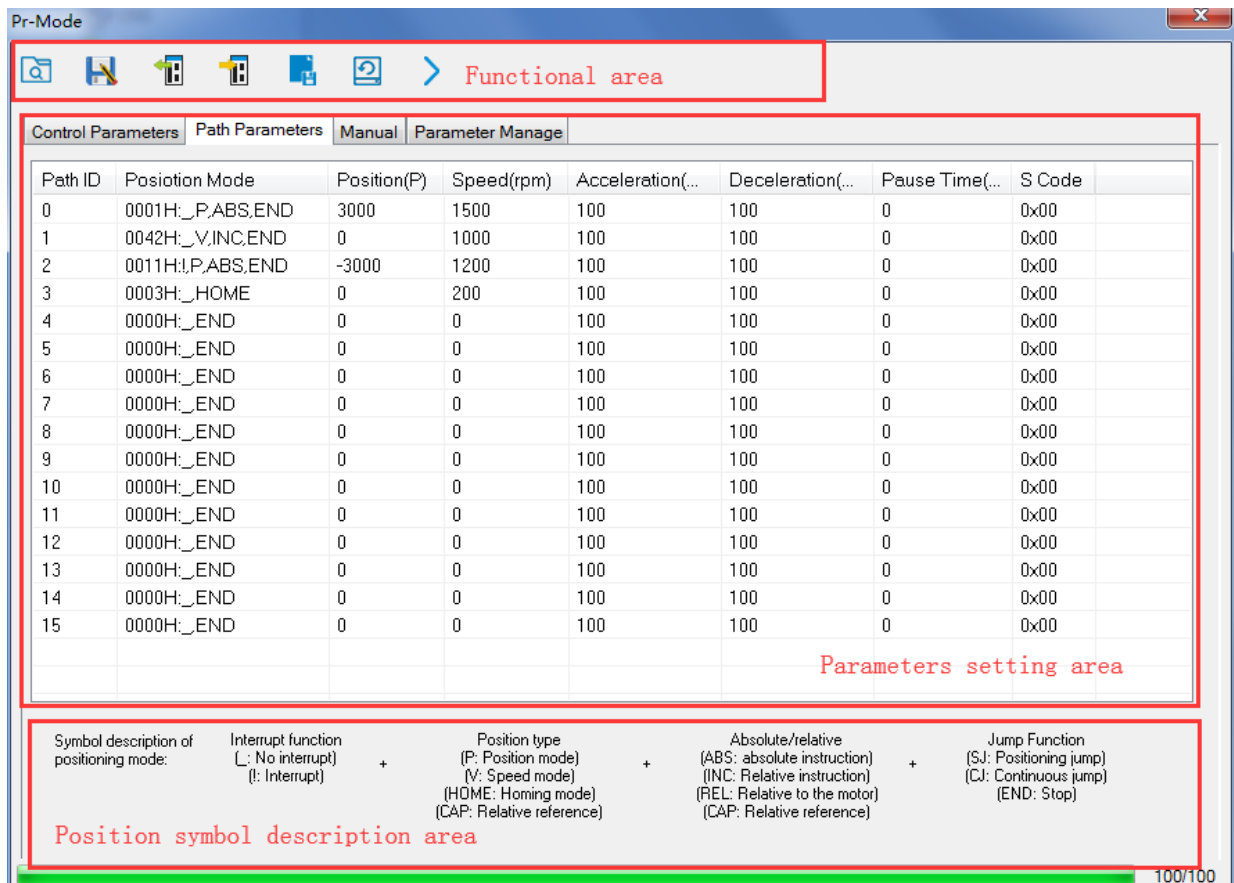
### 9.4.1 Upper computer operation

Upper computer is used for drive parameter setting and save, steps for debugging is:

1. Three-loop control parameters. According to the position mode debugging method.
2. Set the work mode to be PR mode (Pr0.01=0), Internal SERVO-enabled (Pr4.00=83), set the distribution of IO register P4.0-P4.13) 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 through upper computer's " Pr-MODE " interface, include:



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 can not interrupt running.

!V , ABS , SJ1 means that path is speed running, jump to No.1 path with delay, and can interrupt running.

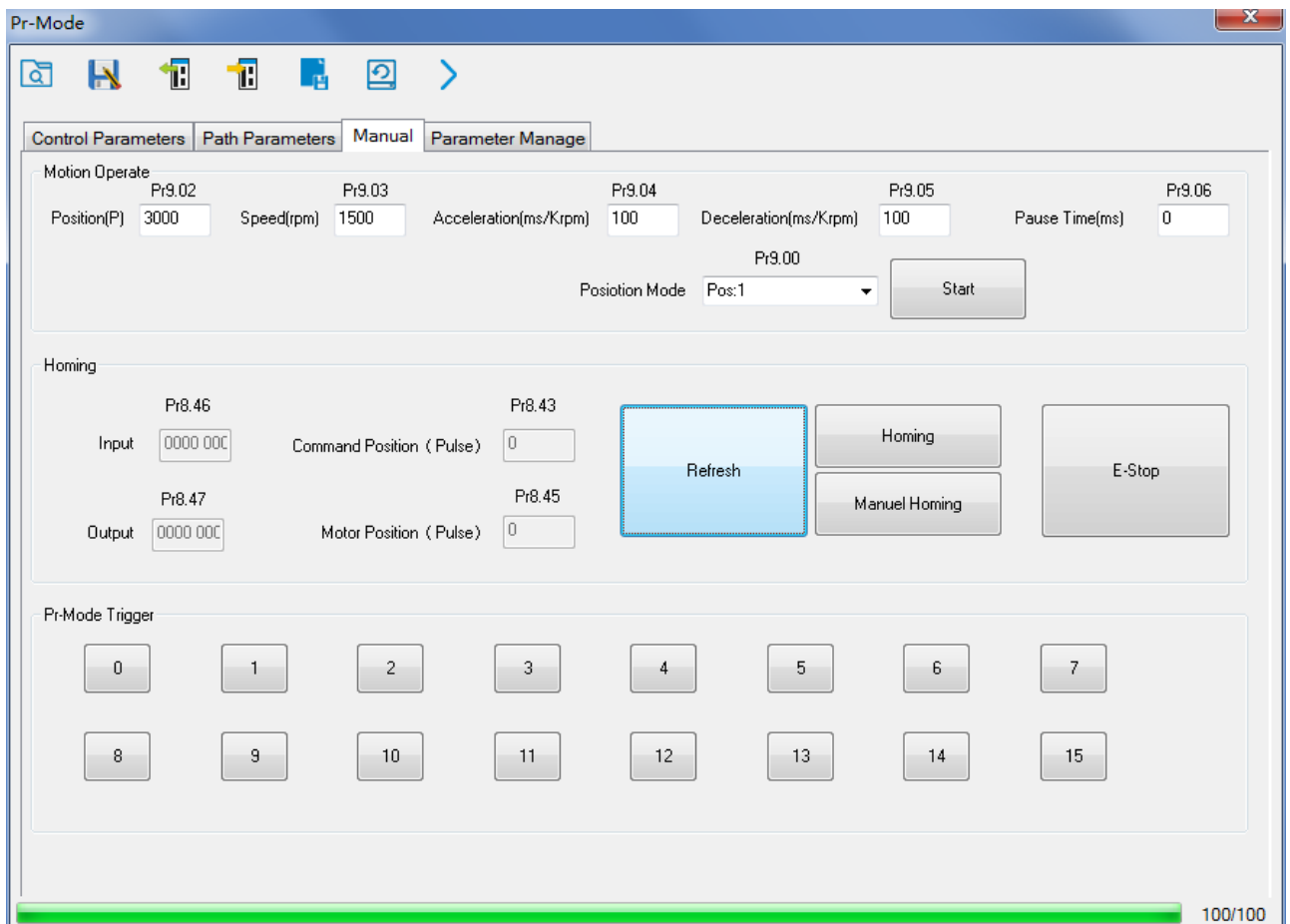
HOME means that path is homing movement.

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



### 9.4.2 IO signal Trigger

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            |
| Positive JOG    | JOG+   | 23h           | A3h            | Torque limit        | TQL     | 06h           | 86h            |
| Negative JOG    | 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            |                     |         |               |                |

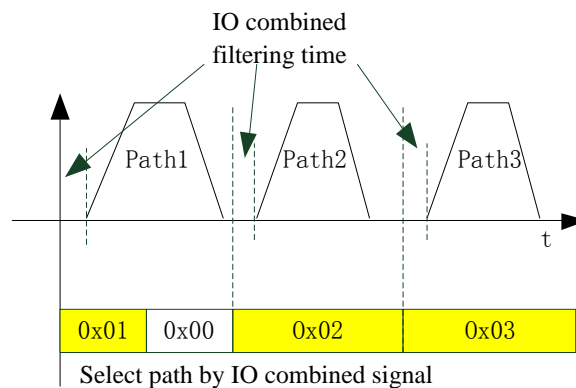
## IO Trigger

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.



- 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.

### 9.4.3 RS485 Communication control mode

Communication control mode can realize same function as IO operation, Can flexible modify parameters and trigger action to run, can control more than one operation by field bus, save the wiring and good flexibility. Communications control includes two modes: Fixed trigger mode and immediately trigger mode.

#### 1、 Parameters setting

| Parameters | Name                | Specification                |
|------------|---------------------|------------------------------|
| Pr0.01     | Control Mode Setup  | Set Pr0.01=6 for Pr-Mode     |
| Pr4.00     | SII Input selection | Set 83 for internal SERVO-ON |

| Pr5.29   | Communication mode     | <table border="1"> <thead> <tr> <th>Value</th> <th>Data bit</th> <th>Parity-check</th> <th>Stop bit</th> </tr> </thead> <tbody> <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> </tbody> </table> | 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 |
|--|------------------------|---|---------------|--------------|--------------|----------|---|---------|-------------|---------|---|----------|---|---------------|-----------|---|-------------|---|----------|---|------------|---|---|---|------|---|---|---|------|---|
|  |                        | 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   | Communication baudrate | <table border="1"> <thead> <tr> <th>Setting value</th> <th>Baud rate</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2400bps</td> </tr> <tr> <td>1</td> <td>4800bps</td> </tr> <tr> <td>2</td> <td>9600bps</td> </tr> <tr> <td>3</td> <td>19200bps</td> </tr> </tbody> </table>   | Setting value | Baud rate    | 0            | 2400bps  | 1 | 4800bps | 2           | 9600bps | 3 | 19200bps | <table border="1"> <thead> <tr> <th>Setting value</th> <th>Baud rate</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>38400bps</td> </tr> <tr> <td>5</td> <td>57600bps</td> </tr> <tr> <td>6</td> <td>115200bps</td> </tr> </tbody> </table> | Setting value | Baud rate | 4 | 38400bps    | 5 | 57600bps | 6 | 115200bps  |   |   |   |      |   |   |   |      |   |
|  |                        | Setting value   | Baud rate     |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
|  |                        | 0   | 2400bps       |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
|  |                        | 1   | 4800bps       |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
|  |                        | 2   | 9600bps       |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
| 3  | 19200bps               |   |               |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
| Setting value  | Baud rate              |   |               |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
| 4  | 38400bps               |   |               |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
| 5  | 57600bps               |   |               |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
| 6  | 115200bps              |   |               |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
| Baud rate deviation is 2400~38400bps±5%,<br>57600~115200bps±2% |                        |   |               |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
| Pr5.31   | Device No.             | Modbus sub-station address number(Slave ID).  |               |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |
| Pr8.02   | PR trigger             | (16bit, 485 address..0x6002)<br>Write 0x01P, P path positioning<br>Write 0x020, homing<br>Write 0x021, set current position as zero point<br>Write 0x040, e-stop<br>Read 0x000p, means positioning completed, can receive new data .<br>Read 0x01P、0x020、0x040 means still no responding to commands.   |               |              |              |          |   |         |             |         |   |          |   |               |           |   |             |   |          |   |            |   |   |   |      |   |   |   |      |   |

## 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

### Communication address mapping of Pr-Mode

| 485 address | Parameter | Name                      | Specification |
|-------------|-----------|---------------------------|---------------|
| 0x6000      | Pr8.00    | PRcontrol setup           | HEX           |
| 0x6002      | Pr8.02    | PRcontrol 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 mode                 | HEX       |
| 0x600b        | Pr8.11                      | Zero position H             | Pulse     |
| 0x600c        | Pr8.12                      | Zero position L             | Pulse     |
| 0x600d        | Pr8.13                      | Homing stop position H      | Pulse     |
| 0x600e        | Pr8.14                      | Homing stop position L      | Pulse     |
| 0x600f        | Pr8.15                      | High speed homing           | r/min     |
| 0x6010        | Pr8.16                      | Low speed homing            | r/min     |
| 0x6011        | Pr8.17                      | Homing acceleration         | ms/Krpm   |
| 0x6012        | Pr8.18                      | Homing deceleration         | ms/Krpm   |
| 0x6016        | Pr8.22                      | Position limit e-stop speed | r/min     |
| 0x6017        | Pr8.23                      | STP e-stop speed            | 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 |
|               | <b>Pr9.00~Pr9.07</b>        | <b>PR0 parameters</b>       |           |
| 0x6200        | Pr9.00                      | PR0 mode                    | HEX       |
| 0x6201        | Pr9.01                      | PR0 position H              | Pulse     |
| 0x6202        | Pr9.02                      | PR0 position L              | Pulse     |
| 0x6203        | Pr9.03                      | PR0 speed                   | r/min     |
| 0x6204        | Pr9.04                      | PR0 acceleration            | ms/Krpm   |
| 0x6205        | Pr9.05                      | PR0 deceleration            | ms/Krpm   |
| 0x6206        | Pr9.06                      | PR0 pause time              | ms        |
| 0x6207        | Pr9.07                      | PR0 trigger                 |           |
| 0x6208~0x620f | <b>Pr9.08~Pr9.15</b>        | <b>PR1 parameters</b>       |           |
|               | The same with Pr9.00~Pr9.07 |                             |           |
| 0x6210~0x6217 | <b>Pr9.16~Pr9.23</b>        | <b>PR2 parameters</b>       |           |
|               | The same with Pr9.00~Pr9.07 |                             |           |
| 0x6218~0x621f | <b>Pr9.24~Pr9.31</b>        | <b>PR3 parameters</b>       |           |
|               | The same with Pr9.00~Pr9.07 |                             |           |
| 0x6220~0x6227 | <b>Pr9.32~Pr9.39</b>        | <b>PR4 parameters</b>       |           |
|               | The same with Pr9.00~Pr9.07 |                             |           |
| 0x6228~0x622f | <b>Pr9.40~Pr9.47</b>        | <b>PR5 parameters</b>       |           |
|               | The same with Pr9.00~Pr9.07 |                             |           |
| 0x6230~0x6237 | <b>Pr9.48~Pr9.55</b>        | <b>PR6 parameters</b>       |           |
|               | The same with Pr9.00~Pr9.07 |                             |           |
| 0x6238~0x623f | <b>Pr9.56~Pr9.63</b>        | <b>PR7 parameters</b>       |           |
|               | The same with Pr9.00~Pr9.07 |                             |           |

|                             |                 |                 |  |
|-----------------------------|-----------------|-----------------|--|
| 0x6240~0x6247               | Pr9.64~Pr9.71   | PR8 parameters  |  |
| The same with Pr9.00~Pr9.07 |                 |                 |  |
| 0x6248~0x624f               | Pr9.72~Pr9.79   | PR9 parameters  |  |
| The same with Pr9.00~Pr9.07 |                 |                 |  |
| 0x6250~0x6257               | Pr9.80~Pr9.87   | PR10 parameters |  |
| The same with Pr9.00~Pr9.07 |                 |                 |  |
| 0x6258~0x625f               | Pr9.88~Pr9.95   | PR11 parameters |  |
| The same with Pr9.00~Pr9.07 |                 |                 |  |
| 0x6260~0x6267               | Pr9.96~Pr9.103  | PR12 parameters |  |
| The same with Pr9.00~Pr9.07 |                 |                 |  |
| 0x6268~0x626f               | Pr9.104~Pr9.111 | PR13 parameters |  |
| The same with Pr9.00~Pr9.07 |                 |                 |  |
| 0x6270~0x6277               | Pr9.112~Pr9.119 | PR14 parameters |  |
| The same with Pr9.00~Pr9.07 |                 |                 |  |
| 0x6278~0x627f               | Pr9.120~Pr9.127 | PR15 parameters |  |
| The same with Pr9.00~Pr9.07 |                 |                 |  |

### 9.4.4 Fixed trigger method

Fixed trigger mode is to config no more than 16 path path. Then, replace CTRG and HOME signal with Pr8.02(trigger register) to trigger the path. This mode apply to fixed motion and simple operation system.

**As below procedure:**

1. Firstly, config 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 (P8.02) .
  - Write 0x01P, P path motion (write 0x010 to run path 0, write 0x013 to run path 3)
  - Write 0x020, homing
  - Write 0x021, set current position as zero point.
  - 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               | Specification  |
|------------|--------------------|--|
| Pr9.00     | Motion mode path 0 | The model of the PR pat, to determine the action property according to motion mode |

|               |                    |  |
|---------------|--------------------|--|
|               |                    | <b>Bit0-3: TYPE:</b><br>0 No Action<br>1 position running<br>2 speed running<br>3 homing<br><b>Bit4: INS,</b><br>0 do not interrupt<br>1 interrupt (All interrupt now)<br><b>Bit5: OVL P,</b><br>0 do not overlap<br>1 overlap<br><b>Bit6-7:</b><br>0 absolute position<br>1 relative instruction<br><b>Bit8-13: 0-15 Jump to the corresponding path</b><br><b>Bit14: JUMP:</b><br>0 do not jump<br>1 jump |
| Pr9.01-Pr9.02 | Position           | P901 for high 16bit, P902 for low 16bit.   |
| Pr9.03        | Speed              | running speed, rpm   |
| Pr9.04        | Acceleration time  | Unit: ms/1000rpm   |
| Pr9.05        | Deceleration time  | Unit: ms/1000rpm   |
| Pr9.06        | Pause time         | Pause time after Instruction stop  |
| Pr9.07        | Special Parameters | Path 0 mapped to Pr8.02 directly   |
| And so on     |                    | Each path occupy eight parameters  |

Set path 1~ path15 as same as path 0 .

Implement choice and start of actions by write corresponding instructions into 0x6002 (P8.02), to select which path to run.

### 9.4.5 Immediately trigger method

Fixed trigger is limited by 16 path, 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. Trigger position, speed , homing by a data frame.

This method adopt path0 to implement, path0 has 8 data in total, the last data P9.07 of it will mapped to P8.02, write in 0x10 can trigger path0 motion immediately.

Operating steps:

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     | <b>ID</b>                      | Sub-station No.    | 0~31   | <b>ID</b>                      | Sub-station No.                | 0~31   |
| 2     | <b>FC</b>                      | Function code      | 0x10   | <b>FC</b>                      | Function code                  | 0x10   |
| 3     | <b>ADDR</b>                    | Address            | 0x62   | <b>ADDR</b>                    | Address                        | 0x62   |
| 4     |                                |                    | 0x00   |                                |                                | 0x00   |
| 5     | <b>NUM1</b>                    | Data quantity Word | 0x00   | <b>NUM</b>                     | Actually written data quantity | 0x00   |
| 6     |                                |                    | 0x08   |                                |                                | 0x08   |
| 7     | <b>NUM2</b>                    | Data quantity Byte | 0x10   | <b>CRC</b>                     | check code                     | L<br>H |
| 8-9   | <b>Pr9.00</b>                  | Mode               | XXXX   |                                |                                |        |
| 10-11 | <b>Pr9.01</b>                  | High position      | XXXX   |                                |                                |        |
| 12-13 | <b>Pr9.02</b>                  | Low position       | XXXX   |                                |                                |        |
| 14-15 | <b>Pr9.03</b>                  | Speed              | XXXX   |                                |                                |        |
| 16-17 | <b>Pr9.04</b>                  | Acceleration       | XXXX   |                                |                                |        |
| 18-19 | <b>Pr9.05</b>                  | Deceleration       | XXXX   |                                |                                |        |
| 20-21 | <b>Pr9.06</b>                  | Delay time         | XXXX   |                                |                                |        |
| 22-23 | <b>Pr9.07</b>                  | Trigger control    | 0x0010 |                                |                                |        |
| 24    | <b>CRC</b>                     | Check code         | L      |                                |                                |        |
| 25    |                                |                    | H      |                                |                                |        |

Please refer to parameter specification for specific data setting.

## 9.5 Operation case

### 9.5.1 IO trigger case

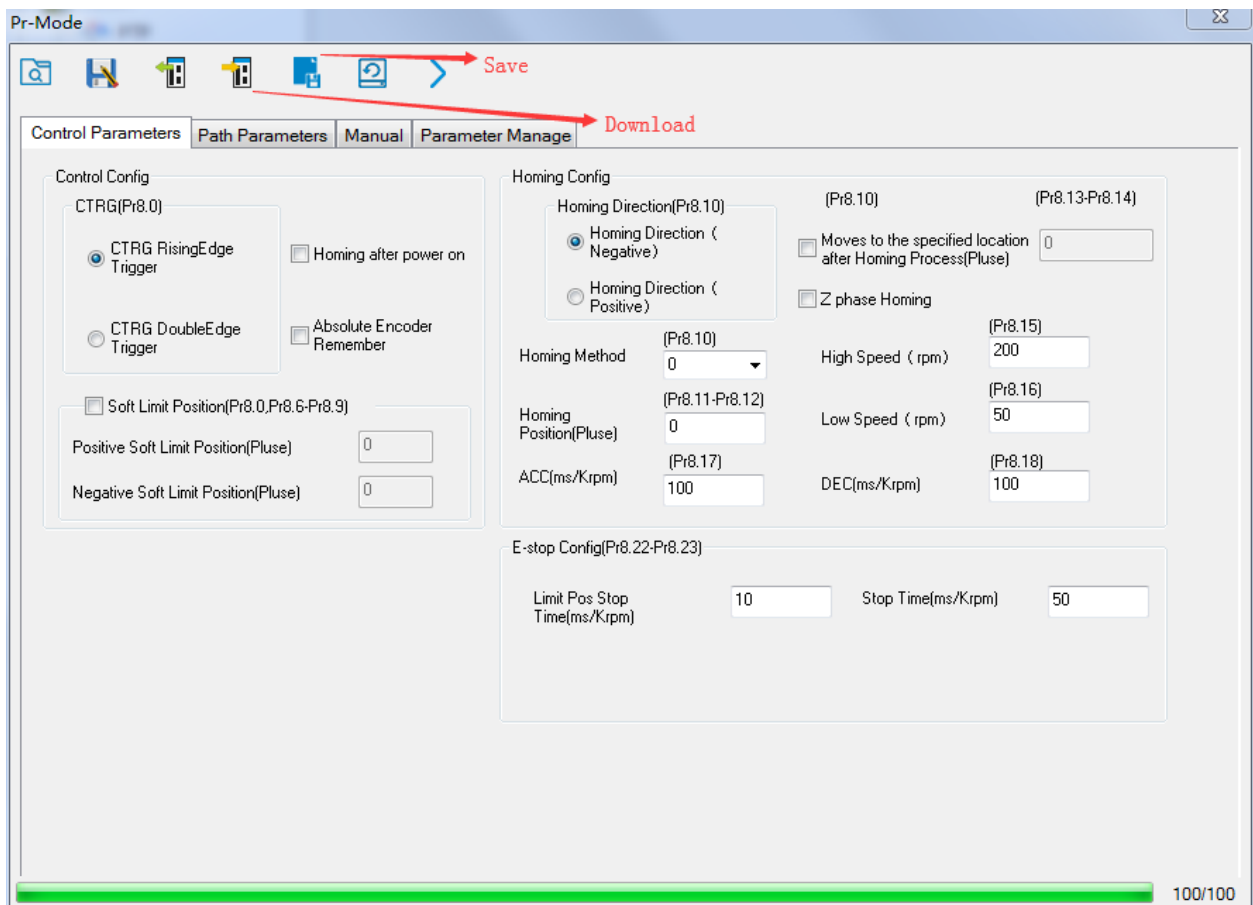
Pr-Mode motion can be triggered by IO signal.

1、Parameters setting as follows:

| Parameters    | Name                | Specification  |
|---------------|---------------------|--|
| Pr0.01        | Control Mode Setup  | Set Pr0.01=6 for Pr-Mode   |
| Pr4.00        | SII Input selection | Set 83 for internal SERVO-ON<br>Set 03 for external SERVO-ON                                     |
| 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.

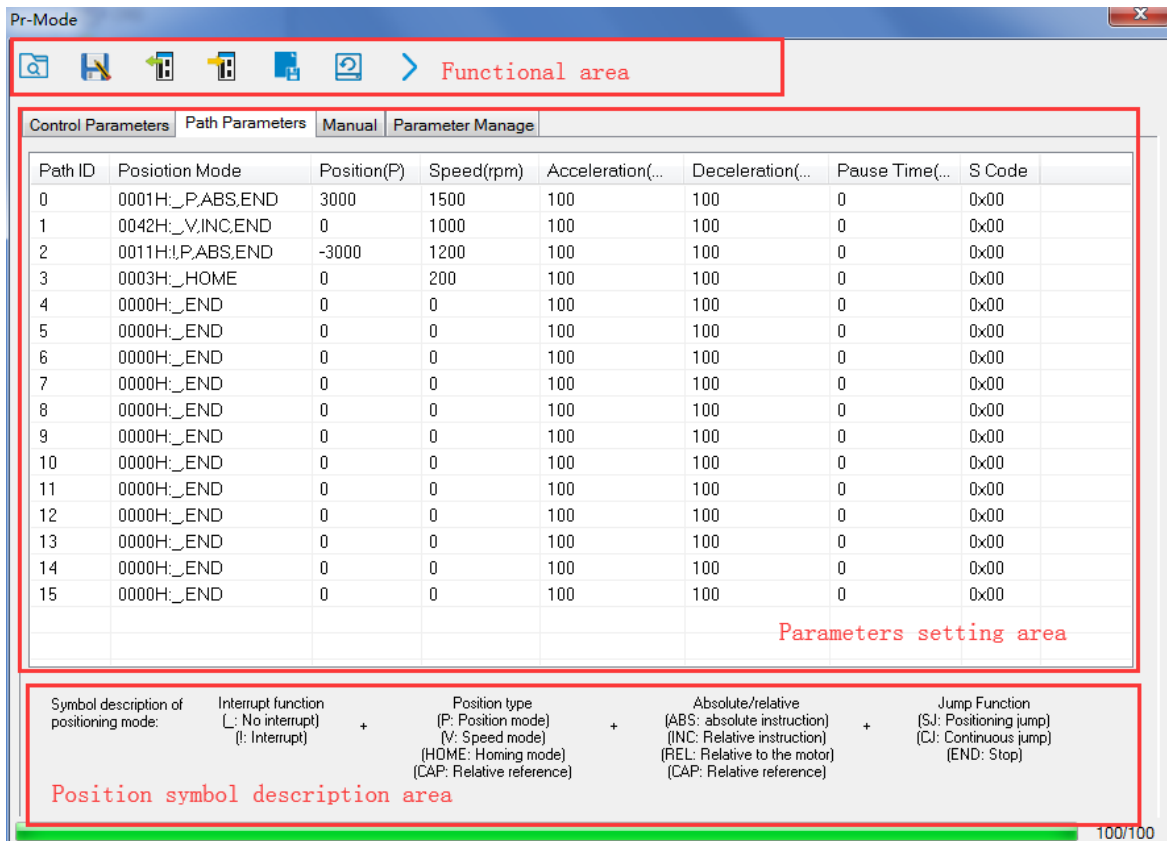
3、Setup path parameters, such as: Position mode, speed, ACC/DEC, etc.

**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.



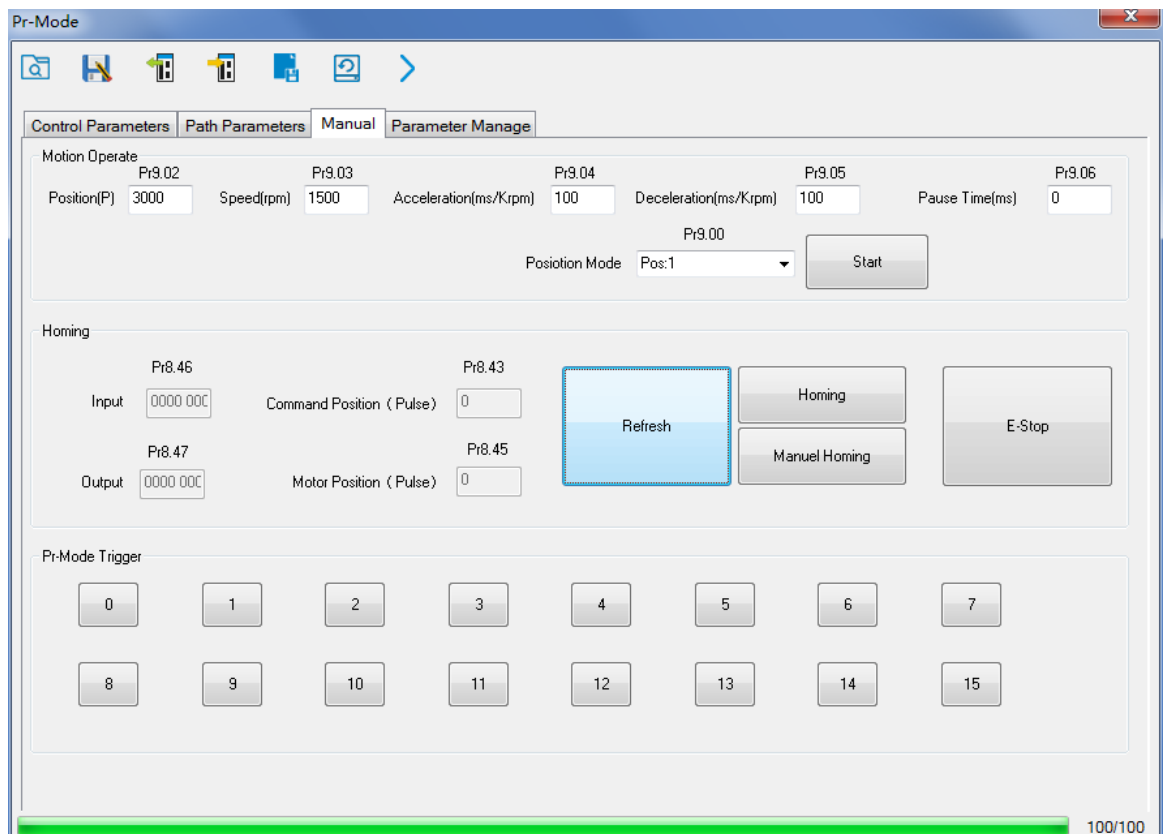
The screenshot shows the 'Pr-Mode' software interface. At the top, there is a 'Functional area' with navigation icons. Below it, there are tabs for 'Control Parameters', 'Path Parameters', 'Manual', and 'Parameter Manage'. The main area displays a table of parameters for 16 paths (Path ID 0 to 15). The table columns are: Path ID, Position Mode, Position(P), Speed(rpm), Acceleration(...), Deceleration(...), Pause Time(...), and S Code.

| Path ID | Position 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   |

Below the table is a 'Position symbol description area' with the following text:

Symbol description of positioning mode: Interrupt function ([: No interrupt] [!: Interrupt]) + Position type (P: Position mode) (V: Speed mode) (HOME: Homing mode) (CAP: Relative reference) + Absolute/relative (ABS: absolute instruction) (INC: Relative instruction) (REL: Relative to the motor) (CAP: Relative reference) + Jump Function (SJ: Positioning jump) (CJ: Continuous jump) (END: Stop)

4、Debug homing process, path trigger motion, input and output, etc. Its debugging interface is shown as follow:



The screenshot shows the 'Pr-Mode' software interface with the 'Manual' tab selected. It displays various control parameters and buttons for debugging.

**Motion Operate:**

- Pr9.02 Position(P): 3000
- Pr9.03 Speed(rpm): 1500
- Pr9.04 Acceleration(ms/Krpm): 100
- Pr9.05 Deceleration(ms/Krpm): 100
- Pr9.06 Pause Time(ms): 0
- Pr9.00 Position Mode: Pos:1
- Start button

**Homing:**

- Pr8.46 Input: 0000 000
- Pr8.43 Command Position (Pulse): 0
- Pr8.47 Output: 0000 000
- Pr8.45 Motor Position (Pulse): 0
- Refresh button (highlighted)
- Homing button
- Manual Homing button
- E-Stop button

**Pr-Mode Trigger:**

- Buttons for paths 0 through 15.

**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.

## 9.5.2 RS485 communication case

### 1、Write single data 0x06

| NO | Send        |                         |          | Receive     |                                   |          |
|----|-------------|-------------------------|----------|-------------|-----------------------------------|----------|
|    | 1           | <b>ID</b>               | Slave ID | 0x01        | <b>ID</b>                         | Slave ID |
| 2  | <b>FC</b>   | Function code           | 0x06     | <b>FC</b>   | Function code                     | 0x06     |
| 3  | <b>ADDR</b> | Address                 | H        | <b>ADDR</b> | Address                           | H        |
| 4  |             |                         | L        |             |                                   | L        |
| 5  | <b>DATA</b> | Data quantity<br>(Word) | H        | <b>DATA</b> | Actually written<br>data quantity | H        |
| 6  |             |                         | L        |             |                                   | L        |
| 7  | <b>CRC</b>  | Check code              | L        | <b>CRC</b>  | 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                |
|----|--------------------------------|------------------------|
| 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                 |

(2) Path 0 (Relative position mode, 10000pulse, 600rpm, 50ms/1000rpm)

| NO | RS485 communication data frame | Details                |
|----|--------------------------------|------------------------|
| 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                 |

(3) Path 0 (Velocity mode, 600rpm, 50ms/1000rpm)

| NO | RS485 communication data frame | Details              |
|----|--------------------------------|----------------------|
| 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               |

(4) Path 1 (Absolute position mode, -200000pulse, 600rpm, 50ms/1000rpm)

| NO | RS485 communication data frame | Details                |
|----|--------------------------------|------------------------|
| 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                 |

(5) Path 1 (Velocity mode, 300rpm, 50ms/1000rpm)

| NO | RS485 communication data frame | Details              |
|----|--------------------------------|----------------------|
| 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               |

(6) Homing

| NO | RS485 communication data frame | Details                |
|----|--------------------------------|------------------------|
| 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                 |

## 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.
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 MODBUS communication frame format operation is shown below:

| Order | Sending orders (Master->Slave) |                    |        | Return command (Slave->Master) |                                |      |
|-------|--------------------------------|--------------------|--------|--------------------------------|--------------------------------|------|
| 1     | <b>ID</b>                      | Sub-station No.    | 0~31   | <b>ID</b>                      | Sub-station No.                | 0~31 |
| 2     | <b>FC</b>                      | Function code      | 0x10   | <b>FC</b>                      | Function code                  | 0x10 |
| 3     | <b>ADDR</b>                    | Address            | 0x62   | <b>ADDR</b>                    | Address                        | 0x62 |
| 4     |                                |                    | 0x00   |                                |                                | 0x00 |
| 5     | <b>NUM1</b>                    | Data quantity Word | 0x00   | <b>NUM</b>                     | Actually written data quantity | 0x00 |
| 6     |                                |                    | 0x08   |                                |                                | 0x08 |
| 7     | <b>NUM2</b>                    | Data quantity Byte | 0x10   | <b>CRC</b>                     | check code                     | L    |
| 8-9   | <b>P9.00</b>                   | Mode               | XXXX   |                                |                                | H    |
| 10-11 | <b>P9.01</b>                   | High position      | XXXX   |                                |                                |      |
| 12-13 | <b>P9.02</b>                   | Low position       | XXXX   |                                |                                |      |
| 14-15 | <b>P9.03</b>                   | Speed              | XXXX   |                                |                                |      |
| 16-17 | <b>P9.04</b>                   | Acceleration       | XXXX   |                                |                                |      |
| 18-19 | <b>P9.05</b>                   | Deceleration       | XXXX   |                                |                                |      |
| 20-21 | <b>P9.06</b>                   | Delay time         | XXXX   |                                |                                |      |
| 22-23 | <b>P9.07</b>                   | Trigger control    | 0x0010 |                                |                                |      |
| 24    | <b>CRC</b>                     | Check code         | L      |                                |                                |      |
| 25    |                                |                    | H      |                                |                                |      |

**Absolute position:** 3F 10 62 00 00 08 10 00 01 00 01 86 A0 01 F4 00 64 00 64 00 00 00 10 31 86

3F slave ID 63

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 Model, Absolute positioning 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, therefore, 00 01 86 A0 represents ten turns of motor rotation

- 01 F4** data written down to the fourth addresses of 6203 mapped to Pr9.03  
Hexadecimal data of Speed=500r/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)
- 31 86** 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 rotation

3F 10 62 00 00 08 10 00 01 00 00 00 00 01 F4 00 64 00 64 00 00 00 10 3B 73

The final analysis was performed at a speed of 500r/min, acceleration and deceleration time of 100ms, and the  
position of absolute positioning 0 rotation was taken

**Homing:** 3F 06 60 02 00 21 33 0C (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 driver, 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:

**3F** slave ID 63

**06** function code, write single data

| NO | Send |                         |      |  | Receive |                                   |      |
|----|------|-------------------------|------|--|---------|-----------------------------------|------|
|    | 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<br>(Word) | H    |  | DATA    | Actually written<br>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 zero point.  
Write 0x040, e-stop

**33 0C** 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.

**Speed:** 3F 10 62 00 00 08 10 00 02 00 00 00 00 03 E8 00 64 00 64 00 00 00 10 41 78

**3F** slave ID 63

**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

Motion Model, 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, therefore, 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)

**41 78** 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, Speed mode

## 9.6 RS485 Parameter address

| Parameter     | Address (decimalism) | Address (HEX) | Data Width  |
|---------------|----------------------|---------------|-------------|
| Pr0.00~Pr0.24 | 0~24                 | 0x0~0x18      | 16 bit data |
| Pr1.00~Pr1.39 | 25~64                | 0x19~0x40     |             |
| Pr2.00~Pr2.29 | 65~94                | 0x41~0x5E     |             |
| Pr3.00~Pr3.29 | 95~124               | 0x5F~0xD6     |             |
| Pr4.00~Pr4.49 | 125~174              | 0x7D~0xFE     |             |

|                |             |               |  |
|----------------|-------------|---------------|--|
| Pr5.00~Pr5.39  | 175~214     | 0xAF~0xD6     |  |
| Pr6.00~Pr6.39  | 215~254     | 0xD7~0xFE     |  |
| Pr7.00~Pr7.91  | 255~349     | 0xFF~0x15D    |  |
| Pr8.00~Pr8.49  | 24576~24625 | 0x6000~0x6031 |  |
| Pr9.00~Pr9.127 | 25088~25215 | 0x6200~0x627F |  |

### Status monitoring

| Sort           | Name                        | Address | Operation | Unit | Specification           |
|----------------|-----------------------------|---------|-----------|------|-------------------------|
| Status monitor | U phase current             | 0x187   | R         | 0.1A | Refer to specification2 |
|                | V phase current             | 0x188   | R         | 0.1A |                         |
|                | Status monitoring pointer 1 | 0x191   | R/W       | --   |                         |
|                | Status monitoring pointer 2 | 0x192   | R/W       | --   |                         |
|                | Status monitoring pointer 3 | 0x193   | R/W       | --   |                         |
|                | Status monitoring pointer 4 | 0x194   | R/W       | --   |                         |
|                | Virtue input 1              | 0x197   | R/W       | --   |                         |
|                | Virtue input 2              | 0x198   | R/W       | --   |                         |
|                | Servo status                | 0x1F0   | R         | --   |                         |
|                | Virtue output               | 0x1F1   | R         | --   |                         |
|                | Status monitoring data 1    | 0x1F3   | R         | --   |                         |
|                | Status monitoring data 2    | 0x1F4   | R         | --   |                         |
|                | Status monitoring data 3    | 0x1F5   | R         | --   |                         |
|                | Status monitoring data 4    | 0x1F6   | R         | --   |                         |

#### Specification 2:

(2-1) Status monitoring: status monitoring X pointer 0x191~0x194 status monitoring X Data: 0x1F3~0x1F6; X=1,2,3,4.

Status monitoring X data and status monitoring X pointer one-to-one correspondence. Status monitoring X data feedback status monitoring.

X pointer points to the data. The corresponding data of status monitoring X pointer are as below:

| Pointer value | Name               | Unit  | Specification |
|---------------|--------------------|-------|---------------|
| 0x03          | Position deviation | pulse |               |
| 0x41          | Speed feedback     | r/min |               |
| 0x42          | Speed deviation    | r/min |               |
| 0x140         | DC bus voltage     | 0.01V |               |
| 0x180         | Analog input 1     | 0.01V |               |

|       |                        |    |                              |
|-------|------------------------|----|------------------------------|
| 0x200 | SI1 Input port status  | -- | =1:High level; =0: Low level |
| 0x201 | SI2 Input port status  | -- | =1:High level; =0: Low level |
| 0x202 | SI3 Input port status  | -- | =1:High level; =0: Low level |
| 0x203 | SI4 Input port status  | -- | =1:High level; =0: Low level |
| 0x204 | SI5 Input port status  | -- | =1:High level; =0: Low level |
| 0x205 | SI6 Input port status  | -- | =1:High level; =0: Low level |
| 0x206 | SO1 Output port status | -- | =1:High level; =0: Low level |
| 0x207 | SO2 Output port status | -- | =1:High level; =0: Low level |
| 0x208 | SO3 Output port status | -- | =1:High level; =0: Low level |
| 0x209 | SO4 Output port status | -- | =1:High level; =0: Low level |

### (2-2) Virture INPUT1: 0x197

| Bit  | Name                              | Symbol  | Operation | Specification           |
|------|-----------------------------------|---------|-----------|-------------------------|
| [0]  | Positive over travel              | POT     | R/W       | =1: valid ; =0: invalid |
| [1]  | Negative over travel              | NOT     | R/W       | =1: valid ; =0: invalid |
| [2]  | Servo enable                      | SRV-ON  | R/W       | =1: valid ; =0: invalid |
| [3]  | Clear alarm                       | A-CLR   | R/W       | =1: valid ; =0: invalid |
| [4]  | Reserved                          | --      | --        | --                      |
| [5]  | Reserved                          | --      | --        | --                      |
| [6]  | Position error clear              | CL      | R/W       | =1: valid ; =0: invalid |
| [7]  | Command pulse input is            | INH     | R/W       | =1: valid ; =0: invalid |
| [8]  | Reserved                          | --      | --        | --                      |
| [9]  | Reserved                          | --      | --        | --                      |
| [10] | Reserved                          | --      | --        | --                      |
| [11] | Electronic gear selection 1       | DIV1    | R/W       | =1: valid ; =0: invalid |
| [12] | Electronic gear selection 2       | DIV2    | R/W       | =1: valid ; =0: invalid |
| [13] | Internal instruction speed choice | INTSPD1 | R/W       | =1: valid ; =0: invalid |
| [14] | Internal instruction speed choice | INTSPD2 | R/W       | =1: valid ; =0: invalid |
| [15] | Internal instruction speed choice | INTSPD3 | R/W       | =1: valid ; =0: invalid |

### (2-3) Virtual INPUT2: 0x198

| Bit      | Name                       | Symbol   | Operation | Specification           |
|----------|----------------------------|----------|-----------|-------------------------|
| [0]      | Zero speed clamping        | ZEROSPD  | R/W       | =1: valid ; =0: invalid |
| [1]      | Torque instruction symbols | VC-SIGN  | R/W       | =1: valid ; =0: invalid |
| [2]      | Torque instruction symbols | TC-SIGN  | R/W       | =1: valid ; =0: invalid |
| [3]      | Forced alarm               | E-STOP   | R/W       | =1: valid ; =0: invalid |
| [4]      | Reserved                   | --       | --        | --                      |
| [5]      | Position error clear       | CL-LAST  | R/W       | =1: valid ; =0: invalid |
| [6]~[15] | Reserved                   | Reserved | --        | --                      |

### (2-4) Servo status: 0x1F0

| Bit      | Name         | Symbol   | Operation | Specification           |
|----------|--------------|----------|-----------|-------------------------|
| [0]      | Reserved     | Reserved | --        | --                      |
| [1]      | Servo enable | SRV-ON   | R         | =1: valid ; =0: invalid |
| [2]      | Servo error  | SRV-ERR  | R         | =1: valid ; =0: invalid |
| [3]~[15] | Reserved     | Reserved | --        | --                      |

### (2-5) Virtual OUTPUT: 0x1F1

| Bit  | Name                            | Symbol   | Operation | Specification           |
|------|---------------------------------|----------|-----------|-------------------------|
| [0]  | Servo ready                     | SRDY     | R         | =1: valid ; =0: invalid |
| [1]  | Reserved                        | --       | --        | --                      |
| [2]  | Positioning completed           | INP      | R         | =1: valid ; =0: invalid |
| [3]  | Speed reach                     | ATSPD    | R         | =1: valid ; =0: invalid |
| [4]  | Torque limit signals effective  | TLC      | R         | =1: valid ; =0: invalid |
| [5]  | zero-speed                      | ZSP      | R         | =1: valid ; =0: invalid |
| [6]  | Velocity Matching               | VCOIN    | R         | =1: valid ; =0: invalid |
| [7]  | Reserved                        | --       | --        | --                      |
| [8]  | Reserved                        | --       | --        | --                      |
| [9]  | Position command have output or | PCMD     | R         | =1: valid ; =0: invalid |
| [10] | Reserved                        | --       | --        | --                      |
| [11] | Reserved                        | --       | --        | --                      |
| [12] | Reserved                        | --       | --        | --                      |
| [13] | Speed command have output or    | VCMD     | R         | =1: valid ; =0: invalid |
| [14] | alarm signal                    | ALARM    | R         | =1: valid ; =0: invalid |
| [15] | Reserved                        | Reserved | --        | --                      |

### (3) Alarm signal

| Sort         | Name              | Address | Operation | Unit | Specification      |
|--------------|-------------------|---------|-----------|------|--------------------|
| Alarm signal | Servo error alarm | 0x1f2   | R         | --   | Refer to explain 3 |

#### Explain3

| Alarm signal define: ADD 0x1f2   |              |  |                      |
|--|--------------|--|----------------------|
| The value of the bit [11:0](HEX).<br>High 4 bit [15:12] must be shielded | Alarm List   | The value of the bit [11:0](HEX).<br>High 4 bit [15:12] must be shielded | Alarm List           |
| 0x000  | No Alarm     | 0x190  | excessive vibration  |
| 0x0E1/0x0E0  | over-current | 0x150  | encoder line breaked |
| 0x100  | over-load    | 0x151/0x170  | encoder data error   |

|              |                                 |                   |   |
|--------------|---------------------------------|-------------------|---|
| 0x180        | position error over-large error | 0x152             | initialized position of encoder error                 |
| 0x1A0        | over-speed                      | 0x240             | CRC verification error when EEPROM parameter is saved |
| 0x1A1        | motor speed out of control      | 0x570             |   |
| 0x0D0        | DC bus under-voltage            | 0x120             | Resistance discharge circuit over-load                |
| 0x0C0        | DC bus over-voltage             | 0x153             | encoder battery error                                 |
| 0x171/0x172  | encoder parameters read error   | 0x210/0x211/0x212 | I/F input interface allocation error                  |
| Other values | Refer to user manual            |                   |   |

#### (4) Auxiliary function

| Sort                         | Name         | Address | Operation | Unit | Specification      |
|------------------------------|--------------|---------|-----------|------|--------------------|
| Auxiliary function command 1 | Control word | 0x19A   | W         | /    | Refer to explain 4 |
|                              | Status word  | 0x1F7   | R         | /    |                    |

#### Explain4

Auxiliary function operation procedure: Start the related functions by transmit control word, estimate completion by querying status word

Status word back to initial status automatically after been read. Auxiliary function as below.

| Address | Control word | Auxiliary function  |
|---------|--------------|---|
| 0x19A   | 0x4444       | Download default parameters (Except the motor parameters) |
|         | 0x5555       | Save parameters   |
|         | 0x7777       | Remove the alarm ( can only clear purgeable alarm )       |
|         | 0x7788       | Clear historical alarm                                    |

| Address | Control word | Specification |
|---------|--------------|---------------|
| 0x1F7   | 0x5555       | OK            |
|         | others       | null          |

## *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  $\times$  G  $\times$  mechanical reduction ratio.

In position control mode, the actual load minimum displacement = minimum command pulse travel  $\times$  G  $\times$  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

### A、Modbus Communication

There are two kinds of modbus communication methods of drivers: RS485 and RS232. RS232 belongs to point-to-point communication, which is used for PC protocol and cannot realize multi-network. RS485 belongs to a single master and multi slave communication mode and can realize multi network control.

#### A.1 Wiring

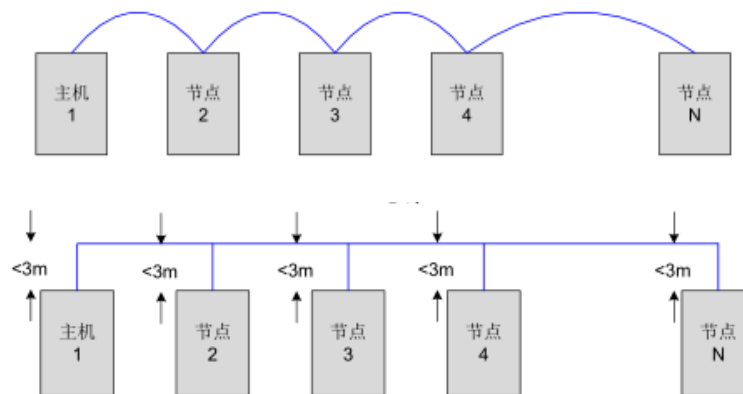
##### A.1.1 RS232 wiring



##### A.1.2 RS485 wiring for single slave



### A.1.3 RS485 wiring for multi slave



### A.1.4 RS485 wiring details

- (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 Parameters and interface for communication

### A.2.1 Parameters setting

| Pr5.29* | mode setup of RS485 communication      | Range | unit     | default      | Related control mode |   |   |
|---------|--|-------|----------|--------------|----------------------|---|---|
|         |  | 0-6   | -        | 5            | P                    | S | T |
|         |  | 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* | baud rate setup of RS485 communication | Range | unit     | default      | Related control mode |   |   |
|         |  | 0-6   | -        | 2            | P                    | S | T |

You can set up the communication speed of RS485.

| Set value | Baud rate | Set value | Baud rate |
|-----------|-----------|-----------|-----------|
| 0         | 2400bps   | 4         | 38400bps  |
| 1         | 4800bps   | 5         | 57600bps  |
| 2         | 9600bps   | 6         | 115200bps |
| 3         | 19200bps  |           |           |

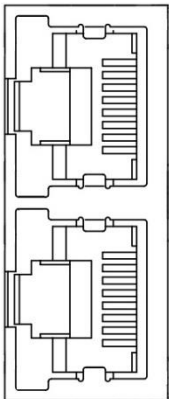
Baud rate error is 2400-38400bps $\pm$ 5% ,57600-115200bps $\pm$ 2%

| Pr5.31* | RS485 slave axis address | Range | unit | default | Related control mode |   |   |
|---------|--------------------------|-------|------|---------|----------------------|---|---|
|         |                          | 0-127 | -    | 1       | P                    | S | T |

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

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

## A.2.2 RS232/RS485 Communication Port

| Port       |  | Pin    | Signal      |
|------------|--|--------|-------------|
| CN4<br>CN5 |  | 1 , 9  | RDO+(RS485) |
|            |  | 2 , 10 | RDO-(RS485) |
|            |  | 3 , 11 | /           |
|            |  | 4 , 12 | TXD(RS232)  |
|            |  | 5 , 13 | RXD(RS232)  |
|            |  | 6 , 14 | VCC5V       |
|            |  | 7 , 15 | GND         |
|            |  | 8 , 16 | /           |
|            |  |        | PE          |

## A.3 Modbus Protocol

The driver supports 16bit data read and write of Modbus-RTU protocol, and its function codes include 0x03,0x06 and 0x10. 0x03 read data function code, 0x06 write single data function code and 0x10 write multiple data function code.

**Notes:** 1word=2byte=16bit

### A.3.1 Function code of read data 0x03

The function code of read data is 0x03. It can read 1~100 16bit data. Now take slave ID 1, read 2 data as an example: (H is 8bit high for 16bit, L is 8bit low for 16bit)

| NO | Send        |                         |         | Receive      |                         |         |
|----|-------------|-------------------------|---------|--------------|-------------------------|---------|
| 1  | <b>ID</b>   | Slave ID                | 0x01    | <b>ID</b>    | Slave ID                | 0x01    |
| 2  | <b>FC</b>   | Function code           | 0x03    | <b>FC</b>    | Function code           | 0x03    |
| 3  | <b>ADDR</b> | Address                 | H       | <b>NUM</b>   | Data quantity<br>(Byte) | 0x00(H) |
| 4  |             |                         | L       |              |                         | 0x04(L) |
| 5  | <b>NUM</b>  | Data quantity<br>(Word) | 0x00(H) | <b>DATA1</b> | Data1                   | H       |
| 6  |             |                         | 0x02(L) |              |                         | L       |
| 7  | <b>CRC</b>  | Check code              | L       | <b>DATA2</b> | Data2                   | H       |
| 8  |             |                         | H       |              |                         | L       |
| 9  |             |                         |         | <b>CRC</b>   | Check code              | L       |
| 10 |             |                         |         |              |                         |         |

**Notes:** The number of receive data is twice the number of send data quantity.

The communication data is shown as below:

[Send] 01 03 00 04 00 02 85 CA

[Receive] 01 03 04 00 00 00 02 7B F2

**Send:** 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:** 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.

### A.3.2 Function code of write single data 0x06

The function code of write single data is 0x06. Now take slave ID 1, write 1 data as an example: (H is 8bit high for 16bit, L is 8bit low for 16bit)

| NO | Send        |                         |      | Receive     |                                   |      |
|----|-------------|-------------------------|------|-------------|-----------------------------------|------|
| 1  | <b>ID</b>   | Slave ID                | 0x01 | <b>ID</b>   | Slave ID                          | 0x01 |
| 2  | <b>FC</b>   | Function code           | 0x06 | <b>FC</b>   | Function code                     | 0x06 |
| 3  | <b>ADDR</b> | Address                 | H    | <b>ADDR</b> | Address                           | H    |
| 4  |             |                         | L    |             |                                   | L    |
| 5  | <b>DATA</b> | Data quantity<br>(Word) | H    | <b>DATA</b> | Actually written<br>data quantity | H    |
| 6  |             |                         | L    |             |                                   | L    |
| 7  | <b>CRC</b>  | Check code              | L    | <b>CRC</b>  | Check code                        | L    |
| 8  |             |                         | H    |             |                                   | H    |

**Notes:** The number of receive frame is the same as the send frame.

The communication data is shown as below:

[Send] 01 06 00 04 00 02 49 CA

[Receive] 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.

### A.3.3 Function code of write multiple data 0x10

The function code of write multiple data is 0x10. In this case, 16 bits of multiple data are written. Now take slave ID 1, write 2 data as an example: (H is 8bit high for 16bit, L is 8bit low for 16bit)

| NO | Send         |                         |                   | Receive     |                                   |          |
|----|--------------|-------------------------|-------------------|-------------|-----------------------------------|----------|
|    | 1            | <b>ID</b>               | Slave ID          | 0x01        | <b>ID</b>                         | Slave ID |
| 2  | <b>FC</b>    | Function code           | 0x10              | <b>FC</b>   | Function code                     | 0x10     |
| 3  | <b>ADDR</b>  | Address                 | H                 | <b>ADDR</b> | Address                           | H        |
| 4  |              |                         | L                 |             |                                   | L        |
| 5  | <b>NUM1</b>  | Data quantity<br>(Word) | 0x00 (H)          | <b>NUM</b>  | Actually written<br>data quantity | 0x00 (H) |
| 6  |              |                         | 0x02 (L)          |             |                                   | 0x02 (L) |
| 7  | <b>NUM2</b>  | Data quantity<br>(Byte) | 0x04<br>(2* NUM1) | <b>CRC</b>  | Check code                        | L        |
| 8  | <b>DATA1</b> | DATA1                   | H                 |             |                                   | H        |
| 9  |              |                         | L                 |             |                                   |          |
| 10 | <b>DATA2</b> | DATA2                   | H                 | <b>CRC</b>  | Check code                        | L        |
| 11 |              |                         | L                 |             |                                   | H        |
| 12 | <b>CRC</b>   | Check code              | L                 |             |                                   |          |
| 13 |              |                         | H                 |             |                                   |          |

The communication data is shown as below:

[Send] 01 10 00 04 00 02 04 01 00 00 00 F3 A0

[Receive] 01 10 00 04 00 02 00 09

**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 0x01000 and 0x0000. The CRC check code is 0xA0F3.

**Receive:** The receive frame represents that write data into slave ID 1 finished successfully.

### A.3.4 Error response

When there is a mistake in the format of the send frame data, the slave feeds back the wrong reply frame data to the master station. The format is as follows:

| NO | Error response frame data (Slave-->Master) |               |                       |
|----|--|---------------|-----------------------|
| 1  | <b>ID</b>                                  | Slave ID      | 0~31                  |
| 2  | <b>FC</b>                                  | Function code | (0x03/0x06/0x10)+0x80 |
| 3  | <b>Error code</b>                          | Error code    | 0x01/0x02/0x03/0x08   |
| 4  | <b>CRC</b>                                 | Check code    | L                     |
| 5  |  |               | H                     |

The error code and its meaning are as follows:

| Error code | Meaning  |
|------------|--|
| 0x01       | Function code error                                |
| 0x02       | Access address error                               |
| 0x03       | Data error, 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

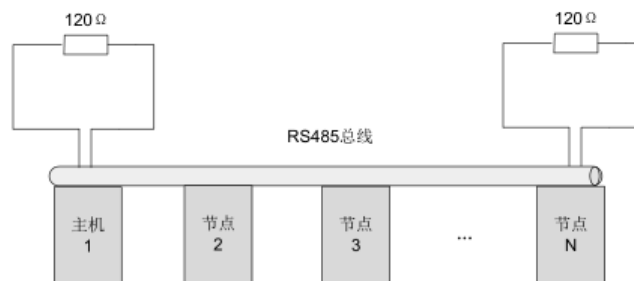
[Receive] 01 91 01 8C 50

**Receive:** Function code error in the send data frame sent by the master station

## A.4 RS485 common problems and solutions

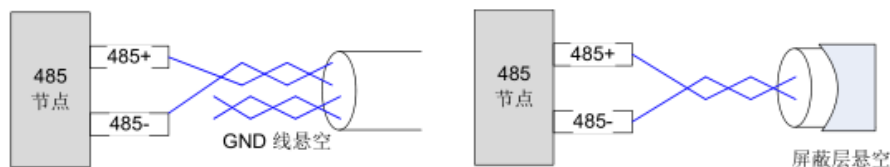
### A.4.1 Common problems

#### 1、Terminal resistance



The correct connection of terminal resistance is shown in the above figure, a 120 ohm terminal resistance need to connect in the head end and the end of the communication bus.

#### 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 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.

### A.4.2 Problem solving procedure

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

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