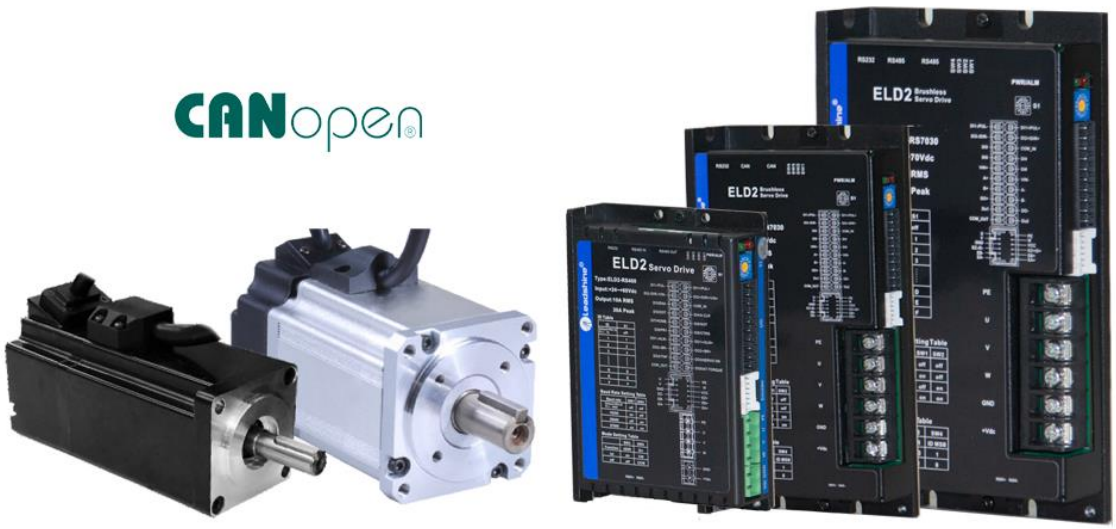
# *ELD2-CAN Series Servo Drives*

# *User Manual*

*Revision 1.12*

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# *Introduction*

**Thanks for purchasing Leadshine ELD2 series low-voltage DC servo drives, this instruction manual provides knowledge and attention for using this drive.**

***Contact tech@leadshine.com for 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.

Be attention to the following warning symbol:

**Warning** indicates that the error operation could result in loss of life or serious injury.

**Caution** indicates that the error operation could result in operator injured, also make equipment damaged.

**Attention** indicates that the error use may damage product and equipment.

## Safety precautions

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

## Acceptance

| **Caution** |
|---|
| ● The product which is damaged or have fault is forbidden to use. |

## Transportation

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

# Installation

**Caution**

***Servo Drive and Servo Motor:***

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

***Servo Drive:***

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

***Servo Motor:***

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

# Wiring

**Warning**

- The workers of participation in wiring or checking must possess sufficient ability do this job.
- Ground the earth terminal of the motor and drive without fail.
- The wiring should be connected after servo drive 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.
- We mustn't connect capacitors, inductors or filters between servo motor and servo drive.
- The wire and temperature-resistant object must not be close to radiator of servo drive and motor.
- The freewheel diode which connect in parallel to output signal DC relay mustn't connect reversely.

# Debugging and running

**Caution**

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

**Caution**

- Install a emergency stop protection circuit externally, the protection can stop running immediately to prevent accident happened and the power can be cut off immediately.
- The run signal must be cut off before resetting alarm signal, just to prevent restarting suddenly.
- The servo drive must be matched with specified motor.

- Don't power on and off servo system frequently, just to prevent equipment damaged.
- Forbidden to modify servo system.

## Fault Processing

**Caution**

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

## System selection

**Attention**

- The rate torque of servo motor should be larger than effective continuous load torque.
- The ratio of load inertia and motor inertia should be smaller than recommended value.
- The servo drive should be matched with servo motor.

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# Chapter 1 Introduction

## 1.1 Product Introduction

ELD2-CAN low-voltage DC servo is a special motion control product designed for machines and applications that request a best balance between outstanding and reasonable cost.

Based on CIA DS 301+DSP 402 sub-protocol, it can be seamlessly connected to the controller/drive that supports this standard protocol.

Combined with abundant features like MFC, vibration suppression, Multi-mode filter function etc. It provide machines a compact size, low tuning works, but high resolution encoder up to 23bit, an unique servo system.

**Talent features compared with pulse servo:**

- ✧ Reduce communication interference and extend communication distance
  The reliability of pulse communication is reduced because the transmission cable of pulse signal is vulnerable to electromagnetic interference. But CAN bus communication can significantly improve the reliability of communication, reduce the influence of interference on instruction and extend the communication distance due to the error detection, limitation and processing mechanism contained in the protocol.
- ✧ Improve motion performance
  The trajectory planning of bus communication servo is realized in the drive. The controller only needs to transfer the target position, speed, acceleration and other information to the drive. Therefore, the drive can predict the motion parameters of the next moment in advance internally, and then take feedforward measures to improve the motion performance.
- ✧ Reduce system wiring complexity
  Under the pulse communication mode, the controller needs to communicate with each drive through the pulse cable connection, which often leads to the dense and complicated wiring of the machine equipment. Under the CAN bus communication mode, the controller only needs to use the cable connection with one of its drives, and the rest of the drives only need to use the chain mode to connect with the drive.
- ✧ Reduce the number of required control unit ports, thereby reducing the cost
  Multiple bus servo drive only need one port connect with movement control unit (motion controller or movement control cards), without pulse module, also don't need increases the number of drive control card because there are so many drives, and don't need to consider computer slot number limitation. It can save the cost of pulse module, control card and industrial control machine.

**Talent feature:**

- ◆ Easy tuning
- ◆ Automatic identification for motor
- ◆ Simple, flexible to control
- ◆ RS485/Modbus/CANopen
- ◆ Notch filter, damping filter
- ◆ Optional feedback

## *1.1.1 Specification and feature*

| Specifications | | | | | |
|---|---|---|---|---|---|
| Drive model | | ELD2-CAN7005B | ELD2-CAN7010B | ELD2-CAN7015B | ELD2-CAN7020B |
| Size(mm) | | 140*79.5*25.5 | 140*79.5*25.5 | 175*101.5*31 | 175*101.5*31 |
| Rated power(kw) | | 0.1 | 0.4 | 0.6 | 0.75 |
| Rated current(Arms) | | 5 | 10 | 15 | 20 |
| Peak current(Apeak) | | 21.2 | 42.5 | 45 | 80 |
| Main power | Voltage(V) | DC24-70(recommended 24-60Vdc) | | | |
| | Current(A) | 5Arms （≤48Vdc）<br>3.5Arms（＞48Vdc） | 10Arms （≤48Vdc）<br>7Arms（＞48Vdc） | 15Arms （≤48Vdc）<br>11Arms（＞48Vdc） | 20Arms （≤48Vdc）<br>14Arms（＞48Vdc） |
| Logic power | Voltage(V) | —— | | | |
| Control power | Voltage(V) | DC12-24 | | | |
| | Current(mA) | ≥12 | | | |
| Control method | | IGBT PWM sinusoidal Wave Drive | | | |
| Overload | | 300% | | | |
| Brake resistor | | External connection | | | |
| Safe function | | —— | | | |
| Protection rank | | IP20 | | | |

| Specifications | | |
|---|---|---|
| Drive model | | ELD2-CAN7030B |
| Size(mm) | | 175*101.5*31 |
| Rated power(kw) | | 1.2 |
| Rated current(Arms) | | 30 |
| Peak current(Apeak) | | 90 |
| Main power | Voltage(V) | DC24-70(recommended 24-60Vdc) |
| | Current(A) | 30Arms （≤48Vdc）<br>21Arms（＞48Vdc） |
| Logic power | Voltage(V) | —— |
| Control power | Voltage(V) | DC12-24 |
| | Current(mA) | ≥12 |
| Control method | | IGBT PWM sinusoidal Wave Drive |
| Overload | | 300% |
| Brake resistor | | External connection |
| Safe function | | —— |
| Protection rank | | IP20 |

| Features | |
|---|---|
| Communication | CANopen |
| Modes of operation | Profile Position/Profile Velocity/Profile Torque/Homing |
| Inputs/Outputs | 4 programmable digital inputs<br>2 programmable digital outputs |
| Brake Output (24vdc) | √ |
| Motor Supported | Brushless/Brushed |
| Feedback Supported | 1000、2500lines incremental TTL signal encoder and 17bit、23bit serial signal encoder<br>Encoder(ABZ)+Hall(UVW)、Encoder(ABZ) |

### *1.1.2 Part Numbering Information*

**ELD2-CAN 7030 B**

- Brake output
- Maximum Output Power
  - 7005: 24-70Vdc , 5Arms rated current
  - 7010: 24-70Vdc , 10Arms rated current
  - •••
  - 7030: 24-70Vdc , 30Arms rated current
- RS: RS485 (Pulse+Dir/Analog Input/Modbus)
- CAN: CANopen
- ELD2 servo drive ( 24-70Vdc)

## *1.2 Inspection of product*

**Check the following thing before using the products :**

a. Check if the product is damaged or not during transportation.

b. Check if the servo drive & motor are complete or not.

c. Check the packing list if the accessories are complete or not

The ELD2 series DC servo drive can be matched with a variety of domestic and foreign servo motor.

| Matched Motors | |
|---|---|
| Power Range | Up to 1200W |
| Motor Supported | Brushless、Brushed |
| Voltage Range | 24 - 70Vdc |
| Feedback supported | 1000. 2500ppr incremental encoder (Encoder(ABZ)+Hall(UVW))<br>17bit/23bit serial signal encoder |
| Motor Size | 40mm,42mm,57mm,60mm,80mm frame,110mm frame or other size |
| Other Requirements | Brake. oil-seal. protection level. Shaft &connector can be customized |

# Chapter 2 Installation

## 2.1 Storage and Installation Circumstance

**Table 2.1 Servo Drive, Servo Motor Storage Circumstance Requirement**

| Item | ELD2 series drive | ELVM low voltage servo motor |
|---|---|---|
| Temperature | -20-80℃ | -20-60℃ |
| Humility | 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 1000m |
| Vibration | Less than 0.5G (4.9m/s$^2$) 10-60Hz (non-continuous working) | |
| Protection level | IP00(no protection) | IP65 |

**Table 2.2 Servo Drive, Servo Motor Installation Circumstance Requirement**

| Item | ELD2 series drive | ELDM low voltage servo motor |
|---|---|---|
| Temperature | 0-55℃ | 0-40℃ |
| Humility | 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 1000m |
| Vibration | Less than 0.5G (4.9m/s$^2$) 10-60Hz (non-continuous working) | |
| Protection level | IP00(no protection) | IP65 |

## 2.2 Servo Drive 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. |

### 2.2.1 Installation Method

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

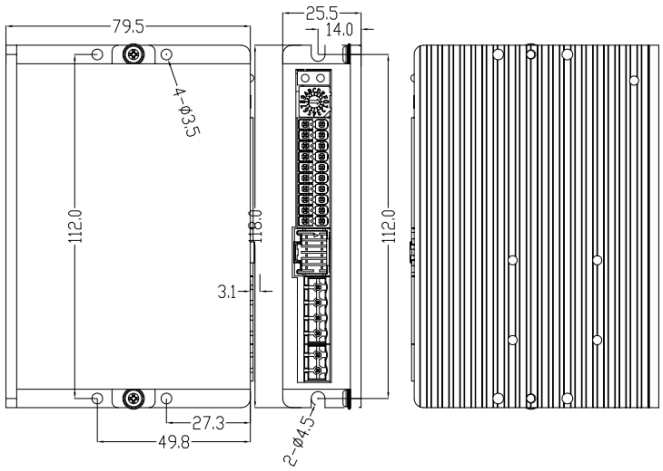



**Figure 2.1(A) installation method of drive ELD2-CAN7005B /ELD2-CAN7010B**

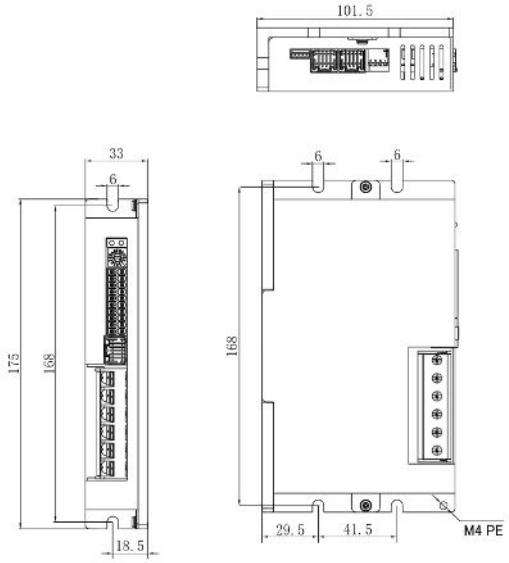



**Figure 2.1(B) installation method of drive ELD2-CAN7015B/ELD2-CAN7020B/ELD2-CAN7030B**

## 2.2.2 Installation Space

Reserve enough surrounding space for effective cooling.

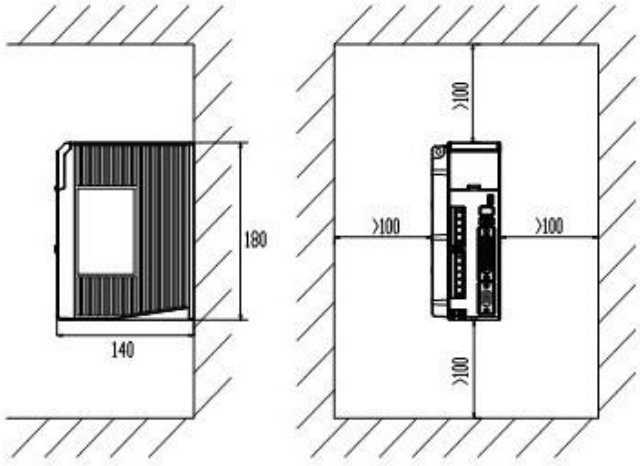



**Figure 2.2 Installation Space for Single Drive**

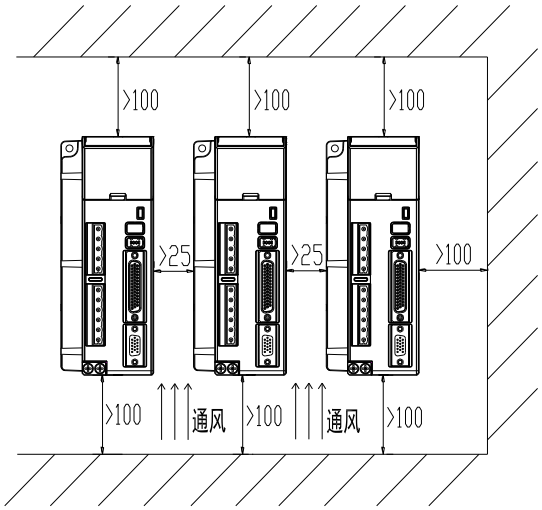



**Figure 2.3 Installation Space for several Drives**

# 2.3 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 3 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 drive without fail.
- The wiring should be connected after servo drive and servo motor installed correctly

## 3.1 Wiring

### 3.1.1 Wire Gauge

**(1)Power supply terminal TB**

● Wiring Diameter:

| Drive | Wiring diameter ($mm^2$/AWG) | | |
|---|---|---|---|
| | Vdc, GND | U.V.W | PE |
| ELD2-CAN7005B | AWG18 | AWG18 | AWG18 |
| ELD2-CAN7010B | AWG16 | AWG16 | AWG16 |
| ELD2-CAN7015B | AWG16 | AWG16 | AWG16 |
| ELD2-CAN7020B | AWG14 | AWG14 | AWG14 |
| ELD2-CAN7030B | AWG12 | AWG12 | AWG12 |

● Grounding: The grounding wire should be as thick as possible, drive servo motor the PE terminal point ground, ground resistance <100 Ω.

●Use noise filter to remove external noise from the power lines and reduce an effect of the noise generated by the servo drive.

● Install fuse (NFB) promptly to cut off the external power supply if drive error occurs.

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

● Diameter: shielded cable (twisting shield cable is better), the diameter ≥ 0.14$mm^2$ (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 10 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 resister**

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

The recommended regenerative resistance specifications for the ELD2 series are as follows:

| Drive | Recommend resister value (Ω) | Recommend resister power (W) |
|---|---|---|
| ELD2-CAN7005B | 10 | 30 |
| ELD2-CAN7010B | 10 | 50 |
| ELD2-CAN7015B | 10 | 50 |
| ELD2-CAN7020B | 10 | 100 |
| ELD2-CAN7030B | 10 | 100 or 150 |

Method for select regenerative resistance specification

- Firstly, use the built-in resistance of the drive to run for a long time to see if it can meet the requirements: ensure that the drive temperature d33<60℃, the braking circuit does not alarm (Regeneration load factor d14<80), and the drive does not report overvoltage error
- If the drive 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 drive, the regenerative energy power is reduced, or a resistance with a smaller external resistance, or a parallel resistance.

The recommended regenerative resistance specifications for the ELD2 series are as follows：
10Ω±5%, 100W RXFB-1, **Part num Code : 10100469**
5Ω±5%, 200W RXLG, **Part num Code : 10100522**

**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.

## *3.1.2 Wiring*

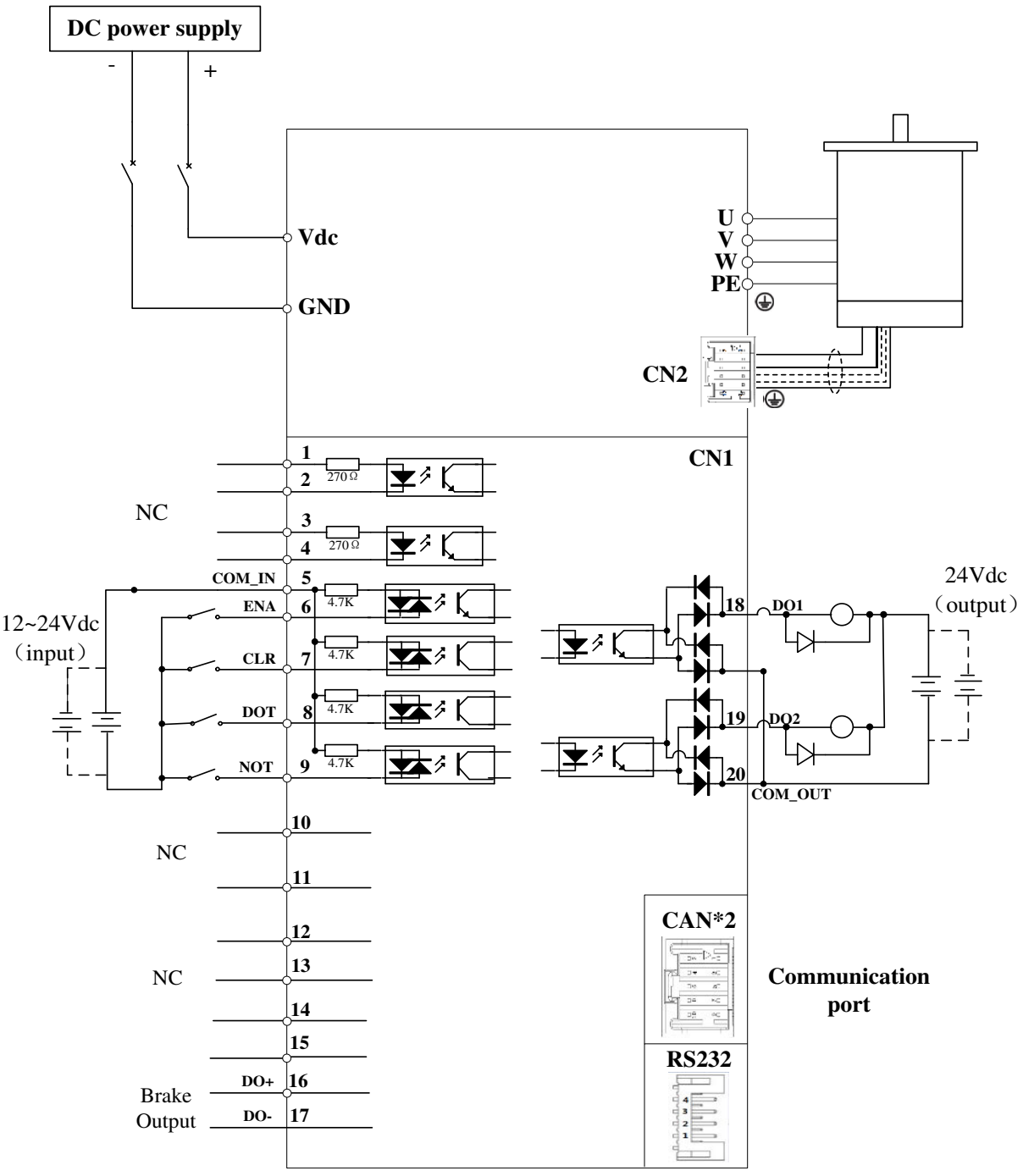



**Figure 3.1 Position Control Mode Wiring**

Notes:

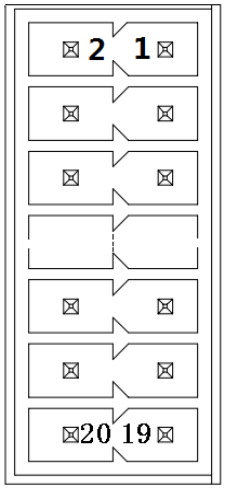
1. Only support 5V pulse and direction signal, 2KΩ resistor must installed with 24V pulse and direction signal.
2. 4 digital inputs DI3~DI6, support NPN and PNP connection, recommend 12~24V input signal.
3. 2 digital outputs DO1~DO2, support NPN and PNP connection, recommend 24V output signal.
4. Brake output(Pin16 and Pin17) is available for :
   ELD2-CAN7005B /ELD2-CAN7010B /ELD2-CAN7015B/ ELD2-CAN7020B/ ELD2-CAN7030B.

# 3.2 Drive Terminals Function

| Port | Function |
|---|---|
| CN1 | Control Signal Port |
| CN2 | Encoder Input Port |
| CN3 | Power Port |
| CN4 | Regenerative resistor Port |
| CN5 | RS232 Communication Port |
| CN6 | CAN Communication Port |
| S1 | CAN slave axis ID |
| SW1~4 | CAN Baud rate \ Terminal resistance |

## 3.2.1 Control Signal Port-CN1 Terminal

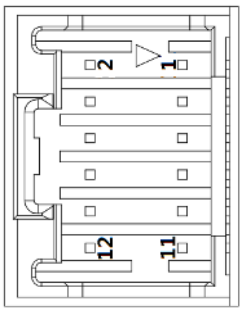
**Table 3.1 Signal Explanation of Control Signal Port-CN1**

| CN1 | | Pin | Signal | IO | Detail |
|---|---|---|---|---|---|
| CN1 |  | 1 | NC | Input | Reserved |
| | | 2 | NC | Input | |
| | | 3 | NC | Input | Reserved |
| | | 4 | NC | Input | |
| | | 5 | COMI | Input | Power supply positive terminal of the external input control signal, 12V ~ 24V |
| | | 6 | DI3 | Input | Digital input signal 3, default value is E-STOP signal, low level available in default , max voltage is 24V input 20KHz |
| | | 7 | DI4 | Input | Digital input signal 4, default value is homing switch signal(HOME-SWITCH) , low level available in default , max voltage |
| | | 8 | DI5 | Input | Digital input signal 5, default value is Positive limit switch signal(POT), low level available in default , max voltage is 24V input 20KHz |
| | | 9 | DI6 | Input | Digital input signal 6, default value is Negative limit switch signal (NOT), low level available in default , max voltage is 24V input 20KHz |
| | | 10 | NC | Input | Reserved |
| | | 11 | NC | Input | |
| | | 12 | A+ | Output | Differential output terminal of motor encoder A phase |
| | | 13 | A- | Output | |
| | | 14 | B+ | Output | Differential output terminal of motor encoder B phase |
| | | 15 | B- | Output | |

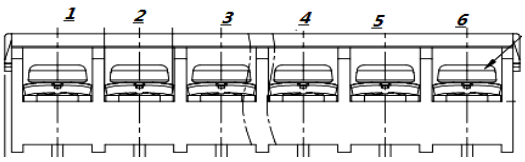
| | | | | | |
|---|---|---|---|---|---|
| | | 16 | DO+ | Output | Brake-OFF output only, can not programed for other function.<br>The current of this digital output is enough to release motor brake. |
| | | 17 | DO- | Output | |
| | | 18 | DO1 | Output | Digital output signal 1 , default value is alarm output，24V, <100mA |
| | | 19 | DO2 | Output | Digital output signal 2 , default value is servo-ready output，24V, <100mA |
| | | 20 | COMO | Output | Digital output signal commonality ground, 24V |

## *3.2.2 Encoder Input Port-CN2 Terminal*

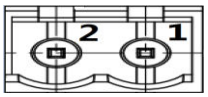
**Table 3.2 Encoder Input Port-CN2 Terminal Signal for ELD2-RS series**

| CN2 | | Pin | Signal | IO | Detail |
|---|---|---|---|---|---|
| Encoder |  | 1 | SHIELD | Input | Ground terminal for shielded |
| | | 2 | HU | Input | Hall sensor U input |
| | | 3 | HW | Input | Hall sensor W input |
| | | 4 | HV | Input | Hall sensor V input |
| | | 5 | VCC | Input | +5V for encoder power supply |
| | | 6 | GND | Input | |
| | | 7 | EZ+/D+ | Input | Encoder channel Z+ input /<br>Serial encoder+ |
| | | 8 | EZ-/D- | Input | Encoder channel Z- input /<br>Serial encoder- |
| | | 9 | EB+ | Input | Encoder channel B+ input |
| | | 10 | EB- | Input | Encoder channel B- input |
| | | 11 | EA+ | PE | Encoder channel A+ input |
| | | 12 | EA- | Input | Encoder channel A- input |

## *3.2.3 Power Port*

| CN3 | | Pin | Signal | Detail |
|---|---|---|---|---|
| Power terminal |  | 1 | VCC | Power for Drive , 24-70vdc |
| | | 2 | GND | |
| | | 3 | W | Power for motor |
| | | 4 | V | |
| | | 5 | U | |
| | | 6 | PE | |

## 3.2.4 Regenerative resistor Port

| CN4 | | Pin | Signal | Detail |
|---|---|---|---|---|
| Regenerative resistor |  | 1 | RBR+ | Regenerative resistor + |
| | | 2 | RBR- | Regenerative resistor - |

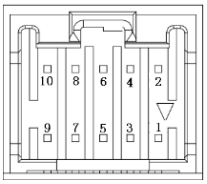
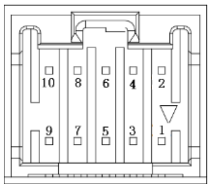
The recommend resistor for most application is 10Ω+/-5%, 100watt

Leadshine can provide resistor: **RXFB-1, Part num Code : 10100469**

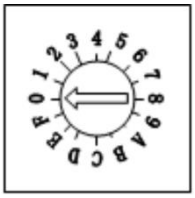
## 3.2.5 Communication Port

| CN5 | | Pin | Signal |
|---|---|---|---|
| RS232 | | 1 | 5V |
| | | 2 | TX |
| | | 3 | GND |
| | | 4 | RX |

## 3.2.6 CAN bus connector

| CN6 | | Pin | Signal | Detail |
|---|---|---|---|---|
| CAN IN |  | 1 | CANH | CANH |
| | | 3 | CANL | CANL |
| | | 5 | GND | GND |
| | | other | NC | |
| **CN6** | | **Pin** | **Signal** | **Detail** |
| CAN OUT |  | 1 | CANH | CANH |
| | | 3 | CANL | CANL |
| | | 5 | GND | GND |
| | | other | NC | |

## 3.2.7 CAN Node-ID and Baud rate switch

| S1 | | NO | CAN Node-ID | NO | CAN Node-ID |
|---|---|---|---|---|---|
| S1 |  | **0** | Pr0.23 Default =16 | **8** | 8 |
| | | **1** | 1 | **9** | 9 |
| | | **2** | 2 | **A** | 10 |
| | | **3** | 3 | **B** | 11 |
| | | **4** | 4 | **C** | 12 |
| | | **5** | 5 | **D** | 13 |

| | | | | | |
|---|---|---|---|---|---|
| | | **6** | 6 | **E** | 14 |
| | | **7** | 7 | **F** | 15 |

If switch S1=0, then Pr0.23 valid.
If switch S1=1~F, S1 switch valid in higher priority than Pr0.23

| CAN Baud rate | SW1 | SW2 |
|---|---|---|
| Pr0.24<br>Default =1MHz | off | off |
| 500 KHz | on | off |
| 250 KHz | off | on |
| 125 KHz | on | on |

If SW1 and SW2 OFF, then Pr0.24 valid
If SW1 or SW2 ON, then these switch valid in higher priority than Pr0.24

**SW3:** CAN terminal resistance

SW3=off，disconnect the terminal resistance

SW3=on，connect the terminal resistance

**SW4：** CAN Node-ID selection（High Bit）

SW4=off, High Bit =0, CAN Node-ID=S1

SW4=on, High Bit =1, CAN Node-ID =16+S1

# *3.3 I/O Interface Principle*

## *3.3.1 Digital Input Interface*

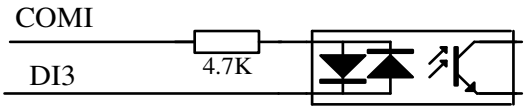



**Figure 3-2 Digital Input Interface**

(1) The user provide power supply, DC 12-24V, current≥100mA

(2) **Notice:** if current polar connect reversely, servo drive doesn't run.

## *3.3.2 Digital Output Interface*

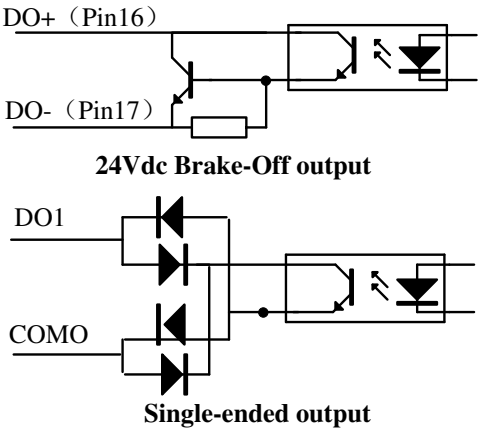



**Figure 3-3 Switch Output Interface**

(1) 2 digital single-ended outputs DO1~DO2, support NPN and PNP connection, recommend 24V output signal.
(2) 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.

**Digital Input function allocation**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr4.02** | Name | Input selection DI3 | | | Mode | | | | | | **F** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x14 | | Index | | | 2402h |
| **Pr4.03** | Name | Input selection DI4 | | | Mode | | | | | | **F** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x16 | | Index | | | 2403h |
| **Pr4.04** | Name | Input selection DI5 | | | Mode | | | | | | **F** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x01 | | Index | | | 2404h |
| **Pr4.05** | Name | Input selection DI6 | | | Mode | | | | | | **F** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x02 | | Index | | | 2405h |

Assign functions to digital inputs.
This parameter use 16 binary system to set up the values,
For the function number, please refer to the following table.

| Signal | Symbol | Setup Value | | 0x60FD(bit) |
|---|---|---|---|---|
| | | Normally open | Normally closed | |
| Invalid | — | 00h | Do not setup | × |
| Positive direction over-travel inhibition input | POT | 01h | 81h | 1 |
| Negative direction over-travel inhibition input | NOT | 02h | 82h | 0 |
| Alarm clear input | A-CLR | 04h | Do not setup | |
| Forced alarm input | E-STOP | 14h | 94h | |
| HOME-SWITCH | HOME-SWITCH | 16h | 96h | 2 |

- Normally open means input signal comes from external controller or component, for example: PLC .
- Normally closed means input signal comes from drive 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 Err210 I/F input multiple assignment error 1or Err211 I/F input multiple assignment error 2.
- E-STOP：Associated parameter Pr4.43

**I/O input digital filtering**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr5.15*** | Name | I/O reading filter | | | Mode | | | | | | **F** |
| | Range | 0~255 | Unit | 0.1ms | Default | 0 | | Index | | | 2515h |
| | I/O input digital filtering; higher setup will arise control delay. | | | | | | | | | | |

**Digital Output function allocation**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr4.10** | Name | Output selection DO1 | | | Mode | | | | | | **F** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x01 | | Index | | | 2410h |
| **Pr4.11** | Name | Output selection DO2 | | | Mode | | | | | | **F** |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x02 | | Index | | | 2411h |

Assign functions to digital outputs.
For the function number, please refer to the following table.

| Signal name | Symbol | Setup value | |
|---|---|---|---|
| | | Normally open | Normally closed |
| Master control output | — | 00h | Do not setup |
| Alarm output | Alm | 81h | 01h |
| Servo-Ready output | S-RDY | 02h | 82h |
| Eternal brake release signal | BRK-OFF | 03h | 83h |
| Positioning complete output | INP | 04h | 84h |
| At-speed output | AT-SPPED | 05h | 85h |
| Torque limit signal output | TLC | 06h | 86h |
| Zero speed clamp detection output | ZSP | 07h | 87h |
| Velocity coincidence output | V-COIN | 08h | 88h |
| Positional command ON/OFF output | P-CMD | 0Bh | 8Bh |
| Speed limit signal output | V-LIMIT | 0Dh | 8Dh |
| Speed command ON/OFF output | V-CMD | 0Fh | 8Fh |
| Servo enable state output | SRV-ST | 12h | 92h |
| Homing process finish | HOME-OK | 22h | A2h |

- Normally open：Active low
- Normally closed：Active high
- Don’t setup to a value other than that specified in the table .
- Pr4.10~Pr4.11 correspond to DO1~DO2 respectively.

# Chapter 4 Parameter

## 4.1 Parameter List

### 4.1.1 Drive Parameters (Group 2000h)

| Mode | | | | | | | Parameter Number | | Name | CANopen Address | Parameters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Classify | Num | | | |
| | | | | | | F | [Class 0] Basic setting | 00 | MFC function | 2000h | Pr_000 |
| | | | | | | F | | 01 | control mode setup | 2001h | Pr_001 |
| | | | | | | F | | 02 | real-time auto-gain tuning | 2002h | Pr_002 |
| | | | | | | F | | 03 | selection of machine stiffness at real-time auto-gain tuning | 2003h | Pr_003 |
| | | | | | | F | | 04 | Inertia ratio | 2004h | Pr_004 |
| | | | | | | | | 06 | Rotation direction setup | 2006h | Pr_006 |
| PP | PV | | HM | | | | | 08 | Command pulse per one motor revolution | 2008h | Pr_008 |
| | | | | | | F | | 13 | 1st torque limit | 2013h | Pr_023 |
| PP | | | HM | | | | | 14 | position deviation excess setup | 2014h | Pr_014 |
| | | | | | | | | 15 | Absolute encoder setup | 2015h | Pr_015 |
| | | | | | | F | | 16 | External regenerative resistance value | 2016h | Pr_016 |
| | | | | | | F | | 17 | External regenerative resistance power value | 2017h | Pr_017 |
| | | | | | | F | | 23 | CAN Node ID | 2023h | Pr_023 |
| | | | | | | F | | 24 | CAN baud rate | 2024h | Pr_024 |
| | | | | | | | | 25 | Synchronous compensation time 1 | 2025h | Pr_025 |
| | | | | | | | | 26 | Synchronous compensation time 2 | 2026h | Pr_026 |
| PP | | | HM | | | | [Class 1] Gain Adjust | 00 | 1st gain of position loop | 2100h | Pr_100 |
| | | | | | | F | | 01 | 1st gain of velocity loop | 2101h | Pr_101 |
| | | | | | | F | | 02 | 1st time constant of velocity loop integration | 2102h | Pr_102 |
| | | | | | | F | | 03 | 1st filter of velocity detection | 2103h | Pr_103 |
| | | | | | | F | | 04 | 1st time constant of torque filter | 2104h | Pr_104 |
| PP | | | HM | | | | | 05 | 2nd gain of position loop | 2105h | Pr_105 |
| | | | | | | F | | 06 | 2nd gain of velocity loop | 2106h | Pr_106 |
| | | | | | | F | | 07 | 2nd time constant of velocity loop integration | 2107h | Pr_107 |
| | | | | | | F | | 08 | 2nd filter of velocity detection | 2108h | Pr_108 |
| | | | | | | F | | 09 | 2nd time constant of torque filter | 2109h | Pr_109 |
| PP | | | HM | | | | | 10 | Velocity feed forward gain | 2110h | Pr_110 |
| PP | | | HM | | | | | 11 | Velocity feed forward filter | 2111h | Pr_111 |
| PP | PV | | HM | | | | | 12 | Torque feed forward gain | 2112h | Pr_112 |

| Mode | | | | | | | Parameter Number | | Name | CANopen Address | Parameters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Classify | Num | | | |
| PP | PV | | HM | | | | | 13 | Torque feed forward filter | 2113h | Pr_113 |
| | | | | | | F | | 15 | Control switching mode | 2115h | Pr_115 |
| | | | | | | F | | 17 | Control switching level | 2117h | Pr_117 |
| | | | | | | F | | 18 | Control switch hysteresis | 2118h | Pr_118 |
| | | | | | | F | | 19 | Gain switching time | 2119h | Pr_119 |
| | | | | | | F | | 37 | Special register | 2137h | Pr_137 |
| | | | | | | | [Class 2] Vibration Restrain Function | 00 | adaptive filter mode setup | 2200h | Pr_200 |
| | | | | | | F | | 01 | 1st notch frequency | 2201h | Pr_201 |
| | | | | | | F | | 02 | 1st notch width selection | 2202h | Pr_202 |
| | | | | | | F | | 03 | 1st notch depth selection | 2203h | Pr_203 |
| | | | | | | F | | 04 | 2nd notch frequency | 2204h | Pr_204 |
| | | | | | | F | | 05 | 2nd notch width selection | 2205h | Pr_205 |
| | | | | | | F | | 06 | 2nd notch depth selection | 2206h | Pr_206 |
| | | | | | | F | | 07 | 3rd notch frequency | 2207h | Pr_207 |
| | | | | | | | | 14 | 1st damping frequency | 2214h | Pr_214 |
| | | | | | | | | 15 | 1st damping filter setup | 2215h | Pr_215 |
| PP | | | HM | | | | | 22 | Positional command smooth filter | 2222h | Pr_222 |
| PP | | | HM | | | | | 23 | Positional command FIR filter | 2223h | Pr_223 |
| | PV | | | | | | [Class 3] Speed, Torque Control | 12 | time setup acceleration | 2312h | Pr_312 |
| | PV | | | | | | | 13 | time setup deceleration | 2313h | Pr_313 |
| | PV | | | | | | | 14 | Sigmoid acceleration/ deceleration time setup | 2314h | Pr_314 |
| | PV | | | | | | | 16 | Speed zero-clamp level | 2316h | Pr_316 |
| | | | | | | | | 23 | Speed mode zero speed static | 2323h | Pr_323 |
| | | | | | | F | [Class 4] I/F Monitor Setting | 00 | input selection DI1 | 2400h | Pr_400 |
| | | | | | | F | | 01 | input selection DI2 | 2401h | Pr_401 |
| | | | | | | F | | 02 | input selection DI3 | 2402h | Pr_402 |
| | | | | | | F | | 03 | input selection DI4 | 2403h | Pr_403 |
| | | | | | | F | | 04 | input selection DI5 | 2404h | Pr_404 |
| | | | | | | F | | 05 | input selection DI6 | 2405h | Pr_405 |
| | | | | | | F | | 10 | output selection DO1 | 2410h | Pr_410 |
| | | | | | | F | | 11 | output selection DO2 | 2411h | Pr_411 |
| PP | | | HM | | | | | 31 | Positioning complete range | 2431h | Pr_431 |
| PP | | | HM | | | | | 32 | Positioning complete output setup | 2432h | Pr_432 |
| PP | | | HM | | | | | 33 | INP hold time | 2433h | Pr_433 |
| | | | | | | F | | 34 | Zero-speed | 2434h | Pr_434 |
| | PV | | | | | | | 35 | Speed coincidence range | 2435h | Pr_435 |
| | PV | | | | | | | 36 | At-speed | 2436h | Pr_436 |
| | | | | | | F | | 37 | Mechanical brake action setting when stopping | 2437h | Pr_437 |
| | | | | | | F | | 38 | Mechanical brake action setting | 2438h | Pr_438 |
| | | | | | | F | | 39 | Brake release speed setup | 2439h | Pr_439 |
| | | | | | | F | | 43 | E-stop function active | 2443h | Pr_443 |
| | | | | | | F | | 04 | Drive inhibit input setup | 2504h | Pr_504 |
| | | | | | | F | | 06 | Sequence at servo-off | 2506h | Pr_506 |

| Mode | | | | | | | Parameter Number | | Name | CANopen Address | Parameters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Classify | Num | | | |
| | | | | | | F | [Class 5] Extended Setup | 08 | Main power off LV trip selection | 2508h | Pr_508 |
| | | | | | | F | | 09 | Main power off detection time | 2509h | Pr_509 |
| | | | | | | | | 10 | Dynamic braking mode | 2510h | Pr_510 |
| | | | | | | | | 11 | Torque setup for emergency stop | 2511h | Pr_511 |
| | | | | | | F | | 12 | Over-load level setup | 2512h | Pr_512 |
| | | | | | | F | | 13 | Over-speed level setup | 2513h | Pr_513 |
| PP | | | HM | | | | | 20 | Position setup unit select | 2520h | Pr_520 |
| | | | | | | F | | 21 | Selection of torque limit | 2521h | Pr_521 |
| | | | | | | F | | 22 | 2nd torque limit | 2522h | Pr_522 |
| | | | | | | | | 33 | Touch probe 1 signal compensation time | 2533h | Pr_533 |
| | | | | | | | | 34 | Touch probe 2 signal compensation time | 2534h | Pr_534 |
| | | | | | | | | 37 | Torque saturation alarm detection time | 2537h | Pr_537 |
| | | | | | | | | 39 | 3rd torque limit | 2539h | Pr_539 |
| | | | | | | | [Class 6] Special Setup | 01 | Encoder zero position compensation | 2601h | Pr_601 |
| PP | | | HM | | | | | 04 | JOG trial run command speed | 2604h | Pr_604 |
| PP | | | HM | | | | | 05 | Position 3rd gain valid time | 2605h | Pr_605 |
| PP | | | HM | | | | | 06 | Position 3rd gain scale factor | 2606h | Pr_606 |
| | | | | | | F | | 07 | Torque command additional value | 2607h | Pr_607 |
| | | | | | | F | | 08 | Positive direction torque compensation value | 2608h | Pr_608 |
| | | | | | | F | | 09 | Negative direction torque compensation value | 2609h | Pr_609 |
| | | | | | | | | 11 | Current response setup | 2611h | Pr_611 |
| | | | | | | | | 12 | Setting of torque limit for zero correction of encoder. | 2612h | Pr_612 |
| | | | | | | F | | 13 | 2nd inertia ratio | 2613h | Pr_613 |
| | | | | | | F | | 14 | Emergency stop time at alarm | 2614h | Pr_614 |
| | | | | | | | | 20 | distance of trial running | 2620h | Pr_620 |
| | | | | | | | | 21 | waiting time of trial running | 2621h | Pr_621 |
| | | | | | | | | 22 | cycling times of trial running | 2622h | Pr_622 |
| | | | | | | | | 25 | Acceleration of trial running | 2625h | Pr_625 |
| | | | | | | | | 26 | Mode of trial running | 2626h | Pr_626 |
| | | | | | | | | 34 | Frame error window time | 2634h | Pr_634 |
| | | | | | | | | 35 | Frame error window | 2635h | Pr_635 |

| Mode | | | | | | | Parameter Number | | Name | CANopen Address | Parameters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Classify | Num | | | |
| | | | | | | | | 61 | Z signal duration time | 2661h | Pr_661 |
| | | | | | | | | 62 | Overload warning threshold | 2662h | Pr_662 |
| | | | | | | | | 63 | upper limit of multi - turn absolute position | 2663h | Pr_663 |

## *4.1.2 Manufacturer Parameters (Group 5000h)*

| Index | Sub-index | Name | Unit | Default | Min | Max | Details |
|---|---|---|---|---|---|---|---|
| 5004 | 01 | RPDO length | | 8 | 0 | 64 | |
| | 02 | TPDO length | | 17 | 0 | 64 | |
| | 03 | The number of RPDO | | 1 | 0 | 4 | |
| | 04 | The number of TPDO | | 1 | 0 | 2 | |
| | 05 | Sync0 Watchdog counter | | 0 | 0 | 65535 | 83Bh Alarm detection |
| | 06 | Reserved | | | 0 | 65535 | |
| | 07 | Sync0 Watchdog limit | | 4 | 0 | 65535 | |
| | 08 | Sync0 Drift watchdog counter | | 0 | 0 | 65535 | 83Ch Alarm detection |
| | 09 | Sync0 Drift watchdog limit | | 4 | 0 | 65535 | |
| | 0A | SM2 watchdog counter | | 0 | 0 | 65535 | 83Ah Alarm detection |
| | 0B | SM2 Watchdog limit | | 4 | 0 | 65535 | |
| | 0C | Application layer SM2/Sync0 watchdog counter | | 0 | | | |
| | 0D | Application layer SM2/Sync0 watchdog limit | | 4 | | | |
| | 0E | Reserved | | | 0 | 500 | |
| | 0F | Time interval between SM2 and Sync0 | ns | 0 | 0 | 1000000000 | 832h Alarm detection |
| 5006 | 00 | Synchronous alarm setting | | 0xFFFF | 0 | 0xFFFF | **Bit0**: 818h Alarm enable switch<br>**Bit1**: 819h<br>**Bit2**: 81Ah<br>**Bit3**: 824h<br>**Bit4**: 825h<br>**Bit5**: Reserved<br>**Bit6**: Reserved<br>**Bit7**: 82Ch<br>**Bit8**: 82Dh<br>**Bit9**: 832h<br>**Bit10~15**: Reserved<br>Notes: 0 invalid; 1 valid |

<table>
<tr><td>5010</td><td>00</td><td>PDO watchdog overtime</td><td>ms</td><td>0</td><td>0</td><td>60000</td><td>0：invalid；<br>> 0：valid；<br>Unit：ms；<br>Such as RPDO timeout alarm 818h, TPDO timeout alarm 819h</td></tr>
<tr><td>5012</td><td>04</td><td>Homing setting</td><td>-</td><td>5</td><td colspan="3">Bit0：Abnormal signal protection<br>0：invalid； 1：valid<br>Bit1：pull back if over travel while final stop<br>0：invalid； 1：valid<br>Bit2/Bit3：
<table>
<tr><td>Bit2</td><td>Bit3</td><td>Positive limit position</td><td>Negative limit position</td><td>Feedback after the homing process</td></tr>
<tr><td>0</td><td>0</td><td>607D-02+ 607C</td><td>607D-01 + 607C</td><td>6064 = 607C</td></tr>
<tr><td>0</td><td>1</td><td>607D-02- 607C</td><td>607D-01 - 607C</td><td>6064 = -607C</td></tr>
<tr><td>1</td><td>-</td><td>607D-02</td><td>607D-01</td><td>6064 = 0</td></tr>
</table>
Bit4: Deal with Overtravel between the high speed and low speed during homing process<br>0：Homing process error (set 6041h bit13=1);<br>1：As normal, continue homing process</td></tr>
<tr><td rowspan="2">5400</td><td>01</td><td>Set synchronization cycle minimum value</td><td>us</td><td>250</td><td>125</td><td>1000</td><td></td></tr>
<tr><td>02</td><td>Set synchronization cycle maximum value</td><td>us</td><td>10000</td><td>4000</td><td>20000</td><td></td></tr>
<tr><td rowspan="7">5500</td><td>01</td><td>Absolute encoder multi turn number</td><td>r</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>02</td><td>Encoder single turn position</td><td>Pulse</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>03</td><td>Encoder feedback position 32 bit low</td><td>Pulse</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>04</td><td>Encoder feedback position 32 bit high</td><td>Pulse</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>05</td><td>The actual mechanical position 32 bit low</td><td>Unit</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>06</td><td>The actual mechanical position 32 bit high</td><td>Unit</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>07</td><td>Number of encoder communication exceptions</td><td></td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="6">5501</td><td>01</td><td>Motor Speed</td><td>r/min</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>02</td><td>Speed of position command</td><td>r/min</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>03</td><td>Speed command</td><td>r/min</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>04</td><td>Actual torque</td><td>0.1%</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>05</td><td>Torque command</td><td>0.1%</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>06</td><td>Relative position error</td><td>Pulse</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 07 | Internal position command | Pulse | - | - | - | - |
| | 08 | Overload ratio | 0.1% | - | - | - | - |
| | 09 | Discharge load rate | 0.1% | - | - | - | - |
| | 0A | Inertia ratio | % | - | - | - | - |
| | 0B | Actual positive torque limit value | 0.1% | - | - | - | - |
| | 0C | Actual negative torque limit value | 0.1% | - | - | - | - |
| | 0D | U phase current detect value | 0.1% | - | - | - | - |
| | 0E | W phase current detect value | 0.1% | - | - | - | - |
| 5502 | 01 | SI input signal | - | - | - | - | - |
| | 02 | DO output signal | - | - | - | - | - |
| | 03 | Reserved | - | - | - | - | - |
| | 04 | Reserved | - | - | - | - | - |
| | 05 | Bus voltage | V | - | - | - | - |
| | 06 | Temperature | ℃ | - | - | - | - |
| | 07 | Power on time | S | - | - | - | - |

### *4.1.3 Device Profile Parameters (Group 6000h)*

| Index | Sub-index | Name | Unit | Default | Min | Max | Mode |
|---|---|---|---|---|---|---|---|
| 603F | 0 | Error code | - | - | - | - | ALL |
| 6040 | 0 | Control word | - | - | - | - | ALL |
| 6041 | 0 | Status word | - | - | - | - | ALL |
| 605A | 0 | Quick stop option code | - | 6 | 0 | 7 | ALL |
| 605B | 0 | Shut down code | - | 0 | 0 | 1 | ALL |
| 605C | 0 | Disable operation code | - | 0 | 0 | 1 | ALL |
| 605D | 0 | Halt option code | - | 1 | 1 | 4 | ALL |
| 605E | 0 | Alarm stop code | - | 0 | 0 | 2 | ALL |
| 6060 | 0 | Mode of operation | - | 8 | 1 | 11 | ALL |
| 6061 | 0 | Mode of operation display | - | - | - | - | ALL |
| 6062 | 0 | Position demand value | Command unit | - | - | - | pp/hm |
| 6063 | 0 | Actual internal position value | Encoder unit | - | - | - | ALL |
| 6064 | 0 | Actual feedback position value | Command unit | - | - | - | ALL |
| 6065 | 0 | Follow error window | Command unit | 10000 | 0 | 2147483647 | pp |
| 6066 | 0 | Follow error detection time | ms | 10 | 0 | 65535 | pp |
| 606B | 0 | Internal command speed | Command unit | - | - | - | pv |
| 606C | 0 | Actual feedback speed value | Command unit | - | - | - | ALL |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6071 | 0 | Target torque | 0.1% | 0 | -32768 | 32767 | pt |
| 6072 | 0 | Max torque | 0.1% | 3000 | 0 | 65535 | ALL |
| 6073 | 0 | Max current | 0.1% | - | - | - | ALL |
| 6074 | 0 | Internal torque command | 0.1% | - | - | - | ALL |
| 6075 | 0 | Rated current | mA | - | - | - | ALL |
| 6076 | 0 | Rated torque | mN.M | | | | |
| 6077 | 0 | Actual torque | 0.1% | - | - | - | ALL |
| 6079 | 0 | Bus voltage | mV | - | - | - | ALL |
| 607A | 0 | Target position | Command unit | 0 | -2147483648 | 2147483647 | pp |
| 607C | 0 | Homing position offset | Command unit | 0 | -2147483648 | 2147483647 | ALL |
| 607D | 1 | Minimum soft limit | Command unit | 0 | -2147483648 | 2147483647 | pp |
| | 2 | Maximum soft limit | Command unit | 0 | -2147483648 | 2147483647 | pp |
| 607E | 0 | Motor rotation direction | - | 0 | 0 | 255 | ALL |
| 607F | 0 | Maximum protocol speed (Restricted by 6080) | Command unit /s | | | | |
| 6080 | 0 | Maximum motor speed | r/min | 5000 | 0 | 6000 | ALL |
| 6081 | 0 | protocol speed (Restricted by 607F) | Command unit /s | 10000 | 0 | 2147483647 | pp |
| 6083 | 0 | Profile acceleration | Command unit /s/s | 10000 | 1 | 2147483647 | pp/pv/ |
| 6084 | 0 | Profile deceleration | Command unit /s/s | 10000 | 1 | 2147483647 | pp/pv |
| 6085 | 0 | Quick stop deceleration | Command unit /s/s | 10000000 | 1 | 2147483647 | pp/pv/hm |
| 6087 | 0 | Torque change rate | 0.1%/s | 100 | 1 | 2147483647 | pt |
| 608F | 1 | Encoder resolution | Encoder unit | - | - | - | ALL |
| | 2 | Motor turns | - | | | | |
| 6091 | 1 | Electron gear molecule | - | 1 | 1 | 2147483647 | ALL |
| | 2 | Electronic gear denominator | - | 1 | 1 | 2147483647 | ALL |
| 6092 | 1 | Number of pulses per rotation | Command unit | 10000 | 1 | 2147483647 | ALL |
| | 2 | Number of physical axis turns | - | | | | |
| 6098 | 0 | Homing method | - | 19 | -6 | 37 | hm |
| 6099 | 1 | High speed of homing | Command unit /s | 10000 | 0 | 2147483647 | hm |
| | 2 | Low speed of homing | Command unit /s | 5000 | 0 | 2147483647 | hm |
| 609A | 0 | Homing acceleration | Command unit /$s^2$ | 10000 | 0 | 2147483647 | hm |
| 60B0 | 0 | Position feedforward | Command unit | 0 | -2147483648 | 2147483647 | |
| 60B1 | 0 | Velocity feedforward(Restricted by 6080) | Command unit /s | 0 | -2147483648 | 2147483647 | pp/pv/hm |
| 60B2 | 0 | Torque feedforward | 0.1% | 0 | -32768 | 32767 | ALL |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 60B8 | 0 | Touch probe control word | - | 0 | 0 | 65535 | ALL |
| 60B9 | 0 | Touch probe statue word | - | - | - | - | ALL |
| 60BA | 0 | Touch probe 1 rising edge capture position | Command unit | - | - | - | ALL |
| 60BB | 0 | Touch probe 1 falling edge capture position | Command unit | - | - | - | ALL |
| 60BC | 0 | Touch probe 2 rising edge capture position | Command unit | - | - | - | ALL |
| 60BD | 0 | Touch probe 2 falling edge capture position | Command unit | - | - | - | ALL |
| 60C5 | 0 | Protocol maximum acceleration | Command unit /s/s | 100000000 | 1 | 2147483647 | ALL |
| 60C6 | 0 | Protocol maximum deceleration | Command unit /s/s | 100000000 | 1 | 2147483647 | ALL |
| 60D5 | 0 | Touch probe 1 rising edge counter | - | - | - | - | ALL |
| 60D6 | 0 | Touch probe 1 falling edge counter | - | - | - | - | ALL |
| 60D7 | 0 | Touch probe 2 rising edge counter | - | - | - | - | ALL |
| 60D8 | 0 | Touch probe 2 falling edge counter | - | - | - | - | ALL |
| 60E0 | 0 | Positive torque limit | 0.1% | 3000 | 0 | 65535 | ALL |
| 60E1 | 0 | Negative torque limit | 0.1% | 3000 | 0 | 65535 | ALL |
| 60F4 | 0 | Actual following error | Command unit | - | - | - | pp/hm |
| 60FA | 0 | Speed of position loop | Command unit /s | - | - | - | csp/pp/hm |
| 60FC | 0 | Internal command position | Encoder unit | - | - | - | pp/hm |
| 60FD | 0 | Status of input | - | - | - | - | ALL |
| 60FE | 1 | Output valid | - | - | - | - | ALL |
| | 2 | Output enable | - | - | - | - | ALL |
| 60FF | 0 | Target speed (Restricted by 6080) | Command unit /s | 0 | -2147483648 | 2147483647 | pv |
| 6502 | 0 | Supported operation mode | - | - | - | - | ALL |

# *4.2 Parameters Function*

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

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

## *4.2.1【Class 0】Basic Setting*

| Pr0.00 | Name | Mode loop gain | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~2000 | Unit | 0.1Hz | Default | 0 | Index | | 2000h | | | |

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

| Setup value | Description |
|---|---|
| 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 :**

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

**Caution:**

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

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

| Pr0.01 | Name | Control Mode Setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~9 | Unit | — | Default | 9 | Index | | | | | 2001h |

Set using control mode:

| Setup value | Content | Details |
|---|---|---|
| 8 | CANopen | PP/PV/PT/HM |

Note: valid after restart power supply.

| Pr0.02 | Name | Real-time Auto-gain Tuning | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 0 | Index | | | | | 2002h |

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

| Setup value | Mode | Varying degree of load inertia in motion |
|---|---|---|
| 0 | invalid | Real-time auto-gain tuning function is disabled. |
| 1 | standard | Basic mode. do not use unbalanced load, friction compensation or gain switching. It is usually for interpolation movement. |
| 2 | positioning | Main application is positioning. it is recommended to use this mode on equipment without unbalanced horizontal axis, ball screw driving equipment with low friction, etc. it is usually for point-to point movement . |

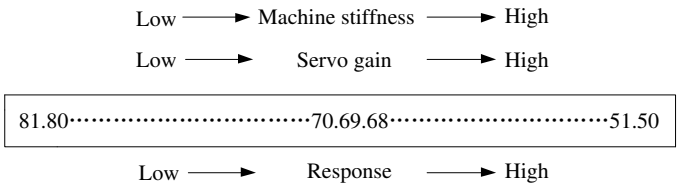
**Caution:** If Pr0.02=1 or 2 , you can't modify the values of Pr1.01 – Pr1.13, the values of them depend on the real-time auto-gain tuning ,all of them are set by the drive itself.

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

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

| Pr0.03 | Name | Selection of machine stiffness at real- time auto-gain tuning | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 50 ~ 81 | Unit | — | Default | 70 | Index | | | | | 2003h |

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




**Notice:** Lower the setup value, higher the velocity response and servo stiffness will be obtained. However, when decreasing the value, check the resulting operation to avoid oscillation or vibration.
Control gain is updated while the motor is stopped. If the motor can't be stopped due to excessively low gain or continuous application of one-way direction command ,any change made to Pr0.03 is not used for update. If the changed stiffness setting is made valid after the motor stopped, abnormal sound or oscillation will be generated. To prevent this problem, stop the motor after changing the stiffness setting and check that the changed setting is enabled.

| Pr0.04 | Name | Inertia ratio | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | % | Default | 250 | Index | 2004h | | | | |

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

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

**Notice:**

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

| Pr0.13 | Name | 1st Torque Limit | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 300 | Index | 2013h | | | | |

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.
Compared with the maximum torque 6072, the actual torque limit value is smaller one.

| Pr0.14 | Name | Position Deviation Excess Setup | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | 0.1rev | Default | 200 | Index | 2014h | | | | |

Set excess range of positional deviation by the command unit(default).Setting the value too small will cause Err180 (position deviation excess detection)

| Pr0.15 | Name | Absolute Encoder Setup | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~15 | Unit | - | Default | 0 | Index | 2015h | | | | |

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

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

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

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

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

**Notes:** Set to 9 after homing process finished and servo disabled, valid after restart power-supply

| Pr0.16 | Name | External regenerative resistance value | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 40~500 | Unit | Ohm | Default | 100 | Index | | | | 2016h | |

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

| Pr0.17 | Name | External regenerative resistance power value | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 20~5000 | Unit | W | Default | 20 | Index | | | | 2017h | |

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

| Pr0.23* | Name | CAN Node ID | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | — | Default | 2 | Index | | | | 2023h | |

Setup the Node-ID of the slave station.

| Pr0.24* | Name | CAN Baud rate | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~7 | Unit | — | Default | 0 | Index | | | | 2024h | |

| Pr0.24 | CAN baud rate (KHz) | Pr0.24 | CAN baud rate (KHz) |
|---|---|---|---|
| **0** | 1000 | **4** | 125 |
| **1** | 800 | **5** | 100 |
| **2** | 500 | **6** | 50 |
| **3** | 250 | **7** | 20 |

| Pr0.25 | Name | Synchronous compensation time 1 | | | Mode | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 1~100 | Unit | 0.1us | Default | 10 | Index | | | | 2025h | |

| |
|---|
| Synchronous jitter compensation range, used in poor synchronization of the master station.<br>Note： Valid after restart power. |

| Pr0.26 | Name | Synchronous compensation time 2 | | | Mode | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 1~2000 | Unit | 0.1us | Default | 50 | Index | | | | | 2026h |
| | Synchronous jitter compensation range, used in poor synchronization of the master station.<br>Note： Valid after restart power. | | | | | | | | | | | |

## *4.2.2【Class 1】Gain Adjust*

| Pr1.00 | Name | 1st gain of position loop | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~30000 | Unit | 0.1/s | Default | 320 | Index | | | | | 2100h |
| | 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 | Name | 1st gain of velocity loop | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 1~32767 | Unit | 0.1Hz | Default | 180 | Index | | | | | 2101h |
| | 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 | Name | 1st Time Constant of Velocity Loop Integration | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 1~10000 | Unit | 0.1ms | Default | 310 | Index | | | | | 2102h |
| | You can set up the integration time constant of velocity loop, Smaller the setup value, faster you can dog-in deviation at stall to 0.The integration will be maintained by setting to"9999".The integration effect will be lost by setting to"10000". | | | | | | | | | | | |

| Pr1.03 | Name | 1st Filter of Velocity Detection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 50~81 | Unit | — | Default | 70 | Index | | | | | 2103h |

You can set up the time constant of the low pass filter (LPF) after the speed detection, in 32 steps (50 to 81).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:

| Setup Value | Speed Detection Filter Cut-off Frequency(Hz) | Setup Value | Speed Detection Filter Cut-off Frequency(Hz) |
|---|---|---|---|
| 81 | 2500 | 65 | 750 |
| 80 | 2250 | 64 | 700 |
| 79 | 2100 | 63 | 650 |
| 78 | 2000 | 62 | 600 |
| 77 | 1800 | 61 | 550 |
| 76 | 1600 | 60 | 500 |
| 75 | 1500 | 59 | 450 |
| 74 | 1400 | 58 | 400 |

| | | | |
|---|---|---|---|
| 73 | 1300 | 57 | 350 |
| 72 | 1200 | 56 | 300 |
| 71 | 1100 | 55 | 250 |
| 70 | 1000 | 54 | 200 |
| 69 | 950 | 53 | 175 |
| 68 | 900 | 52 | 150 |
| 67 | 850 | 51 | 125 |
| 66 | 800 | 50 | 100 |

| Pr1.04 | Name | 1st torque filter | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~2500 | Unit | 0.01ms | Default | 126 | Index | | | | 2104h | |

Set the time constant of the first order hysteresis filter for the insertion of torque instruction. Vibration due to torsional resonance can be controlled.

| Pr1.05 | Name | 2nd gain of position loop | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~30000 | Unit | 0.1/s | Default | 380 | Index | | | | 2105h | |

| Pr1.06 | Name | 2nd gain of velocity loop | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 1~32767 | Unit | 0.1Hz | Default | 180 | Index | | | | 2106h | |

| Pr1.07 | Name | 2nd Time Constant of Velocity Loop Integration | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 1~10000 | Unit | 0.1ms | Default | 10000 | Index | | | | 2107h | |

| Pr1.08 | Name | 2nd Filter of Velocity Detection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~31 | Unit | — | Default | 15 | Index | | | | 2108h | |

| Pr1.09 | Name | 2nd Time Constant of torque filter | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~2500 | Unit | 0.01ms | Default | 126 | Index | | | | 2109h | |

Position loop, velocity loop, velocity detection filter, torque command filter have their 2 pairs of gain or time constant(1st and 2nd).

| Pr1.10 | Name | Velocity feed forward gain | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | 0.10% | Default | 300 | Index | | | | 2110h | |

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 | Name | Velocity feed forward filter | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|

| | Range | 0~6400 | Unit | 0.01ms | Default | 50 | Index | 2111h |
|---|---|---|---|---|---|---|---|---|

Set the time constant of 1st delay filter which affects the input of speed feed forward.
**(usage example of velocity feed forward)**
The velocity feed forward will become effective as the velocity feed forward gain is gradually increased with the speed feed forward filter set at approx.50 (0.5ms). The positional deviation during operation at a constant speed is reduced as shown in the equation below in proportion to the value of velocity feed forward gain.
Position deviation [ unit of command]=command speed [ unit of command /s]/position loop gain[1/s]×(100-speed feed forward gain[%]/100

| Pr1.12 | Name | Torque feed forward gain | | | Mode | PP | PV | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | 0.1% | Default | 0 | Index | | 2112h | | | |

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

| Pr1.13 | Name | Torque feed forward filter | | | Mode | PP | PV | HM | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~6400 | Unit | 0.01ms | Default | 0 | Index | | 2113h | | | |

Set up the time constant of 1st delay filter which affects the input of torque feed forward.
zero positional deviation is impossible in actual situation because of disturbance torque. as with the velocity feed forward, large torque feed forward filter time constant decreases the operating noise but increases positional deviation at acceleration change point.

| Pr1.15 | Name | Mode of position control switching | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10 | Unit | — | Default | 0 | Index | | 2115h | | | |

| Setup value | Switching condition | Gain switching condition |
|---|---|---|
| 0 | Fixed to 1st gain | Fixed to the 1st gain (Pr1.00-Pr1.04) |
| 1 | Fixed to 2nd gain | Fixed to the 2nd gain (Pr1.05-Pr1.09) |
| 2 | Reserved | |
| 3 | Torque command is large | ● Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis)[%]previously with the 1st gain.<br>● Return to the 1st gain when the absolute value of the torque command was kept below (level + hysteresis) [%]previously during delay time with the 2nd gain. |
| 4 | Reserved | Reserved |
| 5 | Speed command is large | ● Valid for position and speed controls.<br>● Shift to the 2nd gain when the absolute value of the speed command exceeded (level + hysteresis)[r/min]previously with the 1st gain.<br>● 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. |
| 6 | Position deviation is large | ● Valid for position control.<br>● Shift to the 2nd gain when the absolute value of the positional deviation exceeded (level + hysteresis)[pulse] previously with the 1st gain.<br>● 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.<br>✧ Unit of level and hysteresis [pulse] is set as the encoder resolution for positional control. |
| 7 | position command exists | ● 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 0 previously during delay time with the 2nd gain. |
| 8 | Not in positioning complete | ● Valid for position control.<br>● Shift to the 2nd gain when the positioning was not completed 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 | Name | Level of position control switching | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | Mode specific | Default | 50 | Index | | | | 2117h | |
| | Unit of setting varies with switching mode.<br>switching condition: position :encoder pulse number ; speed : r/min ; torque : % .<br>Notice: set the level equal to or higher than the hysteresis. | | | | | | | | | | | |

| Pr1.18 | Name | Hysteresis at position control switching | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~20000 | Unit | Mode specific | Default | 33 | Index | | | | 2118h | |
| | Combining Pr1.17(control switching level)setup<br>Notice: when level< hysteresis, the hysteresis is internally adjusted so that it is equal to level. | | | | | | | | | | | |

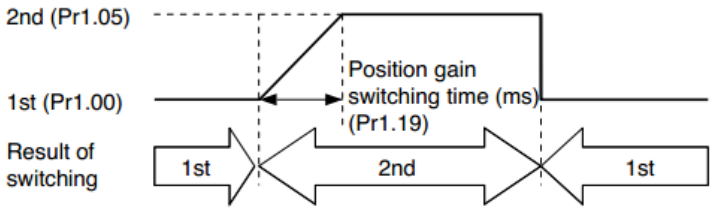
| Pr1.19 | Name | position gain switching time | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 33 | Index | | | | | 2119h |

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)




| Pr1.37 | Name | Special register | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~0xFFFF | Unit | - | Default | 0 | Index | | | | | 2137h |

| Bit | Pr1.37 | Details | Bit | Pr1.37 | Details |
|---|---|---|---|---|---|
| 0 | 0x0001 | shield the speed out of control alarm (1A1) | 7 | 0x0080 | shield the Resistance discharge circuit over-load error（120） |
| 1 | 0x0002 | shield the over-speed alarm（1A0） | 8 | 0x0100 | Reserved |
| 2 | 0x0004 | Enable virtual IO in homing mode | 9 | 0x0200 | shield UVW wire break alarm（0A3） |
| 3 | 0x0008 | Reserved | 10 | 0x0400 | Reserved |
| 4 | 0x0010 | shield the motor over-load error（100） | 11 | 0x0800 | shield Over-current alarm（0E0） |
| 5 | 0x0020 | Torque limit signal output threshold selection in torque mode: shield 6071 | 12 | Reserved | |
| 6 | 0x0040 | shield the motor vibration error（190） | 13 | Reserved | |

## *4.2.3【Class 2】Vibration Suppression*

| Pr2.00 | Name | Adaptive filter mode setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | - | Default | 0 | Index | | | | | 2200h |

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

| Setup value | Details | |
|---|---|---|
| 0 | Adaptive filter: invalid | Parameters related to the 3rd and 4th notch filter hold the current value. |
| 1 | Adaptive filter,1 filter is valid, one time | One adaptive filter is valid, parameters related to the 3rd notch filter will be updated based on adaptive performance. After updated, Pr2.00 returns to 0, stop self-adaptation. |
| 2 | Adaptive filter, 1 filter | One adaptive filter is valid, parameters related to the |

| | | | |
|---|---|---|---|
| | | is valid, It will be valid all the time | 3rd notch filter will be updated all the time based on adaptive performance. |
| | 3-4 | Not use | Non-professional forbidden to use |

| Pr2.01 | Name | 1st notch frequency | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 | Index | | | | 2201h | |

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 | Name | 1st notch width selection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | - | Default | 2 | Index | | | | 2202h | |

Set the width of notch at the center frequency of the 1st notch filter.
Notice: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

| Pr2.03 | Name | 1st notch depth selection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | - | Default | 0 | Index | | | | 2203h | |

Set the depth of notch at the center frequency of the 1st notch filter.
Notice: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

| Pr2.04 | Name | 2nd notch frequency | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 | Index | | | | 2204h | |

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 | Name | 2nd notch width selection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | - | Default | 2 | Index | | | | 2205h | |

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

| Pr2.06 | Name | 2nd notch depth selection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | - | Default | 0 | Index | | | | 2206h | |

Set the depth of notch at the center frequency of the 2nd notch filter.

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

| Pr2.07 | Name | 3rd notch frequency | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 | Index | | | | 2207h | |

Set the center frequency of the 3rd notch filter
Notice: the notch filter function will be invalidated by setting up this parameter to "2000".

Setup invalid after opening self-adaptation function.

| Pr2.14 | Name | 1st damping frequency | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | 0.1Hz | Default | 0 | Index | 2214h | | | | |

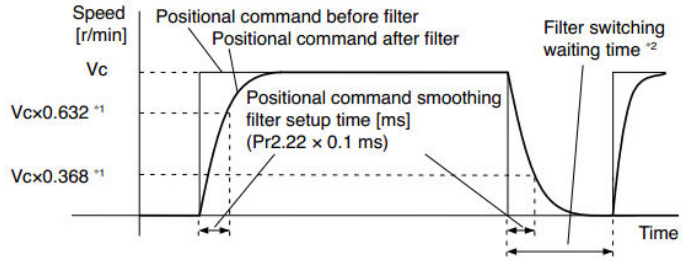
0: close
Setup damping frequency, to suppress vibration at the load edge.

| Pr2.15 | Name | 2nd damping frequency | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | 0.1Hz | Default | 0 | Index | 2215h | | | | |

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

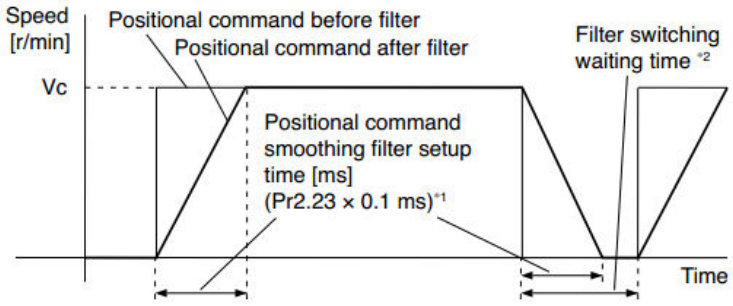
| Pr2.22 | Name | positional command smoothing filter | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | 0.1ms | Default | 0 | Index | 2222h | | | | |

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




| Pr2.23 | Name | positional command FIR filter | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 0.1ms | Default | 0 | Index | 2223h | | | | |

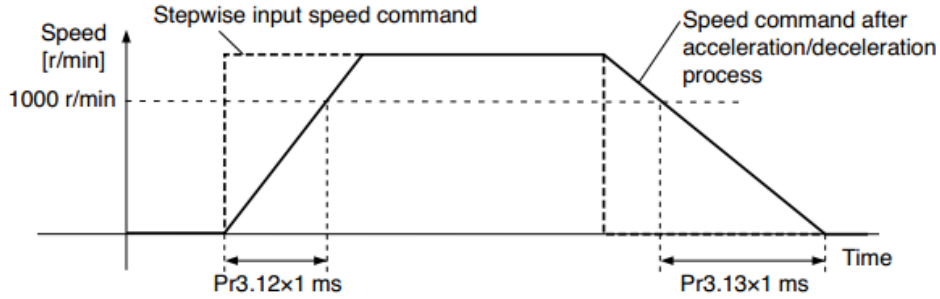
- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied , set up the Vc arrival time as shown in the figure below.




## 4.2.4【Class 3】Velocity/ Torque Control

| Pr3.12 | Name | time setup acceleration | | | Mode | | PV | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | Ms/ (1000RPM) | Default | 100 | Index | 2312h | | | | |

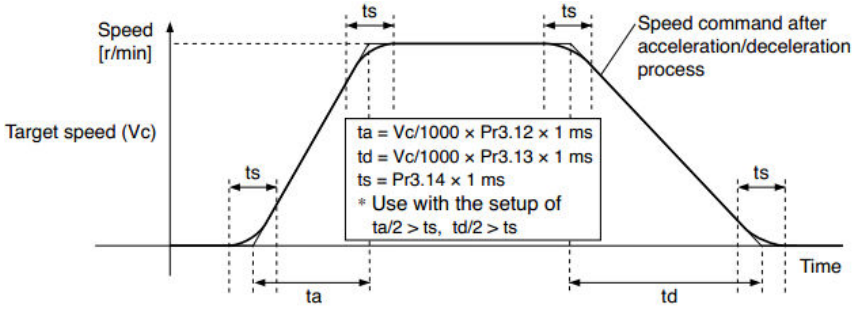
| Pr3.13 | Name | time setup deceleration | | | Mode | | PV | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | Ms/ (1000RPM) | Default | 100 | Index | | 2313h | | | |




**Set** up acceleration/deceleration processing time in response to the speed command input.
Set the time required for the speed command(stepwise input)to reach 1000r/min to Pr3.12
Acceleration time setup. Also set the time required for the speed command to reach from 1000r/min to 0 r/min, to Pr3.13 Deceleration time setup.
Assuming that the target value of the speed command is Vc(r/min), the time required for acceleration /deceleration can be computed from the formula shown below.
Acceleration time (ms)=Vc/1000 *Pr3.12 *1ms
Deceleration time (ms)=Vc/1000 *Pr3.13 *1ms

| Pr3.14 | Name | Sigmoid acceleration/deceleration time setup | | | Mode | | PV | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | ms | Default | 0 | Index | | 2314h | | | |

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.




## *4.2.5【Class 4】I/F Monitor Setting*

| Pr4.02 | Name | Input selection DI3 | | | Mode | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x14 | Index | | 2402h | | |
| Pr4.03 | Name | Input selection DI4 | | | Mode | | | | | | F |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x16 | Index | | 2403h | | |
| Pr4.04 | Name | Input selection DI5 | | | Mode | | | | | | F |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x01 | Index | | 2404h | | |
| Pr4.05 | Name | Input selection DI6 | | | Mode | | | | | | F |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x02 | Index | | 2405h | | |

Assign functions to digital inputs.
This parameter use 16 binary system to set up the values,
For the function number, please refer to the following table.

| Signal | Symbol | Setup value | | 0x60FD(bit) |
|---|---|---|---|---|
| | | Normally open | Normally closed | |
| Invalid | — | 00h | Do not setup | × |
| Positive direction over-travel inhibition input | POT | 01h | 81h | 1 |
| Negative direction over-travel inhibition input | NOT | 02h | 82h | 0 |
| Alarm clear input | A-CLR | 04h | Do not setup | |
| Forced alarm input | E-STOP | 14h | 94h | |
| HOME-SWITCH | HOME-SWITCH | 16h | 96h | 2 |

- Normally open means input signal comes from external controller or component, for example: PLC .
- Normally closed means input signal comes from drive 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 Err210 I/F input multiple assignment error 1or Err211 I/F input multiple assignment error 2.
- E-STOP: Associated parameter Pr4.43

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr4.10** | Name | Output selection DO1 | | | Mode | | | | | | F |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x81 | | Index | | | 2410h |
| **Pr4.11** | Name | Output selection DO2 | | | Mode | | | | | | F |
| | Range | 0~00FFFFFFh | Unit | — | Default | 0x02 | | Index | | | 2411h |

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

| Signal name | Symbol | Setup Value | |
|---|---|---|---|
| | | Normally open | Normally closed |
| Master control output | — | 00h | Do not setup |
| Alarm output | Alm | 81h | 01h |
| Servo-Ready output | S-RDY | 02h | 82h |
| Eternal brake release signal | BRK-OFF | 03h | 83h |
| Positioning complete output | INP | 04h | 84h |
| At-speed output | AT-SPPED | 05h | 85h |
| Torque limit signal output | TLC | 06h | 86h |
| Zero speed clamp detection output | ZSP | 07h | 87h |
| Velocity coincidence output | V-COIN | 08h | 88h |
| Positional command ON/OFF output | P-CMD | 0Bh | 8Bh |
| Speed limit signal output | V-LIMIT | 0Dh | 8Dh |
| Speed command ON/OFF output | V-CMD | 0Fh | 8Fh |
| Servo enable state output | SRV-ST | 12h | 92h |
| Homing process finish | HOME-OK | 22h | A2h |

- Normally open: Active low
- Normally closed: Active high
- Don't setup to a value other than that specified in the table .
- Pr4.10~Pr4.11 correspond to DO1~DO2 respectively.

| Pr4.31 | Name | Positioning complete range | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | | Default | 10 | Index | 2431h | | | | |
| Setup the timing of positional deviation at which the positioning complete signal (INP1) is output. | | | | | | | | | | | | |

| Pr4.32 | Name | Positioning complete output setup | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | - | Default | 0 | Index | 2432h | | | | |

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. |
| 4 | When there is no command, the position determination starts after the delay time set by Pr4.33. The signal will turn on when there is no position command and positional deviation is smaller than Pr4.31 [positioning complete range] |

| Pr4.33 | Name | INP hold time | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~15000 | Unit | 1ms | Default | 0 | Index | 2433h | | | | |

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

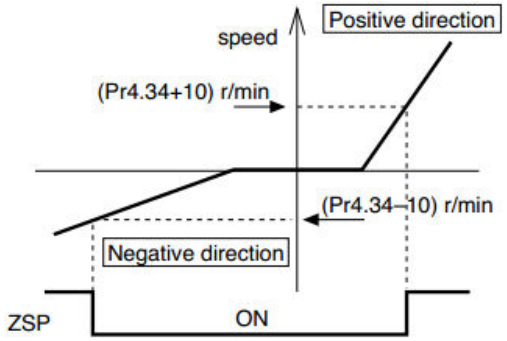
| Setup value | State of Positioning complete signal |
|---|---|
| 0 | The hold time is maintained definitely, keeping ON state until next positional command is received. |
| 1-15000 | ON state is maintained for setup time (ms) but switched to OFF state as the positional command is received during hold time. |

| Pr4.34 | Name | Zero-speed | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | RPM | Default | 50 | Index | 2434h | | | | |

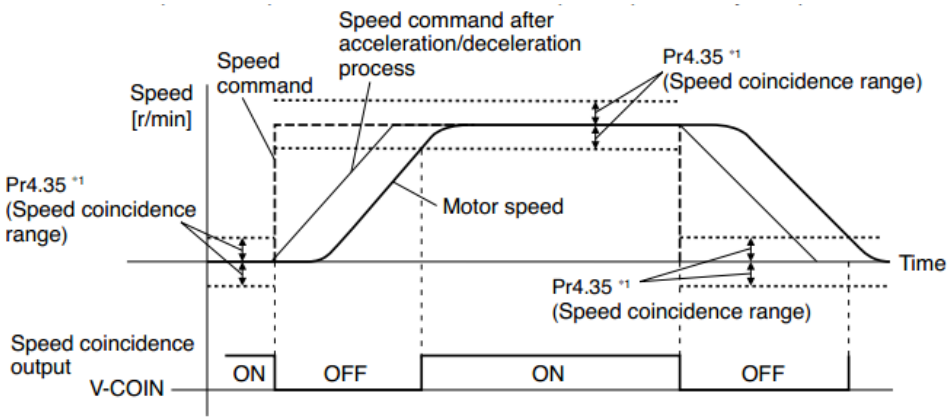
The rotation speed (RPM) was used to set the output timing sequence of the zero speed detection output signal (ZSP). When the motor speed is lower than the setting speed of this parameter, zero speed detection signal (ZSP) is output.

You can set up the timing to feed out the zero-speed detection output signal(ZSP or TCL) in rotate speed (r/min).
The zero-speed detection signal(ZSP) will be fed out when the motor speed falls below the setup of this parameter, Pr4.34

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




| Pr4.35 | Name | Speed coincidence range | | | Mode | | PV | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | RPM | Default | 50 | Index | | | | 2435h | |



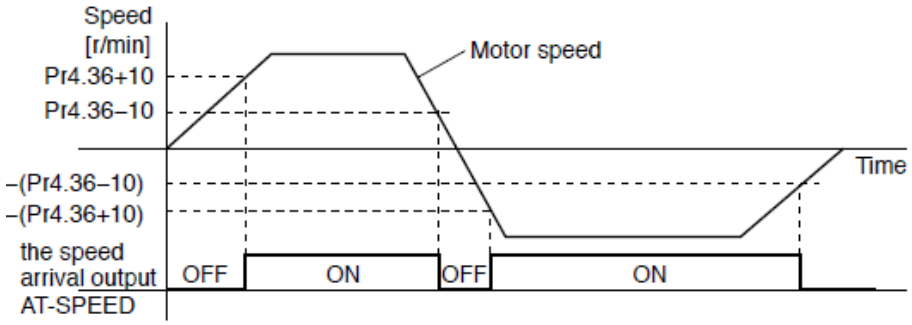

Set the speed coincidence (V-COIN) output detection timing.
Output the speed coincidence (V-COIN) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter.

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

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

| Pr4.36 | Name | At-speed(Speed arrival) | | | Mode | | PV | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 10~2000 | Unit | RPM | Default | 1000 | Index | | | | 2436h | |

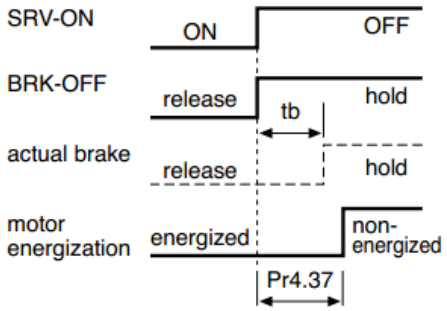
Set the detection timing of the speed arrival output (AT-SPEED).
When the motor speed exceeds this setup value, the speed arrive output (AT-SPEED) is output.
Detection is associated with 10r/min hysteresis .




| Pr4.37 | Name | Mechanical brake action at stalling setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 1ms | Default | 0 | Index | | 2437h | | | |

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

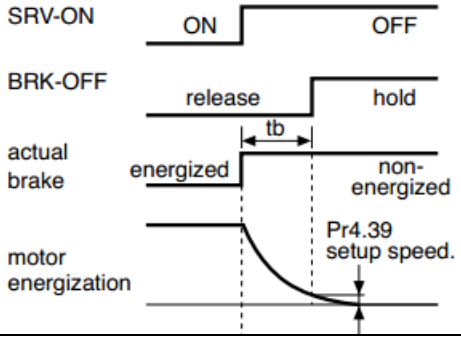
- Set up to prevent a micro-travel/drop of the motor (work) due to the action delay time(tb) of the brake.
- After setting up Pr4.37>=tb, then compose the sequence so as the drive turns to servo-off after the brake is actually activated.




| Pr4.38 | Name | Mechanical brake action at running setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 1ms | Default | 0 | Index | | 2438h | | | |

Mechanical brake start delay time setup, mainly used to prevent servo off "galloping "phenomenon.
Set up time from when detecting the off of servo-on input signal(SRV-ON)is to when external brake release signal(BRK-OFF)turns off, while the motor turns to servo off during the motor in motion.

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




| Pr4.39 | Name | Brake release speed setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 30~3000 | Unit | 1ms | Default | 30 | Index | | 2439h | | | |

Set up the speed timing of braking output checking during operation

| Pr4.43 | Name | E-stop function | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | - | Default | 0 | Index | 2443h | | | | |

0：When E-STOP is effective, the servo will forced to STOP and servo-disabled, and alarm showing（Err570）.
1：When E-STOP is effective, the servo will forced to STOP and keep in servo-enable, no alarm showing.

## *4.2.6【Class 5】Extended Setup*

| Pr5.04 | Name | Over-travel inhibit input setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 0 | Index | 2504h | | | | |

set to 1, no effect on homing mode.

| Setup value | Details |
|---|---|
| 0 | positive and negative limit effective, no alarm output |
| 1 | positive and negative limit effective invalid |
| 2 | positive and negative limit effective, alarm Err26.0 |

In homing mode, POT/NOT invalid Settings please set the object dictionary 5012-04 bit0=1

| Pr5.06 | Name | Stop mode | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | Index | 2506h | | | | |

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

| Setup value | Details |
|---|---|
| 0 | Disabled when disable signal effective and speed reduce to Pr4.39 |
| 1 | Disabled when disable signal effective, free-run to stop |

| Pr5.08 | Name | LV trip selection at main power OFF | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 1 | Index | 2508h | | | | |

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

| Setup value | Action of main power low voltage protection |
|---|---|
| 0 | When the main power is shut off during Servo-On,Err0d.0 will not be triggered and the drive turns to Servo-OFF. The drive returns to Servo-On again after the main power resumption. |
| 1 | When the main power is shut off during Servo-On, the drive will trip due to Err0d.0 |

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

| Pr5.09 | Name | The main power-OFF detection time | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 70~2000 | Unit | 1ms | Default | 70 | Index | 2509h | | | | |

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 | Name | Torque setup for emergency stop | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 0 | Index | 2511h | | | | |

Set up the torque limit at emergency stop
When setup value is 0, the torque limit for normal operation is applied.
Compared with the maximum torque 6072, the actual torque limit value is smaller one.

| Pr5.12 | Name | Over-load level setup | | | Mode | | | F |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~115 | Unit | % | Default | 0 | Index | 2512h |

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 | Name | Over-speed level setup | | | Mode | | | F |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | RPM | Default | 0 | Index | 2513h |

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.

| Pr5.20 | Name | Position setup unit select | | | Mode | | | F |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 2 | Index | 2520h |

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 |

| Pr5.21 | Name | Selection of torque limit | | | Mode | | | F |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~2 | Unit | — | Default | 0 | Index | 2521h |

Set up the torque limiting method;

| Setup value | Positive limit value | Negative limit value |
|---|---|---|
| 0 | Pr0.13 | Pr0.13 |
| 1 | Pr0.13 | Pr5.22 |
| 2 | 60E0 | 60E1 |

Compared with the maximum torque 6072, the actual torque limit value is smaller one

| Pr5.22 | Name | 2nd torque limit | | | Mode | | | F |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 300 | Index | 2522h |

Set up the 2nd limit value of the motor torque output
The value of the parameter is limited to the maximum torque of the applicable motor.
Compared with the maximum torque 6072, the actual torque limit value is smaller one

| Pr5.28 | Name | LED initial status | | | Mode | | | F |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~42 | Unit | — | Default | 34 | Index | 2528h |

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 | 15 | Over-load factor | 30 | Number of abnormal communication of encoder |
| 1 | Motor speed | 16 | Inertia ratio | 31 | Accumulated operation time |
| 2 | Positional command speed | 17 | Factor of no-motor running | 32 | Automatic motor identification |
| 3 | Velocity control command | 18 | No. of changes in I/O signals | 33 | Temperature information |
| 4 | Torque command | 19 | Number of overcurrent signals | 34 | Servo state |
| 5 | Feedback pulse sum | 20 | Absolute encoder data | 35 | / |
| 6 | Command pulse sum | 21 | Absolute external scale position | 36 | Synchronous period |
| 7 | Maximum torque during motion | 22 | Absolute multi-turn position | 37 | Synchronous loss time |
| 8 | | 23 | Communication axis address | 38 | Synchronous type |
| 9 | Control mode | 24 | Encoder positional deviation[encoder unit] | 39 | Whether DC is running or not |
| 10 | I/O signal status | 25 | Motor electromechanical angle | 40 | ACC/DEC |
| 11 | / | 26 | Motor mechanical Angle | 41 | Sub-index of OD index |
| 12 | Error factor and reference of history | 27 | Voltage across PN | 42 | The value of sub-index of OD index |
| 13 | Alarm code | 28 | Software version | | |
| 14 | Regenerative load factor | 29 | | | |

**Notes:** Valid after restart the power.

| Pr5.33 | Name | Touch probe 1 signal compensation time | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | 25ns | Default | 0 | Index | | 2533h | | | |
| | Time compensation for signal acquisition of touch probe 1 to provide more accurate capture position and prevent the instantaneous jitter of capture during master and slave cooperation | | | | | | | | | | | |

| Pr5.34 | Name | Touch probe 2 signal compensation time | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | 25ns | Default | 0 | Index | | 2534h | | | |
| | Time compensation for signal acquisition of touch probe 2 to provide more accurate capture position and prevent the instantaneous jitter of capture during master and slave cooperation | | | | | | | | | | | |

| Pr5.37 | Name | Torque saturation alarm detection time | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~5000 | Unit | ms | Default | 500 | Index | | 2537h | | | |

| | |
|---|---|
| | When the duration of torque saturation reaches this value, the torque saturation signal will turn on.<br>1、Enable the torque saturation alarm, this parameter can be set to specify the output time of the torque saturation signal<br>2、Disable the torque saturation alarm, this parameter can be set to specify the output time after the torque limit arrives while the homing method is torque detection. |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr5.39** | Name | 3rd torque limit | | | Mode | | | | | | | | **F** |
| | Range | 0~500 | Unit | % | Default | 80 | Index | | 2539h | | | | |
| | Set the torque limit of torque limit detection homing method.<br>Compared with the maximum torque 6072, the actual torque limit value is smaller one. | | | | | | | | | | | | |

## *4.2.7【Class 6】Special Setup*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr6.01** | Name | Encoder zero position compensation | | | Mode | | | | | | | | **F** |
| | Range | 0~360 | Unit | ° | Default | 0 | Index | | 2601h | | | | |
| | The Angle of the encoder after zero correction. | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr6.04** | Name | JOG trial run command speed | | | Mode | | | | | | | | **F** |
| | Range | 0~10000 | Unit | r/min | Default | 300 | Index | | 2604h | | | | |
| | You can set up the command speed used for JOG trial run (velocity control). | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr6.05** | Name | Position 3rd gain valid time | | | Mode | **PP** | | | **HM** | | | | |
| | Range | 0~10000 | Unit | 0.1ms | Default | 0 | Index | | 2605h | | | | |
| | Set up the time at which 3rd gain becomes valid.<br>When not using this parameter, set PR6.05=0, PR6.06=100<br>This is valid for only position control/full-closed control. | | | | | | | | | | | | |
| **Pr6.06** | Name | Position 3rd gain scale factor | | | Mode | **PP** | | | **HM** | | | | |
| | Range | 0~1000 | Unit | 100% | Default | 100 | Index | | 2606h | | | | |
| | Set up the 3rd gain by multiplying factor of the 1st gain<br>3rd gain= 1st gain * Pr6.06/100 | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pr6.07** | Name | Torque command additional value | | | Mode | | | | | | | | **F** |
| | Range | -100~100 | Unit | % | Default | 0 | Index | | 2607h | | | | |
| **Pr6.08** | Name | Positive direction torque compensation value | | | Mode | | | | | | | | **F** |
| | Range | -100~100 | Unit | % | Default | 0 | Index | | 2608h | | | | |
| **Pr6.09** | Name | Negative direction torque compensation value | | | Mode | | | | | | | | **F** |
| | Range | -100~100 | Unit | % | Default | 0 | Index | | 2609h | | | | |

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

| Pr6.11 | Name | Current response setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 50~100 | Unit | % | Default | 100 | Index | | | | 2611h | |
| Set the effective value ratio of drive current loop related parameters. | | | | | | | | | | | | |

| Pr6.12 | Name | Setting of torque limit for zero correction of encoder. | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | -300~300 | Unit | % | Default | 50 | Index | | | | 2612h | |
| Setting of torque limit for zero correction of encoder. | | | | | | | | | | | | |

| Pr6.13 | Name | 2nd inertia ratio | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | % | Default | 0 | Index | | | | 2613h | |
| Set up 2nd inertia ratio<br>Set up the ratio of the load inertia against the rotor of the motor ratio.<br>PR6.13= ( load inertia/ rotor inertia ) * 100【%】 | | | | | | | | | | | | |

| Pr6.14 | Name | Emergency stop time at alarm | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~3000 | Unit | ms | Default | 200 | Index | | | | 2614h | |
| Set up the time allowed to complete emergency stop in an alarm condition, exceeding this time puts this system in alarm state. | | | | | | | | | | | | |

| Pr6.20 | Name | Trial run distance | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1200 | Unit | 0.1rev | Default | 10 | Index | | | | 2620h | |
| The distance of running each time in JOG run(position control) | | | | | | | | | | | | |

| Pr6.21 | Name | Trial run waiting time | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~30000 | Unit | ms | Default | 100 | Index | | | | 2620h | |
| The waiting time after running each time in JOG run(position control) | | | | | | | | | | | | |

| Pr6.22 | Name | Trial run cycle times | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | — | Default | 1 | Index | | | | 2622h | |
| The cycling times of JOG run(position control) | | | | | | | | | | | | |

| Pr6.25 | Name | Acceleration of trial running | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | ms | Default | 100 | Index | | | | 2625h | |
| Acceleration of trial running | | | | | | | | | | | | |

| Pr6.26 | Name | Mode of trial running | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | — | Default | 0 | | Index | | 2626h | | |
| | 0：Normal trial run mode<br>1：Aging mode for manufacturers | | | | | | | | | | | |

| Pr6.34 | Name | Frame error window time | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | ms | Default | 100 | | Index | | 2634h | | |
| | Set the CANopen data frame error alarm detection window time | | | | | | | | | | | |

| Pr6.35 | Name | Frame error window | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32767 | Unit | ms | Default | 50 | | Index | | 2635h | | |
| | Set the CANopen data frame error alarm detection window | | | | | | | | | | | |

| Pr6.61 | Name | Z signal duration time | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1000 | Unit | ms | Default | 10 | | Index | | 2661h | | |
| | Set the high level holding time of Z signal<br>1、Z signal for 60FDH；<br>2、Z signal for homing process | | | | | | | | | | | |

| Pr6.62 | Name | Overload warning threshold | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | % | Default | 0 | | Index | | 2662h | | |
| | Before an overload alarm， pre-alarm. | | | | | | | | | | | |

| Pr6.63 | Name | upper limit of multi - turn absolute position | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32766 | Unit | r | Default | 0 | | Index | | 2663h | | |
| | While Pr0.15=2, the feedback position will loop between 0 - (Pr6.63+1)*Encoder resolution | | | | | | | | | | | |

## *4.2.8【Class 7】Factory setting*

| Pr7. 15 | Name | Motor model input | | | Mode | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0~7FFF | Unit | -- | Default | 0 | | |
| Pr7. 16 | Name | Encoder selection | | | Mode | P | S | T |
| | Range | 0~30000 | Unit | -- | Default | 0 | | |

| Motor Model | Pr7.15 | Pr7.16 |
|---|---|---|
| ACM602V36-1000 | 0x8001 | 0x201 |
| ACM602V36-2500 | 0x8001 | 0x204 |
| 57BL180D-1000 | 0x8003 | 0x201 |
| ACM604V60-1000 | 0x8002 | 0x201 |

| | | | |
|---|---|---|---|
| | ACM604V60-2500 | 0x8002 | 0x204 |
| | ELDM6020V36HL-A5 | 0x8004 | 0x201 |
| | ACM602V36-T-2500 | 0x8006 | 0x204 |
| | ACM602V24-T-2500 | 0x8007 | 0x204 |
| | ELDM4005V24HL-B5 | 0x8008 | 0x204 |
| | ELDM4010V24HL-B5 | 0x8009 | 0x204 |
| | ELDM6020V48HL-A5 | 0x800B | 0x201 |
| | ELDM6040V48HL-A5 | 0x800C | 0x201 |
| | ELDM6040V60HL-A5 | 0x800D | 0x201 |
| | ELDM6060V48HL-A5-HD | 0x800E | 0x201 |
| | ELDM8075V48HM-A4-HD | 0x8010 | 0x201 |
| | ELDM6020V24GL-A5 | 0X8016 | 0x201 |
| | ELDM6020V48HL-A5 | 0X8017 | 0x201 |
| | ELDM6040V24HL-A5 | 0X8018 | 0x201 |

| **Pr7.31** | Name | Regenerative resistance control mode setting | | | Mode | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0～2 | Unit | -- | Default | 0 | | |

| Setup value | Details |
|---|---|
| 0 | Disable regenerative resistance discharge |
| 1 | Enable reactive pump lift suppression function |
| 2 | Enable regenerative resistance discharge |

Notice：

| **Pr7.32** | Name | Regenerative resistance open threshold setting | | | Mode | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 20～90 | Unit | V | Default | 80 | | |

The external resistance is activated when the actual bus voltage is higher than Pr7.32 plus Pr7.33 and is deactivated when the actual bus voltage is lower than Pr7.32 minus Pr7.33

Notice：

| **Pr7.33** | Name | Regenerative resistance control hysteresis | | | Mode | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 1～50 | Unit | V | Default | 5 | | |

The external resistance is activated when the actual bus voltage is higher than Pr7.32 plus Pr7.33 and is deactivated when the actual bus voltage is lower than Pr7.32 minus Pr7.33

Notice：

## *4.3 402 Parameters Function*

| **Index 603FH** | Name | Error code | | | | - | Structure | VAR | Type | Uint 16 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RO | Mapping | TPDO | Mode | ALL | Range | 0-65535 | Default | - |

| **Index** | Name | Control word | | | Structure | VAR | Type | Uint 16 |
|---|---|---|---|---|---|---|---|---|

| 6040H | Access | RW | Mapping | RPDO | Mode | ALL | Range | 0-65535 | Default | 0 |
|---|---|---|---|---|---|---|---|---|---|---|

| Bit | 15~11 | 10~9 | 8 | 7 | 6~4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|
| Definition | - | - | Halt | Fault reset | Mode specific | Enable operation | Quick stop | Enable voltage | Switch on |

| Index 6041H | Name | Status word | | | | Structure | VAR | Type | Uint 16 |
|---|---|---|---|---|---|---|---|---|---|
| | Access | RO | Mapping | TPDO | Mode | ALL | Range | 0-0XFFFF | Default | 0 |

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Definition | Reserved | Switch on disabled | Quick stop | Voltage output | Fault | Operation enable | Switch on | Ready to switch on |
| **Bit** | **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** |
| Definition | Reserved | Reserved | Mode specific | Mode specific | Position limit active | Target reached | Remote | Mode specific |

| Index 605AH | Name | Quick stop option code | | | | Structure | VAR | Type | INT 16 |
|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | – | Mode | ALL | Range | 0-7 | Default | 0 |

PP, PV Mode

0 ： Stop according to 3506h(Sequence at Servo-off)，keeping Switch on disabled
1 ： Stop according to 6084h(Profile deceleration)，keeping Switch on disabled
2 ： Stop according to 6085h(Quick stop deceleration)，keeping Switch on disabled
3 ： Stop according to 60C6h(Max deceleration)，keeping Switch on disabled
5 ： Stop according to 6084h(Profile deceleration)，keeping Quick stop active
6 ： Stop according to 6085h(Quick stop deceleration)，keeping Quick stop active
7 ： Stop according to 60C6h(Max deceleration)，keeping Quick stop active

HM Mode

0 ： Stop according to 3506h(Sequence at Servo-off)，keeping Switch on disabled
1 ： Stop according to 609Ah(Homing acceleration)，keeping Switch on disabled
2 ： Stop according to 6085h(Quick stop deceleration)，keeping Switch on disabled
3 ： Stop according to 60C6h(Max deceleration)，keeping Switch on disabled
5 ： Stop according to 609Ah(Homing acceleration)，keeping Quick stop active
6 ： Stop according to 6085h(Quick stop deceleration)，keeping Quick stop active
7 ： Stop according to 60C6h(Max deceleration)，keeping Quick stop active

| Index 605DH | Name | Halt option code | | | | Structure | VAR | Type | INT 16 |
|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | – | Mode | ALL | Range | 1-3 | Default | 1 |

PP, PV Mode

1 ：Stop according to 6084h(Profile deceleration)，keeping Operation enabled

2 ：Stop according to 6085h(Quick stop deceleration)，keeping Operation enabled

3 ：Stop according to 6072h(Max torque)、60C6h(Max deceleration)，Stop according to torque=0Operation enabled

HM Mode

1 ：Stop according to 609Ah(Homing acceleration)，keeping Operation enabled

2 ：Stop according to 6085h(Quick stop deceleration)，keeping Operation enabled

3 ：Stop according to 6072h(Max torque)、60C6h(Max deceleration)，keeping Operation enabled

| **Index 6060H** | Name | Mode of operation | | | | | Structure | VAR | Type | int 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | RPDO | Mode | ALL | Range | 0-10 | Default | 0 |

| NO | Mode | |
|---|---|---|
| 1 | Profile position mode | PP |
| 3 | Profile velocity mode | PV |
| 4 | profile Torque mode | PT |
| 6 | Homing mode | HM |

| **Index 6061H** | Name | Mode of operation display | | | | | Structure | VAR | Type | int 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RO | Mapping | TPDO | Mode | ALL | Range | 0-10 | Default | 0 |

| NO | Mode | |
|---|---|---|
| 1 | Profile position mode | PP |
| 3 | Profile velocity mode | PV |
| 4 | profile Torque mode | PT |
| 6 | Homing mode | HM |

| **Index 6063H** | Name | Actual internal position value | | | | - | Structure | VAR | Type | Dint 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RO | Mapping | TPDO | Mode | ALL | Range | Encoder unit | Default | - |

Actual internal position value, Encoder unit

| **Index 6064H** | Name | Actual feedback position value | | | | - | Structure | VAR | Type | Dint 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RO | Mapping | TPDO | Mode | ALL | Range | Command unit | Default | - |

Actual feedback position value, Command Unit.

6064H * gear ratio(Ref. 6092H-01) = 6063H

| **Index 607AH** | Name | Target position | | | | - | Structure | VAR | Type | int 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | RPDO | Mode | PP | Range | Command unit | Default | - |

Target Position for PP Mode

| Index 607EH | Name | Motor rotation direction | | | | Structure | VAR | Type | Uint 8 |
|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | RPDO | Mode | ALL | Range | 00-FF | Default | 0 |

| Mode | | Value |
|---|---|---|
| Position mode | PP<br>HM | 0：Rotate in the same direction as the position command<br>128：Rotate in the opposite direction as the position command |
| Velocity mode | PV | 0：Rotate in the same direction as the position command<br>64：Rotate in the opposite direction as the position command |
| ALL mode | | 0：Rotate in the same direction as the position command<br>224：Rotate in the opposite direction as the position command |

| Index 608FH-01 | Name | Encoder resolution | | | | - | Structure | VAR | Type | Dint 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RO | Mapping | TPDO | Mode | ALL | Range | | Default | |

Read motor encoder resolution

| Index 6091H-01 | Name | Electronic gear molecule | | | | - | Structure | VAR | Type | Dint 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | RPDO | Mode | ALL | Range | | Default | |

Set the resolution of motor encoder

| Index 6091H-02 | Name | Electronic gear denominator | | | | - | Structure | VAR | Type | Dint 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | RPDO | Mode | ALL | Range | Command unit | Default | - |

Set the number of pulses required for one motor rotation.

| Index 6092H-01 | Name | Number of pulses per rotation | | | | - | Structure | VAR | Type | Dint 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | RPDO | Mode | ALL | Range | Command unit | Default | - |

If 2008H≠0, 6092H-01 does not take effect. Electronic gear ratio = Encoder resolution / 2008H.
If 2008H = 0, 6092H-01 takes effect.
If 6092H-01(Feed constant) is not equal to 608Fh(Position encoder resolution), then:
Electronic gear ratio = Encoder resolution / 6092H-01
If 6092H-01(Feed constant) is equal to 608Fh(Position encoder resolution), then:
Electronic gear ratio = 6091H-01 / 6091H-02

| Index 6098H | Name | Homing Method | | | | | Structure | VAR | Type | Uint 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | RPDO | Mode | ALL | Range | 0-35 | Default | 0 |

| Homing Method | Description |
|---|---|
| -6 | Search the homing point with low speed negative direction, when the torque reached then stop immediately |
| -5 | Search the homing point with low speed positive direction, when the torque reached then stop immediately |
| -4 | Search the homing point with low speed negative direction, when the torque reached then |

| | |
|---|---|
| | change the motion direction, when the torque is gone then stop immediately |
| -3 | Search the homing point with low speed positive direction, when the torque reached then change the motion direction, when the torque is gone then stop immediately |
| -2 | Search the homing point with low speed negative direction, when the torque reached then reverse the direction, when the torque is gone and Z signal coming then stop immediately |
| -1 | Search the homing point with low speed positive direction, when the torque reached then reverse the direction, when the torque is gone and Z signal coming then stop immediately |
| 1 | Search the homing point in negative direction, deceleration point is negative limit switch, homing point is motor Z signal, the negative limit switch falling edge must come before Z signal |
| 2 | Search the homing point in positive direction, deceleration point is positive limit switch, homing point is motor Z signal, the positive limit switch falling edge must come before Z signal |
| 3 | Search the homing point in positive direction, deceleration point is homing switch, homing point is motor Z signal, the falling edge on the same side of homing switch must come before Z signal |
| 4 | Search the homing point in negative direction, deceleration point is homing switch, homing point is motor Z signal, the rising edge on the same side of homing switch must come before Z signal |
| 5 | Search the homing point in negative direction, deceleration point is homing switch, homing point is motor Z signal, the falling edge on the same side of homing switch must come before Z signal |
| 6 | Search the homing point in positive direction, deceleration point is homing switch, homing point is motor Z signal, the rising edge on the same side of homing switch must come before Z signal |
| 7 | Search the homing point in positive direction, deceleration point is homing switch, homing point is motor Z signal, the falling edge on the same side of homing switch must come before Z signal |
| 8 | Search the homing point in positive direction, deceleration point is homing switch, homing point is motor Z signal, the rising edge on the same side of homing switch must come before Z signal |
| 9 | Search the homing point in positive direction, deceleration point is homing switch, homing point is motor Z signal, the rising edge on the other side of homing switch must come before Z signal |
| 10 | Search the homing point in positive direction, deceleration point is homing switch, homing point is motor Z signal, the falling edge on the other side of homing switch must come before Z signal |
| 11 | Search the homing point in negative direction, deceleration point is homing switch, homing point is motor Z signal, the falling edge on the same side of homing switch must come before Z signal |
| 12 | Search the homing point in negative direction, deceleration point is homing switch, homing point is motor Z signal, the rising edge on the same side of homing switch must come before Z signal |
| 13 | Search the homing point in negative direction, deceleration point is homing switch, homing point is motor Z signal on the other side of homing switch, the rising edge on the other side of homing switch must come before Z signal |
| 14 | Search the homing point in negative direction, deceleration point is homing switch, homing point is motor Z signal on the other side of homing switch, the falling edge on the other side of homing switch must come before Z signal |
| 15 | |
| 16 | |
| 17-32 | Similar with 1-14, but the deceleration point coincides with the homing point |
| 33 | Search the homing point in negative direction, homing point is motor Z signal |
| 34 | Search the homing point in positive direction, homing point is motor Z signal |
| 35 | Set the current position as homing point |

| **Index** | Name | Status of digital input | | | Structure | VAR | Type | Dint 32 |
|---|---|---|---|---|---|---|---|---|

| 60FDH | Access | RO | Mapping | TPDO | Mode | ALL | Range | 0-ffff | Default | |
|---|---|---|---|---|---|---|---|---|---|---|

The bits of a 60FDh object are functionally defined as follow:

| Bit31 | Bit30 | Bit29 | Bit28 | Bit27 | Bit26 | Bit25 | Bit24 |
|---|---|---|---|---|---|---|---|
| Z signal | Reserved | Reserved | Reserved | Touch Probe 2 | Touch Probe 1 | BRAKE | INP/V-COIN /TLC |
| **Bit23** | **Bit22** | **Bit21** | **Bit20** | **Bit19** | **Bit18** | **Bit17** | **Bit16** |
| E-STOP | Reserved | Reserved | Reserved | Reserved | Reserved | SI14 | SI13 |
| **Bit15** | **Bit14** | **Bit13** | **Bit12** | **Bit11** | **Bit10** | **Bit9** | **Bit8** |
| SI12 | SI11 | SI10 | SI9 | SI8 | SI7 | SI6 | SI5 |
| **Bit7** | **Bit6** | **Bit5** | **Bit4** | **Bit3** | **Bit2** | **Bit1** | **Bit0** |
| SI4 | SI3 | SI2 | SI1 | Reserved | HOME | POT | NOT |

| Index 60FEH-01 | Name | Output valid | | | | | Structure | VAR | Type | Uint 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | RPDO | Mode | ALL | Range | 0-ffff | Default | 0 |

The bits of a 60FEh object are functionally defined as follow:

| Bit / Sub-index | 31~21 | 21 | 20 | 19 | 18 | 17 | 16 | 15~0 |
|---|---|---|---|---|---|---|---|---|
| 01h | Reserved | DO6 valid | DO5 valid | DO4 valid | DO3 valid | DO2 valid | DO1 valid | Reserved |

| Index 60FEH-02 | Name | Output enable | | | | | Structure | VAR | Type | Uint 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Access | RW | Mapping | | Mode | ALL | Range | 0-ffff | Default | 0 |

The bits of a 60FEh object are functionally defined as follow:

| Bit / Sub-index | 31~21 | 21 | 20 | 19 | 18 | 17 | 16 | 15~0 |
|---|---|---|---|---|---|---|---|---|
| 02h | Reserved | DO6 enable | DO5 enable | DO4 enable | DO3 enable | DO2 enable | DO1 enable | Reserved |

# Chapter 5 CANopen

## 5.1 CAN Interface

The CAN-bus（Controller Area Network-Bus）is a serial communication protocol developed by Bosch to exchange information between electronic control units on automobiles. This system makes possible to share a great amount of information between nodes and control units appended to the system, leading to a major reduction in both the number of sensors required and the quality of cables in the electrical installation.
The CANopen protocol is based in CAN specification, and its frame definition is such that one CAN frame is required for each CANopen message.

## 5.2 CANopen protocol

CANopen is the internationally standardized CAN-based higher-layer protocol for embedded control system , as developed and maintained by CiA members. The set of CANopen specifications comprise the application layer and communication profile, as well as application, device, and interface profiles. CANopen provides very flexible configuration capabilities, and for this reason CANopen networks are used in a very broad range of application fields, such as machine control, medical devices, off-road and rail vehicles, maritime electronics, building automation, power generation, etc.
The CANopen protocol defines basically two aspects of the communication protocol: how the communication should be formatted（CANopen frame）,and what objects are defined in common. Those objects may be used to configure or arbitrate the communication, or simply to exchange application data. Communication objects are available to:

- Exchange process and service data.
- Process or system time synchronization.
- Error state supervision.
- Control and monitoring of node states.

ELD2-CAN series follow the communication rules:

- Comply with CAN 2.0A standard
- Comply with CANopen standard protocol DS 301 _V4.02
- Comply with CANopen standard protocol DSP 402 _V2.01

### 5.2.1 CANopen frame

CANopen protocol is based in CAN frames and uses one CAN frame for each CANopen message. There are two important parts of the frame that the user needs to modify: the arbitration field and the data field. The rest of the fields of the frame are normally automatically configured by the CAN hardware.

**Arbitration field**

In CANopen messages the identifier part of the arbitration field is known as Communication Object Identifier（COB-ID）. It is divided into a 4-bit part function code and a 7-bit node-ID as depicted::

| Bit number: | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Identifier （COB-ID）** | | | | | | | | | | |
| | **Function code** | | | | **Node-ID** | | | | | | |

**COB-ID description**

Parallel to CAN, every node on a CANopen network must have a unique node-ID. The range of valid values comprises from 1 to 127. Zero is not allowed.

Similarly, the priority is determined by the COB-ID and RTR bits. As expected, the RTR bit on the arbitration field is used to request information from a remote node. In particular, it is used to implement the node guarding and TPDO request features, explained in the following chapters. With the exception of these two circumstances, the RTR bit is always set to zero.

The function cade determines the communication object, which should be one of the allowed in CANopen. The final COB-ID od the object depends on the ID of which node receives or transits the message, which allows to further establish priorities between nodes for the same function code.

In a master/slave communication, the message could be divided into two groups, as shown in the following tables.

- CANopen broadcast messages:

| Communication Object | Function code(binary) | COB-ID(hex) |
|---|---|---|
| NMT service | 0000b | 0x000 |
| SYNC | 0001b | 0x080 |

- CANopen peer-to-peer messages:

| Communication Object | Function code(binary) | COB-ID(hex) | Object Dictionary |
|---|---|---|---|
| Emergency | 0001b | 0x080+Node-ID | 1024H,1015H |
| TXPDO1(transmit) | 0011b | 0x180+Node-ID | 1800H |
| RXPDO1(receive) | 0100b | 0x200+Node-ID | 1400H |
| TXPDO2(transmit) | 0101b | 0x280+Node-ID | 1801H |
| RXPDO2(receive) | 0110b | 0x300+Node-ID | 1401H |
| TXPDO3(transmit) | 0111b | 0x380+Node-ID | 1802H |
| RXPDO3(receive) | 1000b | 0x400+Node-ID | 1402H |
| TXPDO4(transmit) | 1001b | 0x480+Node-ID | 1803H |
| RXPDO4(receive) | 1010b | 0x500+Node-ID | 1403H |
| SDO(transmit) | 1011b | 0x580+Node-ID | 1200H |
| SDO(receive) | 1100b | 0x600+Node-ID | 1200H |
| NMT error control | 1110b | 0x700+Node-ID | 1016H~1017H |

The COB-ID of No. 4 slave station TPDO2 = 0x280 + 4 = 0x284

## *5.2.2 CANopen objects*

In the CANopen protocol, there are defined three main sets of objects, organized in profile areas:

- **Communication profile area (0x1000 to 0x1FFF)**: These objects relate to CANopen communication, as defined in the DS301 communication profile. Objects in this address range are used to configure CANopen messages, and for general CANopen network setting.
- **Manufacturer profile area (0x2000 to 0x5FFF)**: These objects are manufacturer specific. Detailed

information about the specific objects implemented in EMCL can be found all through this document.

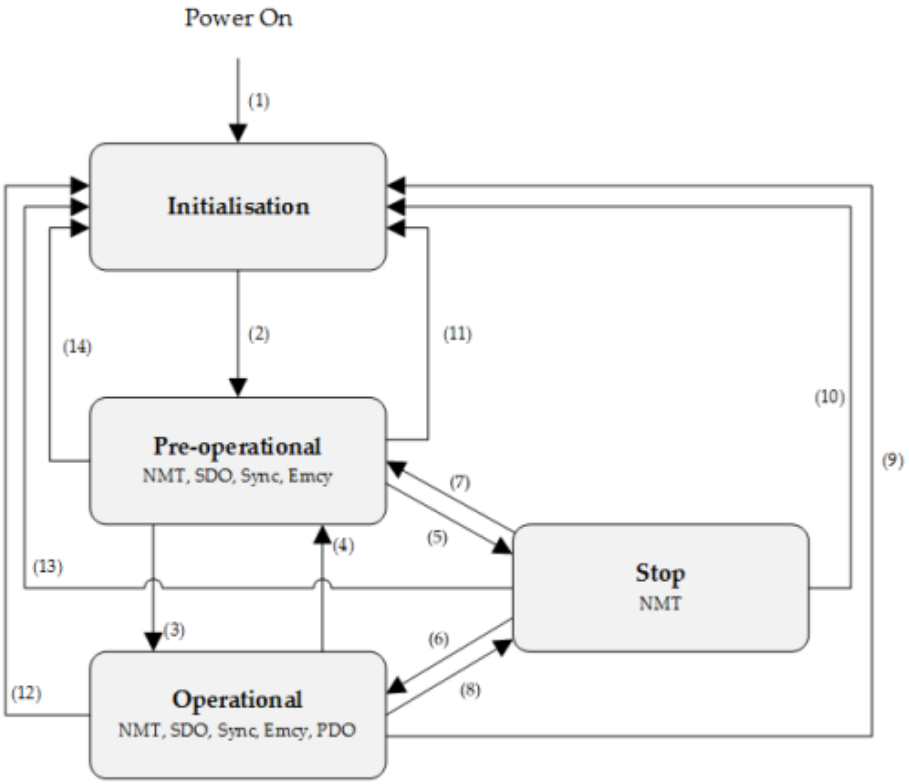
- **Device profile area (0x6000 to 0x9FFF)**: These objects are standardized device profile objects as defined in the DSP402 profile, which is the CANopen profile for servo drives.

This chapter is focused on the Communication profile area. DS301 defines special objects for the communication profile, responsible of managing system elements related to CANopen communications.

# *5.3 NMT*

The network management (NMT) protocols provide services for network initialization, error control and device status control. NMT objects are used for executing NMT services. The NMT follows a master-slave structure and therefore requires that one CANopen device in the network fulfils the function of the NMT master. All other CANopen devices are regarded as NMT slaves. An NMT slave is uniquely identified in the network by its Node ID, a value in the range of 1 to 127.

The NMT state machine defines the communication status for CANopen devices.




NMT state machine

| Transition | Event |
|---|---|
| (1) | After power on the system goes directly to *initialization* state |
| (1) | Once *initialization* is completed the system enters to *Pre-operational* state |
| (3), (6) | Reception of *Start remote node* command |
| (4), (7) | Reception of *Enter pre-operational state* command |
| (5), (8) | Reception of *Stop remote node* command |
| (9), (10), (11) | Reception of *Reset remote node* command |
| (12), (13), (14) | Reception of *Reset communication* command |

**NMT state initialization**

The initialization state could be divided into three sub-states that are executed in a sequential way: Initializing (performs the basic CANopen initializations), Reset application (in where all manufacturer-specific and standardized profile area parameters are set) and Reset communication (where the communication profile and parameters are set).

At the end of initialization state the device sends a boot-up message and goes directly to Pre-Operational state.

**NMT state pre-operational**

In Pre-Operational state, the communication using SDO messages is possible. PDO message are not yet defined and therefore communication using these message is not allowed. The device will pass to Operational message after receiving a NMT start node command.

Normally the master puts a node in Pre-Operational state during the set-up and configuration of device parameters.

**NMT state operational**

In Operational state all kind of messages are active, even PDO messages.

**NMT state stopped**

When entering in Stopped state, the device is forced to stop all communications with the exception of the NMT commands. (Node Guarding & Life Guarding).

**NMT states and communication object relation**

Following table shows the relation between communication states and communication objects. Services on the listed communication objects may only be executed if the devices involved in the communication are in the appropriate communication states

## *5.3.1 NMT services*

The structure of each NMT service command is as follows:

| COB-ID(hex) | Number of Bytes | Data field | |
|---|---|---|---|
| | | Byte 0 | Byte 1 |
| 0x000 | 2 | Command specifier | Node-ID |

The possible NMT services commands are the followings:

| Command specifier(hex) | Command description |
|---|---|
| 01 | Start remote node |
| 02 | Stop remote node |
| 80 | Enter pre-operational |
| 81 | Reset node |
| 82 | Reset communication |

**Example of Node-ID=1 NTM services:**

| COB-ID(hex) | Number of Bytes | Data(hex) | Description |
|---|---|---|---|
| 000 | 2 | 80 01 | NMT Host commands node 1 into Pre-Operational state |
| 000 | 2 | 01 01 | NMT Host commands node 1 into Operational state |
| 000 | 2 | 02 01 | NMT Host commands node 1 into Pre-Operational state |
| 000 | 2 | 82 01 | NMT Host commands a communication reset to node 1 |
| 701 | 1 | 00 | Node 1 response with a boot-up message |

## *5.3.1 NMT error control*

**Protocol node guarding**

The NMT Master can monitor the communication status of each node using the Node Guarding protocol. During node guarding, a controller is polled periodically and is expected to respond with its communication state within a pre-defined time frame. Note that responses indicating an acceptable state will alternate between two different values due to a toggle bit in the returned value. If there is no response, or an unacceptable state occurs, the NMT master could report an error to its host application.

The NMT master sends a node guarding request using the following a Remote Frame message:

| COB-ID(hex) | Number of Bytes | RTR |
|---|---|---|
| 0x700+Node-ID | 0 | 1 |

The NMT slave will generate a node guarding answer using the following message:

| COB-ID(hex) | Number of Bytes | RTR | Data field(Byte 1) | |
|---|---|---|---|---|
| | | | Bit 7 | Bit 6 to 0 |
| 0x700+Node-ID | 1 | 1 | Toggle | NMT communication state |

Note that the slave answers toggling a bit between consecutive responses. The value of the toggle bit of the first response after the guarding protocol becomes actives is zero.

The state of the heartbeat producer could be one of the followings:

| Communication State value(hex) | State definition |
|---|---|
| 00 | Boot-up |
| 04 | Stopped |
| 05 | Operational |
| 7F | Pre-operational |

**Example of NMT Node guarding:**

| COB-ID(hex) | Number of Bytes | Data(hex) | Description |
|---|---|---|---|
| 701 | 0 | - | Master sends a CAN remote frame without data to node 1 |
| 701 | 1 | 7F | Node 1 sends the actual NMT state (pre-operational) toggling the 7$^{th}$ bit |
| 701 | 0 | 0 | Master sends a CAN remote frame without data to node 1 |
| 701 | 1 | FF | Node 1 sends the actual NMT state (pre-operational) toggling the 7$^{th}$ bit |

**Protocol heartbeat**

The heartbeat protocol defines an error control service without need for remote frame. A heartbeat producer (in this scope a controller) transmits a Heartbeat message cyclically. Transmit cycle of heartbeat message could be configured using the object Producer heartbeat time (0x1017). If the Heartbeat is not received by the consumer (in this scope a master) within an expected period of time (normally specified as Consumer heartbeat time) It could report an error to its host application.

The heartbeat message generated by the producer will be as follows:

| COB-ID(hex) | Number of Bytes | Data field(Byte 1) | |
|---|---|---|---|
| | | Bit 7 | Bit 6 to 0 |
| 0x700+Node-ID | 1 | Reserved | NMT communication state |

The state of the heartbeat producer could be one of the followings:

| Communication State value(hex) | State definition |
|---|---|
| 00 | Boot-up |
| 04 | Stopped |
| 05 | Operational |
| 7F | Pre-operational |

**Example of NMT heartbeat:**

| COB-ID(hex) | Number of Bytes | Data(hex) | Description |
|---|---|---|---|
| 705 | 1 | 7F | Node 5 sends a heartbeat indicating pre-operational state |
| 705 | 1 | 7F | After producer heartbeat time, Node 5 sends again a heartbeat indicating pre-operational state |

**Protocol life guarding**

In Life guarding protocol the NMT slave monitors the status of the NMT master. This protocol utilizes the objects Guard time (0x100C) and Life time factor (0x100D) to determine a "Lifetime" for each NMT slave (Lifetime = Guard Time * Life Time Factor). If a node does not receive a Node Guard message within its Lifetime, the node assumes communication with the host is lost sends an emergency message and performs a fault reaction. Each node may have a different Lifetime.

**Example of NMT life guarding:**

| COB-ID(hex) | Number of Bytes | RTR | Data(hex) | Description |
|---|---|---|---|---|
| 705 | 1 | 1 | - | Master sends a CAN remote frame without data to node 1 |
| 705 | 1 | 1 | - | Master sends a CAN remote frame without data to node 1 |
| … | … | … | … | Delay Higher than Guard Time*Life Time Factor |
| 81 | 8 | 0 | 30 81 11 00 00 00 00 00 | Node 1 send an EMCY indicating the lifeguard error |

**Protocol boot-up**

An NMT slave issues the Boot-up message to indicate to the NMT-Master that it has entered the state Pre-operational from state Inititalising

**Example of NMT Boot-up:**

| COB-ID(hex) | Number of Bytes | Data(hex) | Description |
|---|---|---|---|
| 705 | 1 | 00 | Node 5 sends a boot-up NMT message |

# *5.4 SDO*

The SDO are communication channels with two basic characteristics:

- Client / Server relationship
- It provides access to the dictionary of CANopen objects of the device.

The SDO are used to transfer multiple object content simultaneously (each with an arbitrary amount of information) from client to server and vice versa.

SDO are transferred as a sequence of segments. Before sending the segments there is an initialization process

in which the server and clients prepare themselves to send the segments. However, it is also possible to send information (up to 4bytes) during the initialization process. This mechanism is called SDO expedited transfer. The SDO message will be as follows:

Master to Slave(Write)

| COB-ID(hex) | Byte 0 | Byte 1:2 | Byte 3 | Byte 4:7 |
|---|---|---|---|---|
| 0x600+Node-ID | SDO send Command | Object Dictionary | Index | Data |

Slave to Master(Feedback)

| COB-ID(hex) | Byte 0 | Byte 1:2 | Byte 3 | Byte 4:7 |
|---|---|---|---|---|
| 0x580+Node-ID | SDO receive Command | Object Dictionary | Index | Data |

**Example of SDO:**

- The master uses the SDO to write data to objects in the nodes

| COB-ID | Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 | Description |
|---|---|---|---|---|---|---|---|---|---|
| Master to Slave(Write) | | | | | | | | | Setup into Node 2<br>1081h-03=20F0(hex) |
| 602 | 2B | 01 | 18 | 03 | F0 | 20 | 00 | 00 | |
| Slave to Master(Feedback) | | | | | | | | | |
| 582 | 60 | 01 | 18 | 03 | 00 | 00 | 00 | 00 | |

- The master uses the SDO to read data from objects in the nodes

| COB-ID | Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 | Description |
|---|---|---|---|---|---|---|---|---|---|
| Master to Slave(Write) | | | | | | | | | Read from Node 2<br>1081h-03=20F0(hex) |
| 602 | 40 | 01 | 18 | 03 | 00 | 00 | 00 | 00 | |
| Slave to Master(Feedback) | | | | | | | | | |
| 582 | 4B | 01 | 18 | 03 | F0 | 20 | 00 | 00 | |

# *5.5 PDO*

PDOs are messages send without confirmation used for real time information transfer. PDOs are mapped to a single CAN frame and can contain multiple object dictionary entries with a maximum of 8 bytes of data. Each PDO has an identifier and is transmitted by only one node in the network, however it could be received by more than one node. PDOs must be configured previous to using them.

There are two types of PDO messages: Transmit PDO (TPDO) and Receive PDO (RPDO).

The trigger event of the PDO message could be configured using the communication parameter object and the object dictionary entries transmitted could be also defined using the PDO mapping list.

Therefore, each PDO is defined by means of:

- A PDO communication parameter
- A PDO mapping object

ELD2-CAN series include 4 RPDO and 4 TPDO.

**Transmit PDO (TPDO)**

TPDOs are configured to send data from node to master after the occurrence of a trigger event or after a remote request by means of a RTR.

TPDOs have three transmission types:

- **Internal event or timer:** Message transmission is triggered when the value mapped into the PDO has changed or when the specified time (event-timer) has elapsed. PDO transmission is controlled by producer.
- **Remotely request:** Message transmission is initiated on receipt of a RTR message. PDO transmission is driven by the PDO consumer.
- **Synchronously trigger:** Message transmission is triggered by the reception of a certain number of SYNC objects (see TPDO1 definition for further information). The PDO transmission is controlled by the SYNC producer.

**Example of an internal event TPDO:**

| COB-ID(hex) | Number of Bytes | Data(hex) | Description |
|---|---|---|---|
| 182 | 2 | 63 22 | Node 2 sends the Transmit PDO1 with a content value of 0x2263. |

**Receive PDO (RPDO)**

The master uses the RPDO to write data to objects in the nodes.

RPDOs have two transmission types:

- **Asynchronous:** Message content is applied upon receipt of the RPDO. The PDO reception is controlled by the PDO producer.
- **Synchronously trigger:** Message content is applied after the reception of a certain number of SYNC objects. The PDO reception is controlled by the SYNC producer.

**Example of an asynchronous RPDO:**

| COB-ID(hex) | Number of Bytes | Data(hex) | Description |
|---|---|---|---|
| 202 | 2 | 22 12 | Master sends a RPDO1 to Node 2 with a content value of 0x1222. |

# *5.6 SYNC*

SYNC object is a broadcast message sent by one of the devices in the bus (normally the master) to provide synchronization to the network and to allow coordination between nodes. The nodes could be programmed to return any variable (actual position, etc) by means of TPDO at reception of SYNC object. The SYNC object has no data.

**Example of SYNC:**

| COB-ID(hex) | Number of Bytes | Data(hex) | Description |
|---|---|---|---|
| 80 | 0 | - | Producer sends a SYNC message to all bus nodes. |

# *5.7 EMCY*

Emergency objects are triggered by the occurrence of a CANopen device internal error situation and are transmitted from an emergency producer (normally a node) on the CANopen device. An emergency object is sent only once per error event. Zero or more emergency consumers may receive the emergency object.

| COB-ID(hex) | Byte number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 80+Node ID | | Emergency error codes (Object 0x603F) | Error registers (Object 0x1001) | Reserved |

ELD2-CAN series include Emergency error codes (Object 0x603F):

| Emergency error codes | Description |
|---|---|
| 0000H | - |
| 8110H | CAN bus over-run |
| 8120H | CAN in error passive mode |
| 8130H | Lifeguard error |
| 8140H | Recovered from CAN bus off |
| 8141H | CAN Bus off occurred |
| 8150H | Send COB-ID conflicts |
| 8210H | PDO not processed due to length error |
| 8220H | PDO exceeds length error |

ELD2-CAN series include Error registers (Object 0x1001):

| Bit | Description |
|---|---|
| 0 | Generic Error |
| 1 | Current |
| 2 | Voltage |
| 3 | Temperature |
| 4 | Communication |
| 5 | Error specified by device protocol |
| 6 | Reserved |
| 7 | Leadshine specific error |

# Chapter 6 Trial Run

**Attention**

- Ground the earth terminal of the motor and drive without fail. the PE terminal of drive must be reliably connected with the grounding terminal of equipment.
- The drive power need with isolation transformer and power filter in order to guarantee the security and anti-jamming capability.
- Check the wiring to make sure correctness before power on.
- Install a emergency stop protection circuit externally, the protection can stop running immediately to prevent accident happened and the power can be cut off immediately.
- If drive alarm occurs, the cause of alarm should be excluded and Svon signal must be invalid before restarting the drive.
- 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 drive without load for safety first.

***Contact tech@leadshine.com for more technical service .***

## 6.1 Inspection Before trial Run

### 6.1.1 Inspection on wiring

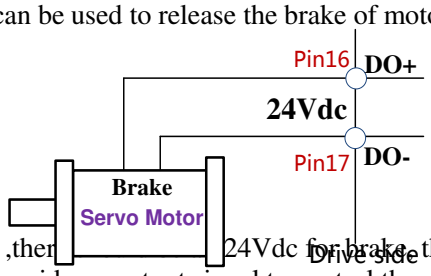
**Table 6.1 Inspection Item Before Run**

| No | Item | Content |
|---|---|---|
| 1 | Wiring Inspection | 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 CN3(it is unnecessary to connect CN1 and CN3 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 | The range of control power input Vdc, GND must be in the rated range (24-60Vdc). |
| 3 | Fixing of position | the motor and drive 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. |

### 6.1.2 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 .

✓ **For ELD2-CAN7005B\ELD2-CAN7010B\ELD2-CAN7015B\ELD2-CAN7020B\ELD2-CAN7030B:** Pin16/17 (DO+/DO-) can be used to release the brake of motor directly.




About the wire of brake ,ther 24Vdc for brake, the brake will be released with the 24Vdcinput, and the drive provide an output signal to control the connection or disconnection of the 24Vdc , and it is forbidden to connect these signal directly for the power of 24Vdc , it will destroy the hardware of servo drive.

### *6.1.3 Inspection on Parameters Setting*

| Motor Model | Pr7.15 | Pr7.16 |
|---|---|---|
| ACM602V36-1000 | 0x8001 | 0x201 |
| ACM602V36-2500 | 0x8001 | 0x204 |
| 57BL180D-1000 | 0x8003 | 0x201 |
| ACM604V60-1000 | 0x8002 | 0x201 |
| ACM604V60-2500 | 0x8002 | 0x204 |
| ELDM6020V36HL-A5 | 0x8004 | 0x201 |
| ACM602V36-T-2500 | 0x8006 | 0x204 |
| ACM602V24-T-2500 | 0x8007 | 0x204 |
| ELDM4005V24HL-B5 | 0x8008 | 0x204 |
| ELDM4010V24HL-B5 | 0x8009 | 0x204 |
| ELDM6020V48HL-A5 | 0x800B | 0x201 |
| ELDM6040V48HL-A5 | 0x800C | 0x201 |
| ELDM6040V60HL-A5 | 0x800D | 0x201 |
| ELDM6060V48HL-A5-HD | 0x800E | 0x201 |
| ELDM8075V48HM-A4-HD | 0x8010 | 0x201 |
| ELDM6020V24GL-A5 | 0X8016 | 0x201 |
| ELDM6020V48HL-A5 | 0X8017 | 0x201 |
| ELDM6040V24HL-A5 | 0X8018 | 0x201 |

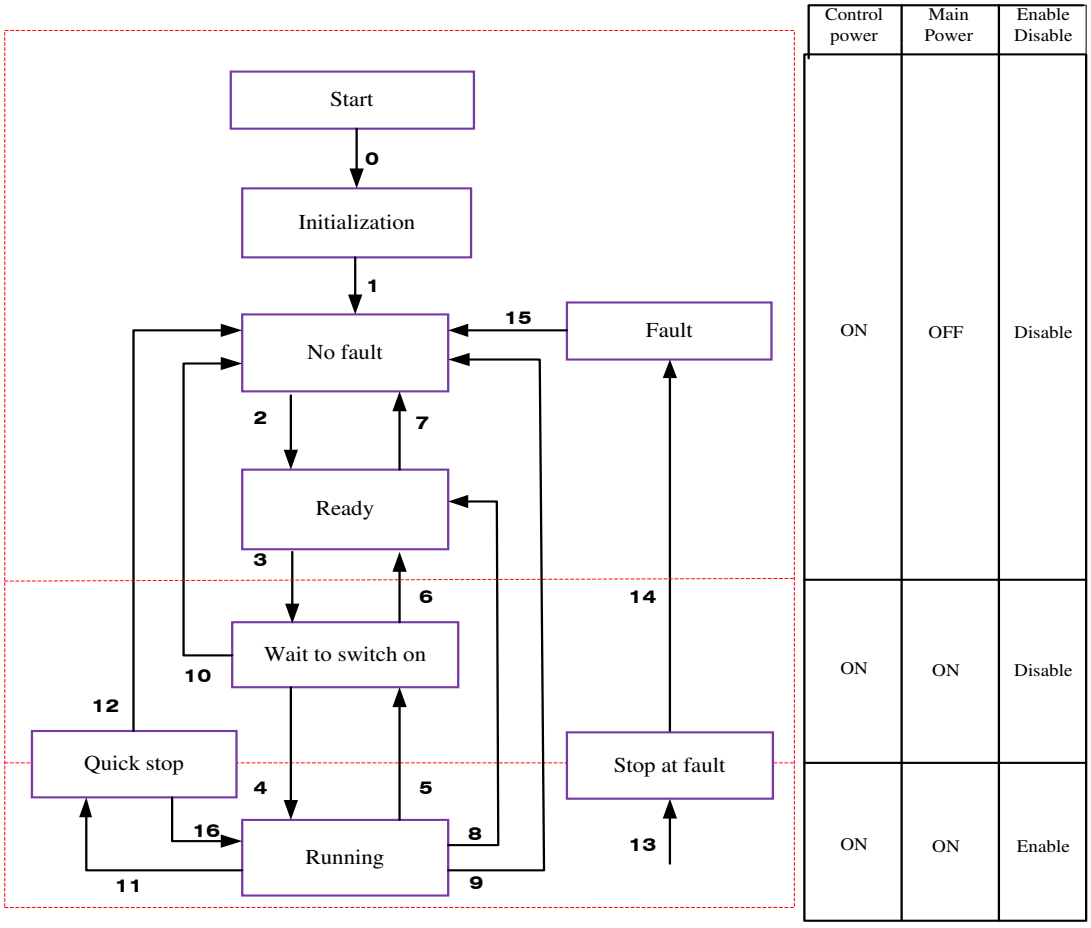
# *6.2 ELD2-CAN motion control procedure*

A. The CANopen master sends "control word (6040h)" to initialize the drive.
B. Drive feedback "status word (6041h)" to the master to show ready status (status word indication).
C. Master send enable command (control word switch).
D. The drive enables and feeds back to the master.
E. The master station sends homing command to return to homing position
F. Drive returns to homing position complete and notifies master station (status word indication)
G. The master station sends the position mode command for position movement (position motion parameters and control word) or sends the speed command for speed movement (speed motion parameters and control word).

H. When the drive is finished executing the movement (position motion/velocity motion), ELD2-CAN feeds back the position/speed to the master station for monitoring during the motion

I. The master station sends commands for the next motion.

# 6.3 CIA 402 State Machine




**Figue 6.1 ELD2-CAN 402 State Machine switchover diagram**

The states are described in the following stable 6.2

**Table 6.2 State description**

| States | Details |
|---|---|
| Initialization | Initialization of the servo drive and self-check have been done.<br>Parameter setting or drive function cannot be implemented.<br>If there is brake, the brake will not release, servo disabled. |
| No fault | No fault exists in the servo drive or the fault is eliminated<br>Parameter setting of the servo drive is allowed. |
| Ready | The servo drive is ready. Parameter setting of the servo drive is allowed. |
| Wait to switch on | The servo drive waits to switch on. Parameter setting of the servo drive is allowed. |
| Running | The servo drive is in normal running state; a certain control mode is enabled;<br>The motor is energized, and rotates when the reference is not 0.<br>Parameters with the setting condition of ‘during running’ can be set. |
| Quick stop | The quick stop function is enabled, and the servo drive executes quick stop.<br>Parameters with the setting condition of ‘during running’ can be set. |
| Stop at fault | A fault occurs, and the servo drive stops. |

| | |
|---|---|
| | Parameters with the setting condition of ‘during running’ can be set. |
| Fault | The stop process is completed, and all the drive function are inhibited.<br>Parameter setting is allowed for users to eliminate faults. |

The conversion of CIA402 state machine is accomplished by the control word (6040h) of the ELD2-CAN servo system operated by the master station.

# 6.4 Common Functions for All Modes

## 6.4.1 Motor Rotation Direction

The Rotation Direction is defined in 607Eh.

| Mode | | Value |
|---|---|---|
| Position mode | PP<br>HM | 0：Rotate in the same direction as the position command<br>128：Rotate in the opposite direction as the position command |
| Velocity mode | PV | 0：Rotate in the same direction as the position command<br>64：Rotate in the opposite direction as the position command |
| Torque mode | PT | 0：Rotate in the same direction as the position command<br>32：Rotate in the opposite direction as the position command |
| ALL mode | | 0：Rotate in the same direction as the position command<br>224：Rotate in the opposite direction as the position command |

## 6.2.2 Drive Stop

If the 6085h is not 0, the 6085h object will be used as the deceleration speed for quick stop. If the 6085h is 0, the servo will be stopped quickly according to the maximum current limit.

The emergency stop when meet limit switch, motor will stop rapidly according to the maximum current limit.

When the state machine is switched to an enable state the motor will stop freely. When bit8(Halt) of 6040h is 1, the motor will stop with deceleration set in 6084h.

## 6.4.3 Electronic Gear Ratio

ELD2-CAN position mode include protocol position mode (PP) and homing mode (HM), only in these two modes does the electronic gear ratio valid.

Electronic gear ratio range is 1/1000~8000, otherwise ErA00 warning will appear (the warning is not saved, after modification to a reasonable range, the operation panel alarm will automatically disappear, but the 402 state will still be in the "error" state, write 0x80 into 6040h to reset.

The electronic gear ratio setting is defined by 608Fh(Position encoder resolution),6091h(Gear ratio) and 6092h(Feed constant), which can only be effectively changed in the pre-operational state.

608Fh(Position encoder resolution) is the resolution of the encoder, which is read internally without additional setting. 6092h_01 represents the number of pulses that can be set for each rotation of the motor. 6091h_01/6091h_02 is real-time update effective.

The electronic gear subdivision method can be determined by modifying 6092h_01(Feed constant)

The subdivision method of electronic gear can be determined by modifying 6092h_01(Feed constant) .

1、If 6092h_01(Feed constant) is not equal to 608Fh(Position encoder resolution), then:

Electronic gear ratio = encoder resolution / 6092h_01

2、If 6092h_01(Feed constant) is equal to 608Fh(Position encoder resolution), then:

Electronic gear ratio = 6091_01/6092h_01

Electronic gear ratio range is 1/1000~8000.

**Note:** when the setting value exceeds this range, the error will be reported and automatically reset to the default value. The default values of 6091_01, 6091_02 and 6092_01 are 1, 1 and 10000.

## *6.4.4 Control Word*

The binary representation of the controlword (6040) is as follows:

| Bit | 15~11 | 10~9 | 8 | 7 | 6~4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|
| Definition | - | - | Halt | Fault reset | Mode specific | Enable operation | Quick stop | Enable voltage | Switch on |

| Command | Bit7 and Bit0 to Bit3 | | | | | 6040 Value | 402 State machine *1) |
|---|---|---|---|---|---|---|---|
| | 7：Fault reset | 3：Enable operation | 2：Quick stop | 1：Enable voltage | 0：Switch on | | |
| Power off | 0 | × | 1 | 1 | 0 | 0006h | 2;6;8 |
| Switch on | 0 | 0 | 1 | 1 | 1 | 0007h | 3* |
| Switch on | 0 | 1 | 1 | 1 | 1 | 000Fh | 3** |
| No voltage output | 0 | × | × | 0 | × | 0000h | 7;9;10;12 |
| Quick stop | 0 | × | 0 | 1 | × | 0002h | 7;10;11 |
| Operation disable | 0 | 0 | 1 | 1 | 1 | 0007h | 5 |
| Operation enable | 0 | 1 | 1 | 1 | 1 | 000Fh | 4;16 |
| Fault reset | Rising edge | × | × | × | × | 0080h | 15 |

× is not affected by this bit state

* indicates that this transition is performed in the device start state

** indicates that it has no effect on the start state and remains in the start state

*1) The state machine switch corresponds to figure 6.1

The definition of bit 8 and bit 6~4 in different operation modes are shown in the following table

| Bit | Operation Mode | | | |
|---|---|---|---|---|
| | Profile Position (PP) | Profile Velocity (PV) | Profile Torque (PT) | Homing (HM) |
| 8 | Halt | Halt | Halt | Halt |
| 6 | Abs / Rel | - | - | - |
| 5 | Change set immediately | - | - | - |
| 4 | New set-point | - | - | Homing operation start |

## *6.4.5 Status Word*

Bit definition of Status Word 6041h.

The binary representation of the statusword (6041) is as follows:

| Bit | Definition |
|---|---|
| 15~14 | Reserved |
| 13~12 | Mode specific |
| 11 | Position limit active |
| 10 | Target reached |
| 9 | Remote |
| 8 | Mode specific |
| 7 | Reserved |
| 6 | Switch on disabled |
| 5 | Quick stop |
| 4 | Voltage output |
| 3 | Fault |
| 2 | Operation enable |
| 1 | Switch on |
| 0 | Ready to switch on |

Bit 11 is valid when the software or hardware limit is in effect.

The combination of bit 6 and bit 0~3 represents the device state shown in following table

| Combination of bit 6 and bit 3~0 | Description |
|---|---|
| **××××,××××,×0××,0000** | Not ready to switch on |
| **××××,××××,×1××,0000** | Switch on disabled |
| **××××,××××,×01×,0001** | Ready to switch on |
| **××××,××××,×01×,0011** | Switch on |
| **××××,××××,×01×,0111** | Operation enabled |
| **××××,××××,×00×,0111** | Quick stop active |
| **××××,××××,×0××,1111** | Fault reaction active |
| **××××,××××,×0××,1000** | Fault |

× is not affected by this bit state

The definition of bit 8 and bit 12~13 in different operation modes are shown in the following table

| Bit | Operation Mode | | | |
|---|---|---|---|---|
| | Profile Position (PP) | Profile Velocity (PV) | Profile Torque (PT) | Homing (HM) |
| 13 | Following error | - | - | Homing error |
| 12 | - | Velocity is 0 | - | Homing attained |
| 8 | Abnormal stop | - | - | Abnormal stop |

### 6.4.6 Drive Enable

This section describes how to enable the drive by control word (6040h), how to view the drive enable states by status word (6041h)

**Steps:**

1: Write 0 to the control word 6040h
2: Write 6 to the control word 6040h
3: Write 7 to the control word 6040h
4: Write F to the control word 6040h

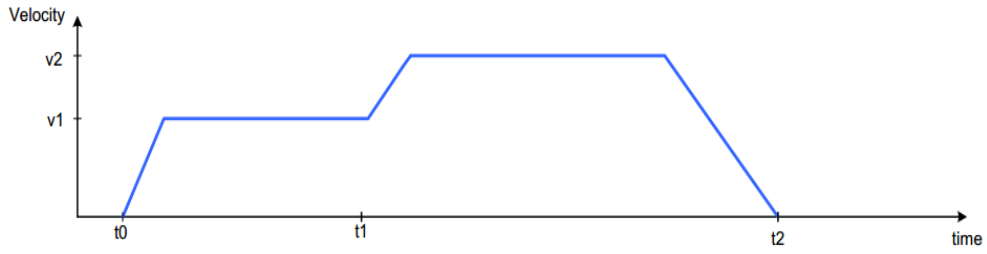
## 6.5 Profile position mode

When using network command source, the validation process for a new target position is the following:

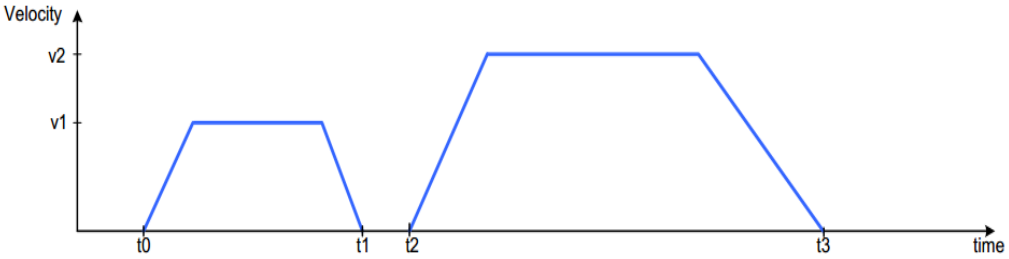
- The requested target position is sent to the motion controller.
- After the new target position has been delivered to the drive, the motion controller expects a controlword with a rising edge of the "***New set point*** " bit.
- Upon reception of the controlword with the rising edge of the "***New set point*** " bit, the motion controller issues a statusword with a "Set point acknowledge" bit rising edge.
- To signal its ability to accept new set points, the motion controller issues a statusword with the "Set point acknowledge" bit cleared.

If the system was not processing any position, the new position is processed and the motion starts. Nevertheless, if there was a previous set point being processed. the behavior of the system depends on the "***Change set immediately*** " bit in the controlword:

- If the "Change set immediately" bit of the controlword is 1, the target point is the new set point, and motion is started to reach this new set point.




- If the "Change set immediately" bit of the controlword is 0, the new set point is added to a buffer of set points, and the motion to the previous set being processed is not altered.




### 6.5.1 Controlword in profile position mode

The profile position mode uses some bits of the controlword and the statusword for mode specific purposes.

The binary representation of the controlword(6040) in profile position mode is as follows:

| Bit | 15~9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | - | Halt | Fault reset | Abs / rel | Change set immediately | New set-point | Enable operation | Quick stop | Enable voltage | Switch on |

If no positioning is in progress, the rising edge of bit 4 will start the positioning of the axis. In case a positioning is in progress, the definitions given in the following table shall be used.

| Change set immediately | New set-point | Description |
|---|---|---|
| 0 | 0 1 | Actual positioning will be completed (target reached) before the next one gets started (Set of set-points mode) |
| 1 | 0 1 | Next positioning shall be started immediately interrupting the actual one. |

Next table defines the values for bit 6 and 8 of the controlword.

| Name | Value | Description |
|---|---|---|
| Abs / rel | 0 | Target position is an absolute value. |
| | 1 | Target position is a relative value. |
| Halt | 0 | Execute positioning. |
| | 1 | Stop axis with profile deceleration(6084h). |

## *6.5.2 Statusword in profile position mode*

The binary representation of the statusword(6041) in profile position mode is as follows:

| Bit | Definition |
|---|---|
| 15~14 | Reserved |
| 13 | Following error |
| 12 | - |
| 11 | Position limit active |
| 10 | Target reached |
| 9 | Remote |
| 8 | Abnormal stop |
| 7 | Reserved |
| 6 | Switch on disabled |
| 5 | Quick stop |
| 4 | Voltage output |
| 3 | Fault |
| 2 | Operation enable |
| 1 | Switch on |
| 0 | Ready to switch on |

The meaning of each bit is described below, depending on its value:

| Name | Value | Description |
|---|---|---|
| Target reached | 0 | Halt=0: Target position not reached<br>Halt=1: Axis decelerates |
| | 1 | Halt=0: Target position reached |

| | | |
|---|---|---|
| | | Halt=1: Axis has velocity 0 |
| Following error | 0 | No following error |
| | 0 | Following error |

## *6.5.3 Related objects*

| Object Dictionary | Description | Setup value | Units |
|---|---|---|---|
| 6060H | Mode of operation | 1 | |
| 6040H | Controlword | | |
| 6041H | Statusword | | |
| 607AH | Target position | | Pulse |
| 6081H | Profile velocity | | Pulse /s |
| 6083H | Profile acceleration | | Pulse /s $^2$ |
| 6084H | Profile deceleration | | Pulse /s $^2$ |
| 6092H | Feed constant | | |

## *6.5.4 Example of profile position mode*

| No | Command | Function |
|---|---|---|
| 1 | 81 00 00 00 00 00 00 00 | Reset all nodes. If you need to reset the specified node, the node number is changed by modifying the two digits after 81 (note that it is hexadecimal) |
| 2 | 01 00 00 00 00 00 00 00 | Start remote control for all nodes. If remote control of the specified node needs to be started, the node number is changed by modifying the two-digit number after 01 (note that it is hexadecimal). |
| 3 | 2b 40 60 00 06 00 00 00 | Write control word as 06H，state machine switching status<br>Switch On Disabled->Ready to Switch On |
| 4 | 2b 40 60 00 07 00 00 00 | Read control word as 07H，state machine switching status<br>Ready to Switch On-> Switched On<br>The relay in the actuator is engaged |
| 5 | 2b 40 60 00 0f 00 00 00 | Write control word as 0fH，state machine switching status<br>Switched On->Operation Enable. Servo-Enabled |
| 6 | 2f 60 60 00 01 00 00 00 | Write operation mode as 1H, profile position mode |
| 7 | 23 81 60 00 90 D0 03 00 | Write the protocol speed as 3D090H(1500rpm, 10000p/r) |
| 8 | 23 83 60 00 90 D0 03 00 | Write the protocol acceleration as 3D090H(1500rpm/s, 10000p/r) |
| 9 | 23 7a 60 00 20 4E 00 00 | Write the target location at 4E20H（2 rotations, 10000p/r） |
| 10 | 2b 40 60 00 4f 00 00 00 | Write the control word as 4fH，<br>Set to relative motion mode |
| 11 | 2b 40 60 00 5f 00 00 00 | Write the control word as 5fH. Execute positioning |
| 12 | 2b 40 60 00 07 00 00 00 | Write control word as 07H,state machine switching status<br>Operation Enable -> Switched On. Servo-Disabled |
| 13 | 2b 40 60 00 06 00 00 00 | Write control word as 06H,state machine switching status<br>Switched On ->Ready to Switch On |

Notes: The COB-ID of step 1 (reset node) and step 2 (start node) is "0x000", and the COB-ID of the remaining

steps is the address 0x600 + Node ID

# 6.6 Profile velocity mode

Target velocity obtained from the command source is processed immediately on reception (system limits, etc.), and is delivered to the profiler afterwards. According to the predetermined parameters, the profiler generates and provides the control unit with the instantaneous target torque to be achieved. Upon reaching the target, a statusword is issued as a notification to other nodes.

## 6.6.1 Controlword in profile velocity mode

The profile velocity mode uses some bits of the controlword and the statusword for mode specific purposes. The binary representation of the controlword(6040) in profile velocity mode is as follows:

| Bit | 15~9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | - | Halt | Fault reset | - | - | - | Enable operation | Quick stop | Enable voltage | Switch on |

The action taken is described below, depending on the value of each bit:

| Name | Value | Description |
|---|---|---|
| Halt | 0 | Execute velocity movement |
| | 1 | Stop the movement |

## 6.6.2 Statusword in profile velocity mode

The binary representation of the statusword(6041) in profile velocity mode is as follows:

| Bit | Definition |
|---|---|
| 15~14 | - |
| 13 | - |
| 12 | Velocity is 0 |
| 11 | - |
| 10 | Target reached |
| 9 | - |
| 8 | - |
| 7 | - |
| 6 | Switch on disabled |
| 5 | Quick stop |
| 4 | Voltage output |
| 3 | Fault |
| 2 | Operation enable |
| 1 | Switch on |
| 0 | Ready to switch on |

The meaning of each bit is described below, depending on its value:

| Name | Value | Description |
|---|---|---|
| Target reached | 0 | Halt=0: Target velocity not reached<br>Halt=1: Axis decelerates |
| | 1 | Halt=0: Target velocity reached |

| | | |
|---|---|---|
| | | Halt=1: Axis has velocity 0 |
| Velocity is 0 | 0 | Velocity is not equal 0 |
| | 0 | Velocity is equal 0 |

### *6.6.3 Related objects*

| Object Dictionary | Description | Setup value | Units |
|---|---|---|---|
| 6060H | Mode of operation | 3 | |
| 6040H | Controlword | | |
| 6041H | Statusword | | |
| 60FFH | Target velocity | | Pulse /s |
| 6083H | Profile acceleration | | Pulse /s $^2$ |
| 6084H | Profile deceleration | | Pulse /s $^2$ |
| 606CH | Velocity actual value | | Pulse /s |
| 606BH | Velocity demand value | | Pulse /s |

### *6.6.4 Example of profile velocity mode*

| No | Command | Function |
|---|---|---|
| 1 | 81 00 00 00 00 00 00 00 | Reset all nodes. If you need to reset the specified node, the node number is changed by modifying the two digits after 81 (note that it is hexadecimal) |
| 2 | 01 00 00 00 00 00 00 00 | Start remote control for all nodes. If remote control of the specified node needs to be started, the node number is changed by modifying the two-digit number after 01 (note that it is hexadecimal). |
| 3 | 2b 40 60 00 06 00 00 00 | Write control word as 06H，state machine switching status Switch On Disabled->Ready to Switch On |
| 4 | 2b 40 60 00 07 00 00 00 | Read control word as 07H，state machine switching status Ready to Switch On-> Switched On<br>The relay in the actuator is engaged at this point |
| 5 | 2b 40 60 00 0f 00 00 00 | Write control word as 0fH，state machine switching status Switched On->Operation Enable. Servo-Enabled |
| 6 | 2f 60 60 00 03 00 00 00 | Write operation mode as 3H, profile velocity mode |
| 7 | 23 83 60 00 90D0 03 00 | Write the protocol acceleration as 3D090H(1500rpm/s, 10000p/r) |
| 8 | 23 ff 60 00 90 D0 03 00 | Write the protocol speed as 3D090H(1500rpm, 10000p/r ) |
| 9 | 2b 40 60 00 07 00 00 00 | Write control word as 07H,state machine switching status Operation Enable -> Switched On. Servo-Disabled |
| 10 | 2b 40 60 00 06 00 00 00 | Write control word as 06H,state machine switching status Switched On ->Ready to Switch On |

Notes: The COB-ID of step 1 (reset node) and step 2 (start node) is "0x000", and the COB-ID of the remaining steps is the address 0x600 + Node ID

# 6.7 Profile torque mode

Target torque obtained from the command source is processed immediately on reception (system limits, etc.), and is delivered to the profiler afterwards. According to the predetermined parameters, the profiler generates and provides the control unit with the instantaneous target torque to be achieved. Upon reaching the target, a statusword is issued as a notification to other nodes.

## 6.7.1 Controlword in profile torque mode

The profile velocity mode uses some bits of the controlword and the statusword for mode specific purposes. The binary representation of the controlword(6040) in profile torque mode is as follows:

| Bit | 15~9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Definition | - | Halt | Fault reset | - | - | - | Enable operation | Quick stop | Enable voltage | Switch on |

The action taken is described below, depending on the value of each bit:

| Name | Value | Description |
|---|---|---|
| Halt | 0 | Execute torque movement |
| | 1 | Stop the movement |

## 6.7.2 Statusword in profile torque mode

The binary representation of the statusword(6041) in profile torque mode is as follows:

| Bit | Definition |
|---|---|
| 15~14 | - |
| 13 | - |
| 12 | - |
| 11 | - |
| 10 | Target reached |
| 9 | - |
| 8 | - |
| 7 | - |
| 6 | Switch on disabled |
| 5 | Quick stop |
| 4 | Voltage output |
| 3 | Fault |
| 2 | Operation enable |
| 1 | Switch on |
| 0 | Ready to switch on |

The meaning of each bit is described below, depending on its value:

| Name | Value | Description |
|---|---|---|
| Target reached | 0 | Halt = 0: Target torque not reached<br>Halt = 1: Axis decelerates |
| | 1 | Halt = 0: Target torque reached |

| | | |
|---|---|---|
| | | Halt = 1: Axis has velocity 0 |

## 6.7.3 Related objects

| Object Dictionary | Description | Setup value | Units |
|---|---|---|---|
| 6060H | Mode of operation | 4 | |
| 6040H | Controlword | | |
| 6041H | Statusword | | |
| 6071H | Target torque | | 0.1% |
| 6087H | Torque change rate | | 0.1%/s |
| 6080H | Maximum motor speed | | r/min |
| 6074H | Torque demand | | 0.1% |
| 6077H | Torque actual value | | 0.1% |

## 6.7.4 Example of profile torque mode

| No | Command | Function |
|---|---|---|
| 1 | 81 00 00 00 00 00 00 00 | Reset all nodes. If you need to reset the specified node, the node number is changed by modifying the two digits after 81 (note that it is hexadecimal) |
| 2 | 01 00 00 00 00 00 00 00 | Start remote control for all nodes. If remote control of the specified node needs to be started, the node number is changed by modifying the two-digit number after 01 (note that it is hexadecimal). |
| 3 | 2b 40 60 00 06 00 00 00 | Write control word as 06H，state machine switching status Switch On Disabled->Ready to Switch On |
| 4 | 2b 40 60 00 07 00 00 00 | Read control word as 07H，state machine switching status Ready to Switch On-> Switched On<br>The relay in the actuator is engaged at this point |
| 5 | 2b 40 60 00 0f 00 00 00 | Write control word as 0fH，state machine switching status Switched On->Operation Enable. Servo-Enabled |
| 6 | 2f 60 60 00 04 00 00 00 | Write operation mode as 4H, profile torque mode |
| 7 | 23 71 60 00 14 00 00 00 | Write the torque value as 14H （20*0.1%=1% rated torque） |
| 8 | 2b 74 20 00 e8 03 00 00 | Write the speed limit (Pr3.21) as 3e8H (1000 RPM) |
| 9 | 23 87 60 00 14 00 00 00 | Write the rate of change in torque as 14H（That is, increases to 20*0.1% of the rated torque =2% /s） |
| 10 | 2b 40 60 00 07 00 00 00 | Write control word as 07H,state machine switching status Operation Enable -> Switched On. Servo-Disabled |
| 11 | 2b 40 60 00 06 00 00 00 | Write control word as 06H,state machine switching status Switched On ->Ready to Switch On |

Notes: The COB-ID of step 1 (reset node) and step 2 (start node) is "0x000", and the COB-ID of the remaining steps is the address 0x600 + Node ID

# 6.8 Homing mode

Typically, in a homing method there are two homing speeds: the faster speed is used to find the mechanical limit, and the slower speed is used to find the index pulse. There is a compromise between search speed and homing precision, due to maximum axis deceleration and inertia.

## 6.8.1 Controlword in profile homing mode

The profile velocity mode uses some bits of the controlword and the statusword for mode specific purposes. The binary representation of the controlword(6040) in profile homing mode is as follows:

| Bit | 15~9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | - | Halt | Fault reset | - | - | Homing operation start | Enable operation | Quick stop | Enable voltage | Switch on |

The action taken is described below, depending on the value of each bit:

| Name | Value | Description |
|---|---|---|
| Homing operation start | 0 | Do not start homing procedure |
| | 1 | Start homing procedure |
| Halt | 0 | Execute the instruction of bit 4 |
| | 1 | Stop axis with homing acceleration |

## 6.8.2 Statusword in profile homing mode

The binary representation of the statusword(6041) in profile homing mode is as follows:

| Bit | Definition |
|---|---|
| 15~14 | - |
| 13 | Homing error |
| 12 | Homing attained |
| 11 | - |
| 10 | Target reached |
| 9 | - |
| 8 | Abnormal stop |
| 7 | - |
| 6 | Switch on disabled |
| 5 | Quick stop |
| 4 | Voltage output |
| 3 | Fault |
| 2 | Operation enable |
| 1 | Switch on |
| 0 | Ready to switch on |

The meaning of each bit is described below, depending on its value:

| Homing error | Homing attained | Target reached | Description |
|---|---|---|---|
| 0 | 0 | 0 | Homing procedure is in progress |
| 0 | 0 | 1 | Homing procedure is interrupted or not started |
| 0 | 1 | 0 | Homing is attained but target is not reached |
| 0 | 1 | 1 | Homing mode carried out successfully |
| 1 | 0 | 0 | Homing error occurred;<br>Homing mode carried out not successfully;<br>Velocity is not zero |
| 1 | 0 | 1 | Homing error occurred;<br>Homing mode carried out not successfully;<br>Velocity is zero |
| 1 | 1 | x | Reserved |

## *6.8.3 Related objects*

| Object Dictionary | Description | Setup value | Units |
|---|---|---|---|
| 6060H | Mode of operation | - | |
| 6040H | Controlword | | |
| 6041H | Statusword | | |
| 6098H | Homing method | | |
| 6099H | Homing speeds | | Command unit /s |
| 609AH | Homing acceleration | | Command unit /$s^2$ |
| 607CH | Home offset | | Command unit |

## *6.8.4 Example of homing mode*

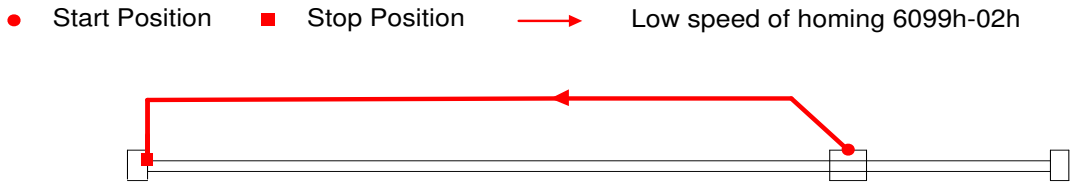
| No | Command | Function |
|---|---|---|
| 1 | 81 00 00 00 00 00 00 00 | Reset all nodes. If you need to reset the specified node, the node number is changed by modifying the two digits after 81 (note that it is hexadecimal) |
| 2 | 01 00 00 00 00 00 00 00 | Start remote control for all nodes. If remote control of the specified node needs to be started, the node number is changed by modifying the two-digit number after 01 (note that it is hexadecimal). |
| 3 | 2b 40 60 00 06 00 00 00 | Write control word as 06H，state machine switching status<br>Switch On Disabled->Ready to Switch On |
| 4 | 2b 40 60 00 07 00 00 00 | Read control word as 07H，state machine switching status<br>Ready to Switch On-> Switched On<br>The relay in the actuator is engaged at this point |
| 5 | 2b 40 60 00 0f 00 00 00 | Write control word as 0fH，state machine switching status<br>Switched On->Operation Enable. Servo-Enabled |

| | | |
|---|---|---|
| 6 | 2f 60 60 00 06 00 00 00 | Write operation mode as 6H, homing mode |
| 7 | 23 99 60 01 30 75 00 00 | Write home speed-high speed as 7530H（180rpm, 10000p/r） |
| 8 | 23 99 60 02 20 4e 00 00 | Write home speed-low speed as 4e20H（120rpm, 10000p/r） |
| 9 | 23 9a 60 00 30 75 00 00 | Write the acceleration of home speed as 7530H（180rpm/s,10000p/r） |
| 10 | 2f 98 60 00 16 00 00 00 | Write home method as 16H（The 22rd home method） |
| 11 | 2b 40 60 00 1f 00 00 00 | Write the control word as 1f, set the 4th digit of 6040H as 1, start homing mode. |
| 12 | 2b 40 60 00 0f 00 00 00 | Write the control word as 0f, and set the 4th digit of 6040H as 0, do not start homing mode. |
| 14 | 2b 40 60 00 07 00 00 00 | Write control word as 07H,state machine switching status Operation Enable -> Switched On. Servo-Disabled. |
| 15 | 2b 40 60 00 06 00 00 00 | Write control word as 06H,state machine switching status Switched On ->Ready to Switch On. |

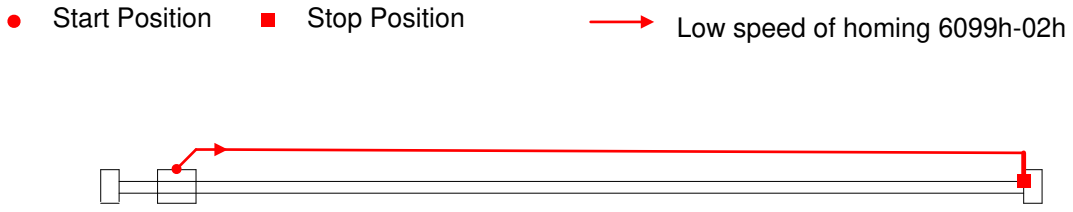
Notes: The COB-ID of step 1 (reset node) and step 2 (start node) is "0x000", and the COB-ID of the remaining steps is the address 0x600 + Node ID

## *6.8.5 Homing Method*

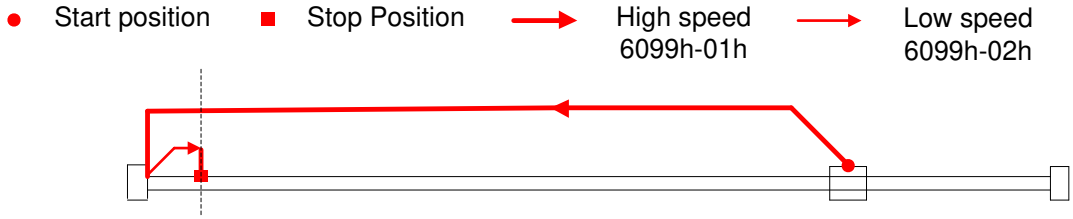
**Method -6:** Search the homing point with low speed negative direction, when the torque reached then stop immediately.



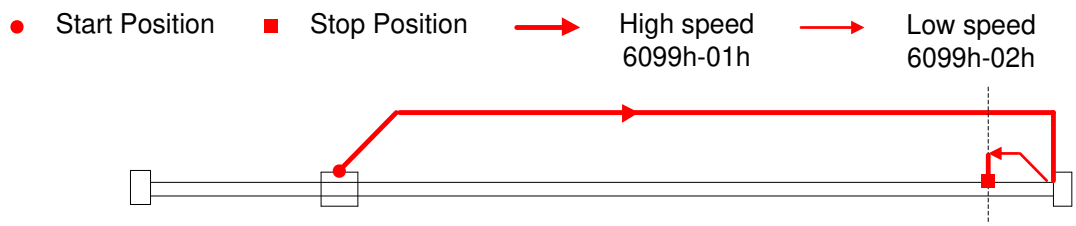

**Method -5:** Search the homing point with low speed positive direction, when the torque reached then stop immediately.



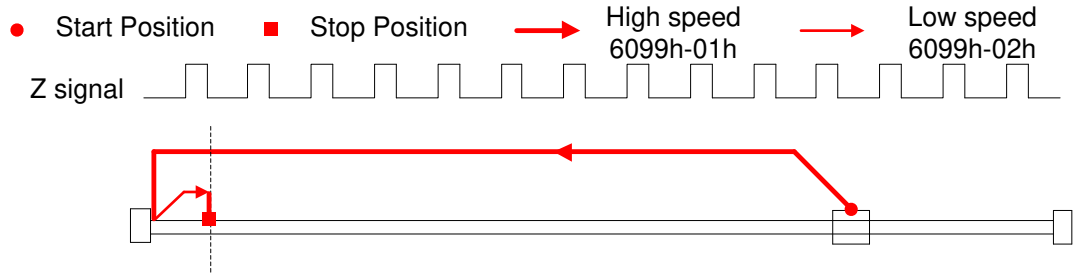

**Method -4:** Search the homing point with low speed negative direction, when the torque reached then change the motion direction, when the torque is gone then stop immediately.



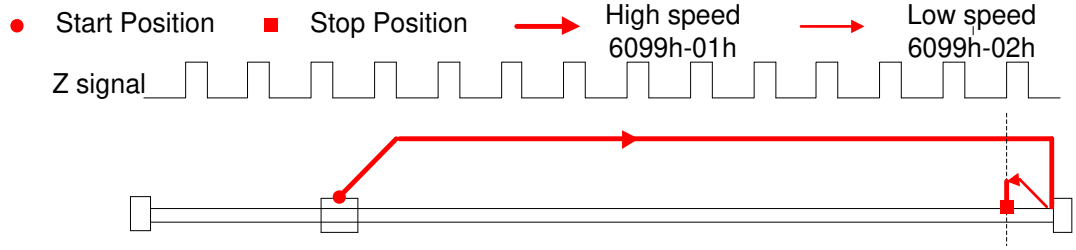

**Method -3:** Search the homing point with low speed positive direction, when the torque reached then change the motion direction, when the torque is gone then stop immediately.




**Method -2:** Search the homing point with low speed negative direction, when the torque reached then reverse the direction, when the torque is gone and Z signal coming then stop immediately.




**Method -1:** Search the homing point with low speed positive direction, when the torque reached then reverse the direction, when the torque is gone and Z signal coming then stop immediately.

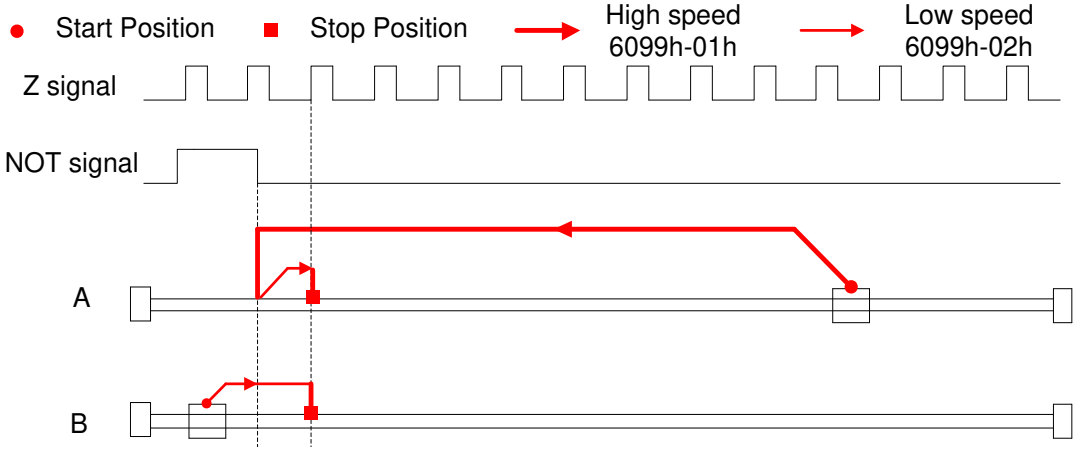



**Method 1:**

If the negative limit switch is invalid, the motor will move in negative direction at high speed until the negative limit switch signal is valid. The motor stops and starts moving at low speed in positive direction. The motor stops after leaving the negative limit switch and the first encoder Z signal is valid, as shown in figure.

If the motor stops at the negative limit position when it starts to move, the motor will move in positive direction at low speed. The motor stops after leaving the negative limit switch and the first encoder Z signal is valid, as shown in figure.

If the positive limit signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.

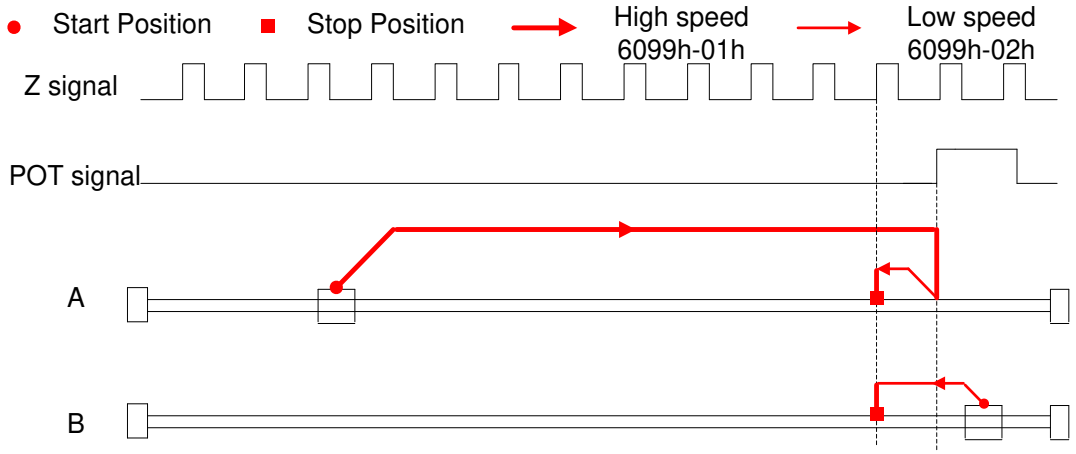


**Method 2:**

If the positive limit switch is invalid, the motor will move in positive direction at high speed until the positive limit switch signal is valid. The motor stops and starts moving at low speed in negative direction. The motor stops after leaving the positive limit switch and the first encoder Z signal is valid, as shown in figure.

If the motor stops at the positive limit position when it starts to move, the motor will move in negative direction at low speed. The motor stops after leaving the positive limit switch and the first encoder Z signal is valid, as shown in figure.

If the negative limit signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.

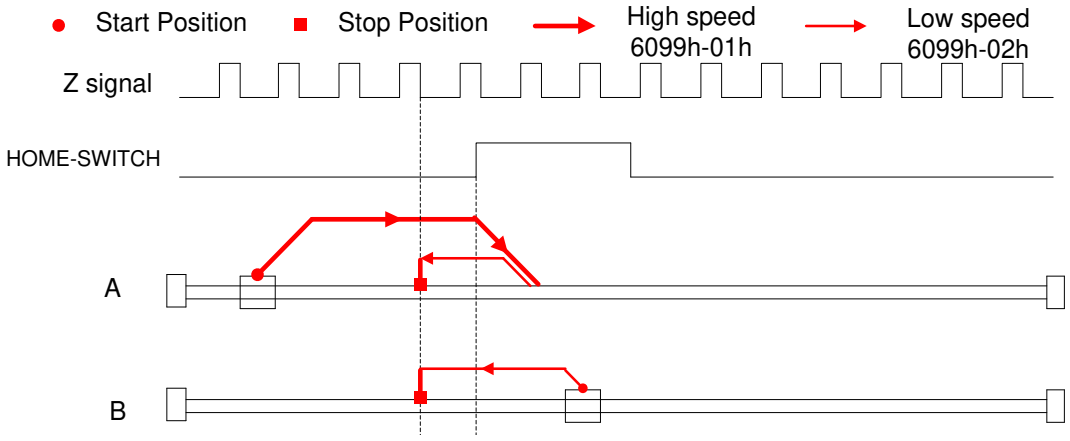



**Method 3:**

If the homing switch is invalid, the motor will move in positive direction at high speed until the homing switch signal is valid. The motor stops and starts moving at low speed in negative direction. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the motor stops at the homing switch position when it starts to move, the motor will move in negative direction at low speed. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the positive/negative limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.

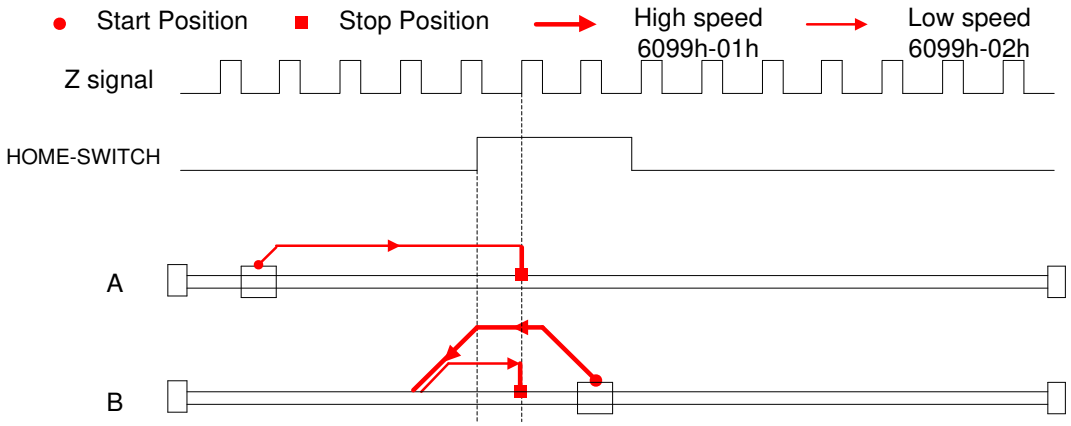



**Method 4:**

If the homing switch is invalid, the motor will move in positive direction at low speed until the homing switch signal is valid. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the motor stops at the homing switch position when it starts to move, the motor will move in negative direction at high speed until the homing switch invalid. Then the motor reverse the direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the positive/negative limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.

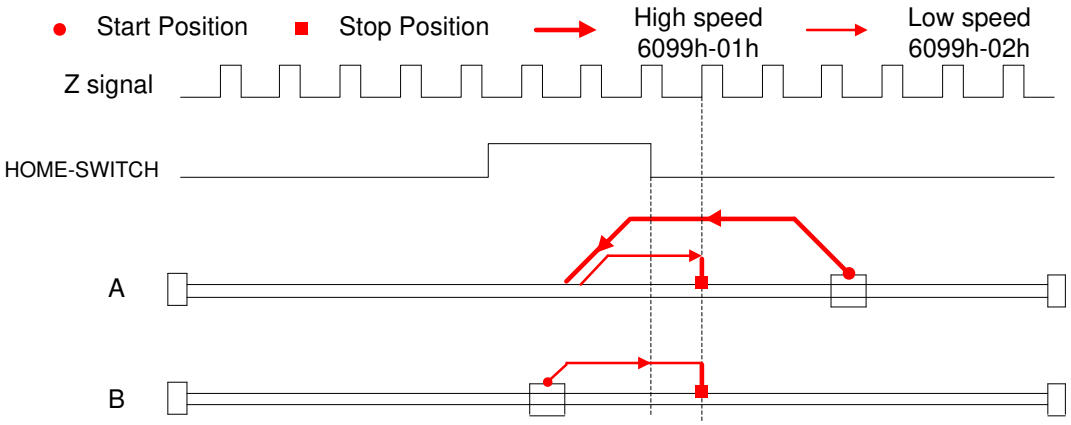



**Method 5:**

If the homing switch is invalid, the motor will move in negative direction at high speed until the homing switch signal is valid. Then the motor reverse the direction at low speed. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the motor stops at the homing switch position when it starts to move, the motor will move in positive direction at low speed. The motor stops after the homing switch invalid and the first encoder Z signal is valid, as shown in figure.

If the positive/negative limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.



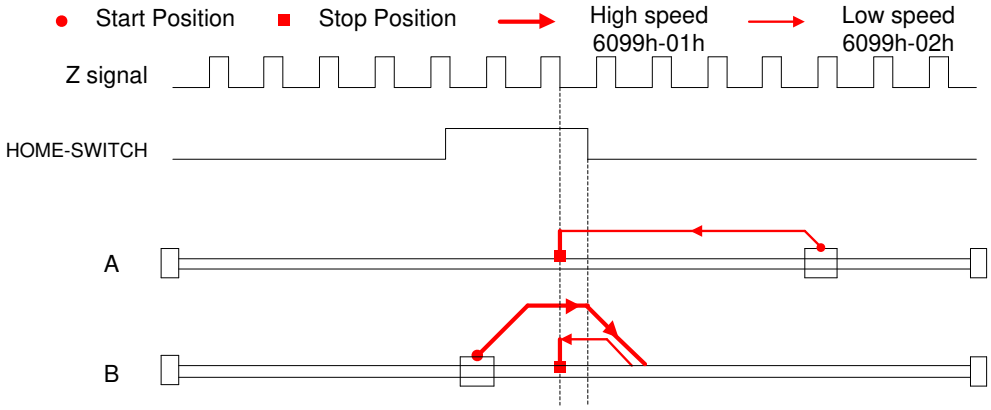

**Method 6:**

If the homing switch is invalid, the motor will move in negative direction at low speed until the homing switch signal is valid. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the motor stops at the homing switch position when it starts to move, the motor will move in positive direction at high speed until the homing switch invalid. Then the motor reverse the direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the positive/negative limit switch signal is valid during the homing process, the status word (6041h) bit

13 will be valid, indicating that the homing error and the motor will stop immediately.



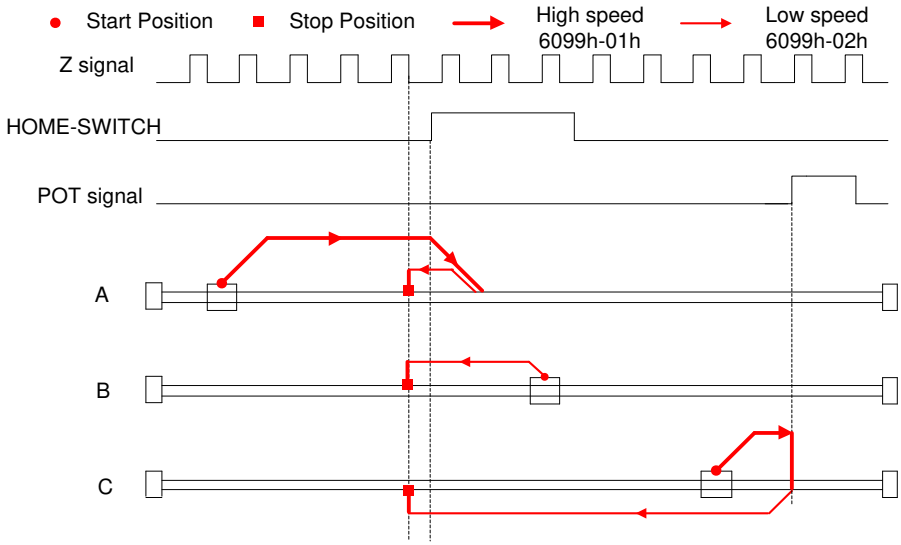

**Method 7:**

If the homing switch and positive limit switch is invalid, the motor will move in positive direction at high speed until the homing switch signal is valid. Then the motor reverse the direction at low speed. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the positive limit switch is invalid and motor stops at the homing switch position when it starts to move, the motor will move in negative direction at low speed until the homing switch signal is valid. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the homing switch and positive limit switch is invalid, the motor will move in positive direction at high speed until the positive limit switch valid. Then the motor reverse the direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the negative limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.




**Method 8:**

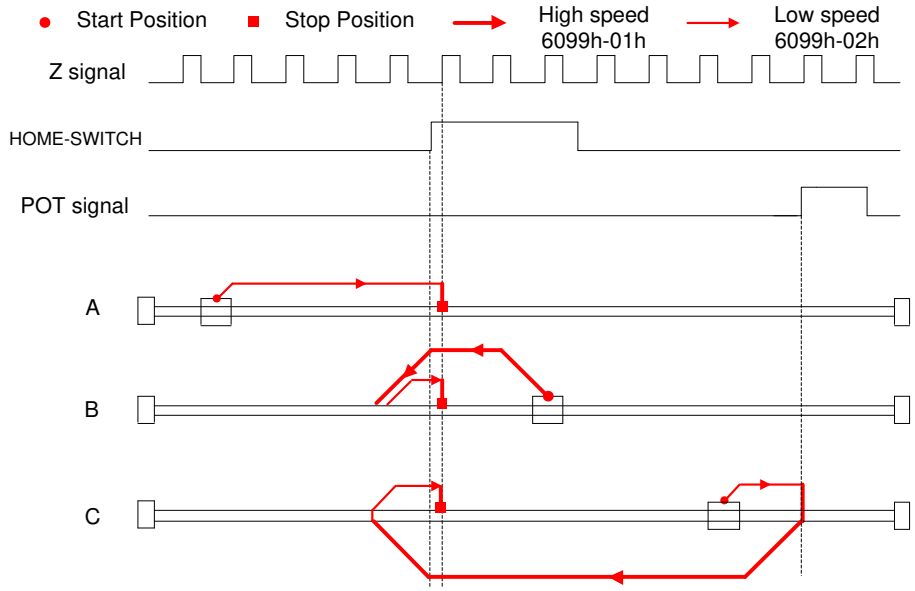
If the homing switch and positive limit switch is invalid, the motor will move in positive direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the positive limit switch is invalid and motor stops at the homing switch position when it starts to move, the motor will move in negative direction at high speed until the homing switch signal is invalid. Then the motor reverse the direction at low speed. The motor stops after the homing switch valid and the first encoder Z

signal is valid, as shown in figure.

If the homing switch and positive limit switch is invalid, the motor will move in positive direction at low speed until the positive limit switch valid. Then the motor reverse the direction at high speed until the homing switch invalid. Then the motor move in positive direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the negative limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.



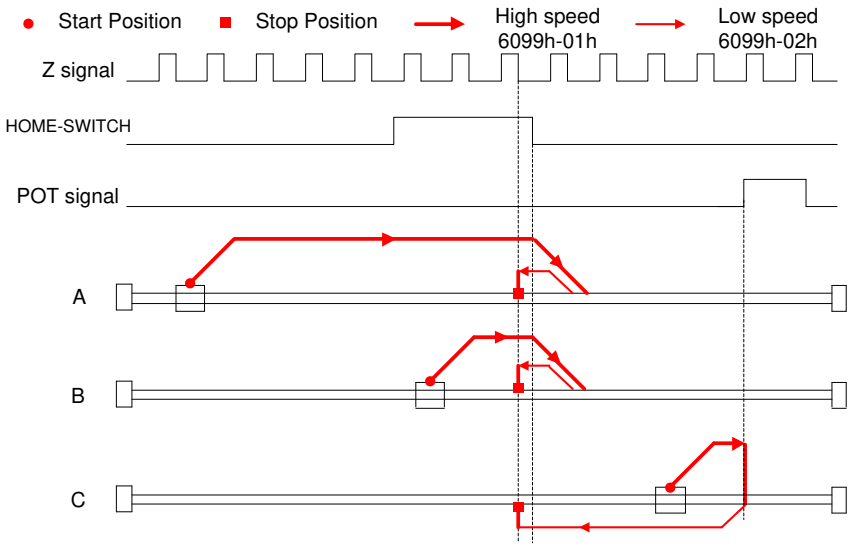

**Method 9:**

If the homing switch and positive limit switch is invalid, the motor will move in positive direction at high speed until the homing switch invalid. Then the motor reverse the direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the positive limit switch is invalid and motor stops at the homing switch position when it starts to move, the motor will move in positive direction at high speed until the homing switch signal is invalid. Then the motor reverse the direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the homing switch and positive limit switch is invalid, the motor will move in positive direction at high speed until the positive limit switch valid. Then the motor reverse the direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the negative limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.



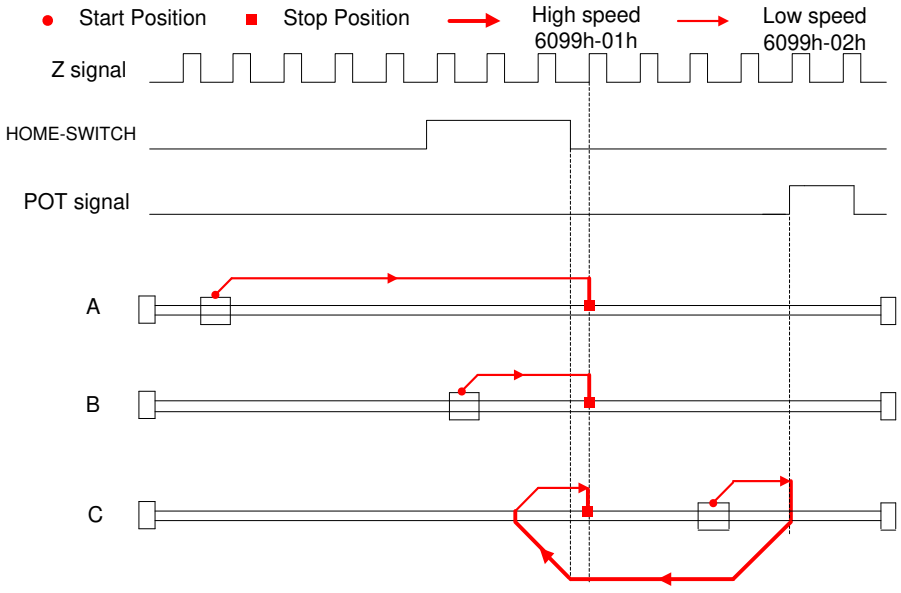

**Method 10:**

If the homing switch and positive limit switch is invalid, the motor will move in positive direction at low speed. The motor stops after the homing switch invalid and the first encoder Z signal is valid, as shown in figure.

If the positive limit switch is invalid and motor stops at the homing switch position when it starts to move, the motor will move in positive direction at low speed. The motor stops after the homing switch invalid and the first encoder Z signal is valid, as shown in figure.

If the homing switch and positive limit switch is invalid, the motor will move in positive direction at low speed until the positive limit switch valid. Then the motor reverse the direction at high speed until the homing switch valid. Then the motor move in positive direction at low speed. The motor stops after the homing switch invalid and the first encoder Z signal is valid, as shown in figure.

If the negative limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.



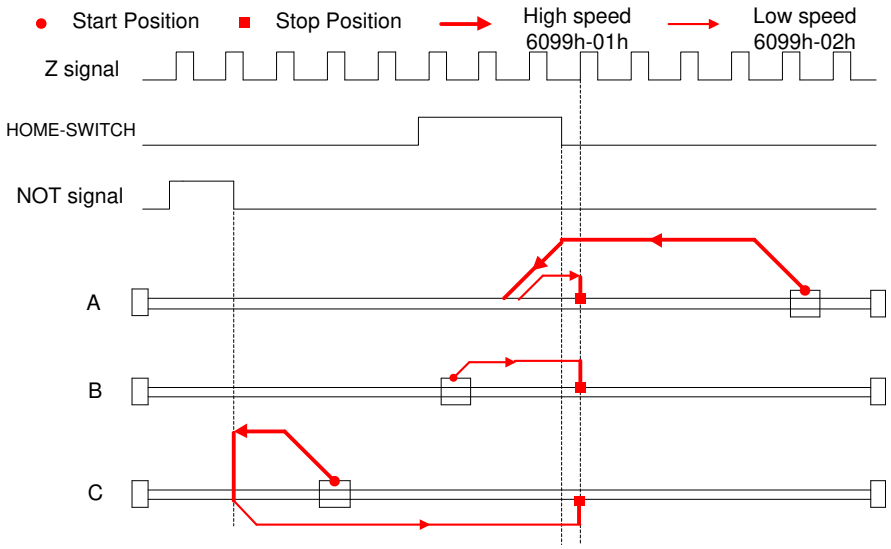
**Method 11**

If the homing switch and negative limit switch is invalid, the motor will move in negative direction at high speed until the homing switch signal is valid. Then the motor reverse the direction at low speed. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the negative limit switch is invalid and motor stops at the homing switch position when it starts to move, the motor will move in positive direction at low speed. The motor stops after leaving the homing switch and the first encoder Z signal is valid, as shown in figure.

If the homing switch and positive limit switch is invalid, the motor will move in negative direction at high speed until the negative limit switch valid. Then the motor reverse the direction at low speed. The motor stops after the homing switch invalid and the first encoder Z signal is valid, as shown in figure.

If the positive limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.



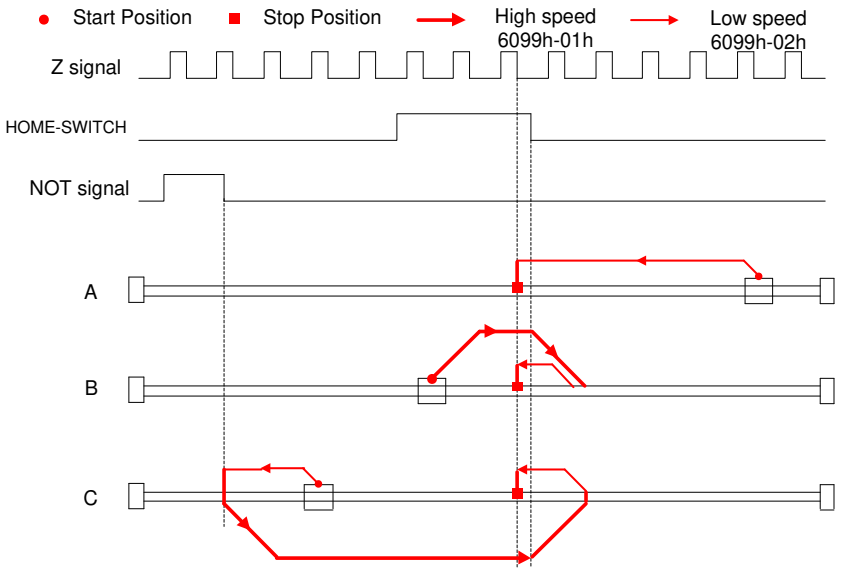

**Method 12:**

If the homing switch and positive limit switch is invalid, the motor will move in negative direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the negative limit switch is invalid and motor stops at the homing switch position when it starts to move, the motor will move in positive direction at high speed until the homing switch signal is invalid. Then the motor reverse the direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the homing switch and negative limit switch is invalid, the motor will move in negative direction at low speed until the positive limit switch valid. Then the motor reverse the direction at high speed until the homing switch invalid. Then the motor move in negative direction at low speed. The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the positive limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.



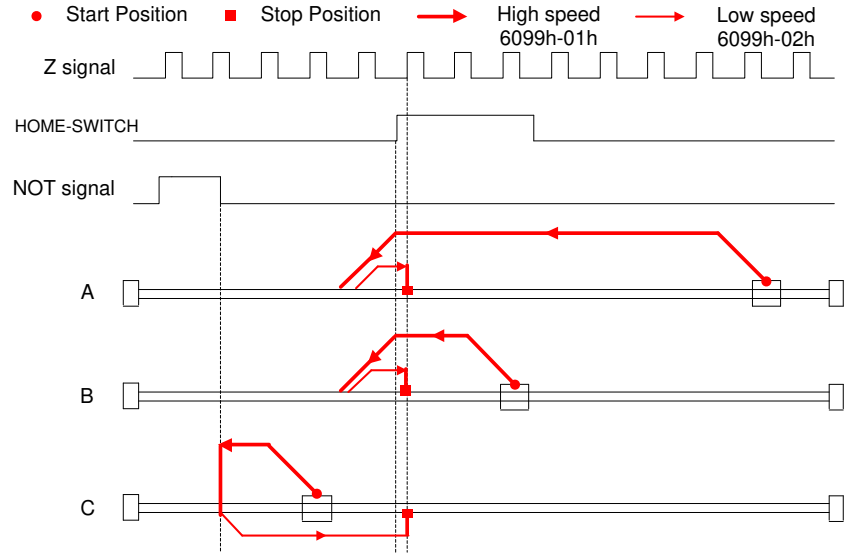

**Method 13:**

If the homing switch and negative limit switch is invalid, the motor will move in negative direction at high speed until the homing switch invalid.Then the motor reverse the direction at low speed.The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the negative limit switch is invalid and motor stops at the homing switch position when it starts to move, the motor will move in negative direction at high speed until the homing switch signal is invalid. Then the motor reverse the direction at low speed.The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the homing switch and positive limit switch is invalid, the motor will move in negative direction at high speed until the negative limit switch valid. Then the motor reverse the direction at low speed.The motor stops after the homing switch valid and the first encoder Z signal is valid, as shown in figure.

If the positive limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.



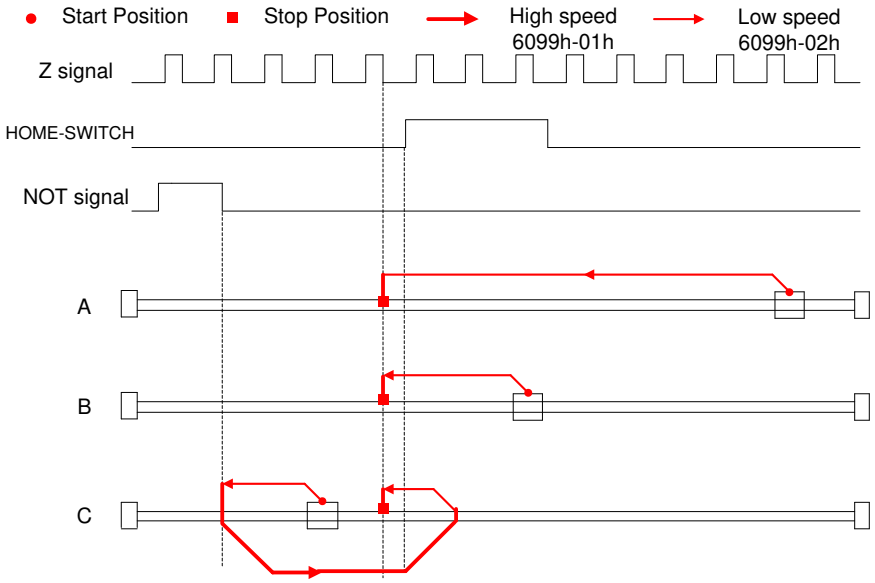
**Method 14:**

If the homing switch and positive limit switch is invalid, the motor will move in negative direction at low speed. The motor stops after the homing switch invalid and the first encoder Z signal is valid, as shown in figure.

If the negative limit switch is invalid and motor stops at the homing switch position when it starts to move, the motor will move in negative direction at low speed. The motor stops after the homing switch invalid and the first encoder Z signal is valid, as shown in figure.

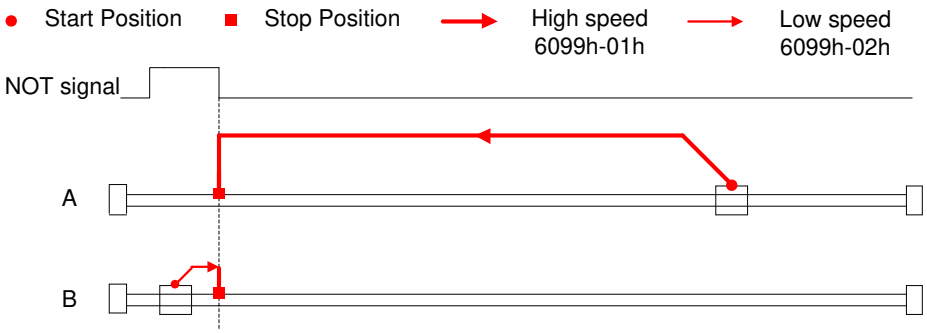
If the homing switch and positive limit switch is invalid, the motor will move in negative direction at low speed until the negative limit switch valid. Then the motor reverse the direction at high speed until the homing switch valid. Then the motor move in negative direction at low speed. The motor stops after the homing switch invalid and the first encoder Z signal is valid, as shown in figure.

If the positive limit switch signal is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.



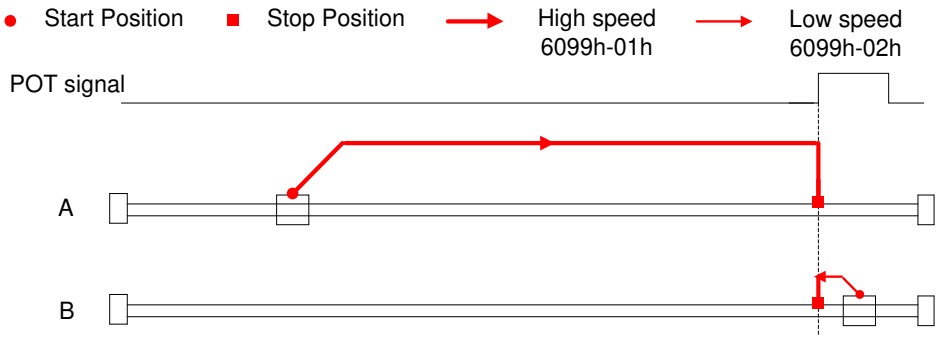

**Method 17:**

This method is similar to method 1



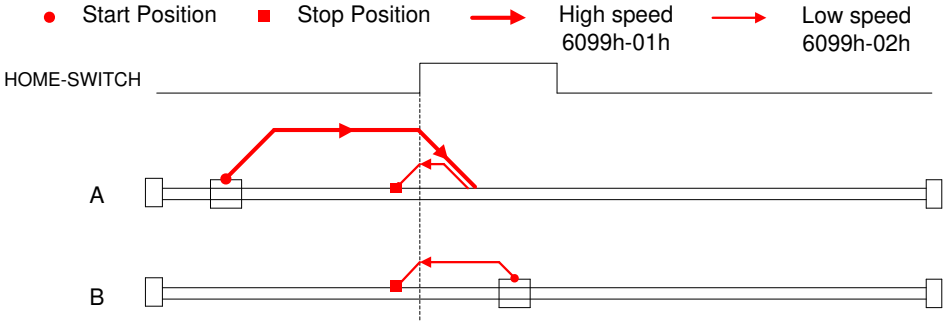
**Method 18:**

This method is similar to method 2



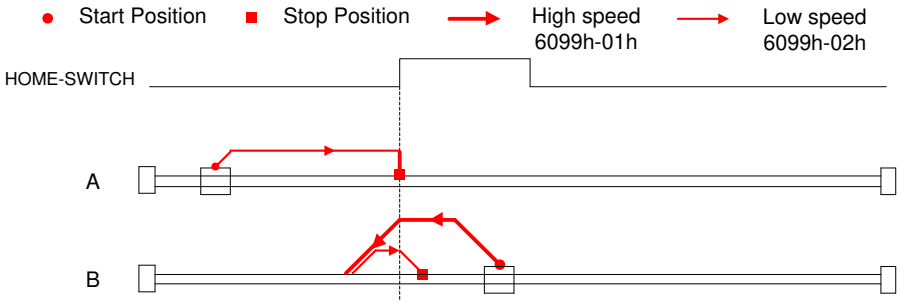

**Method 19:**

This method is similar to method 3



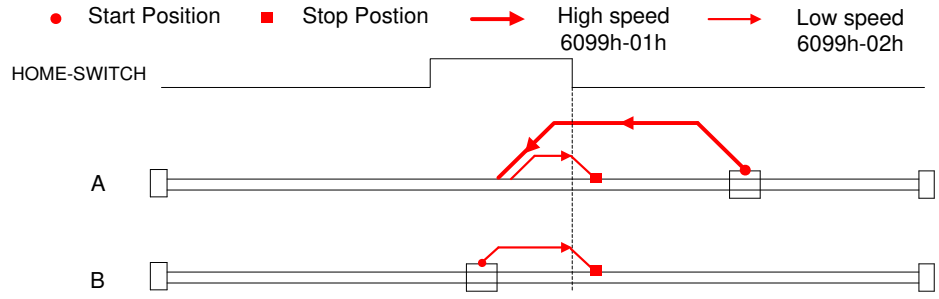

**Method 20:**

This method is similar to method 4



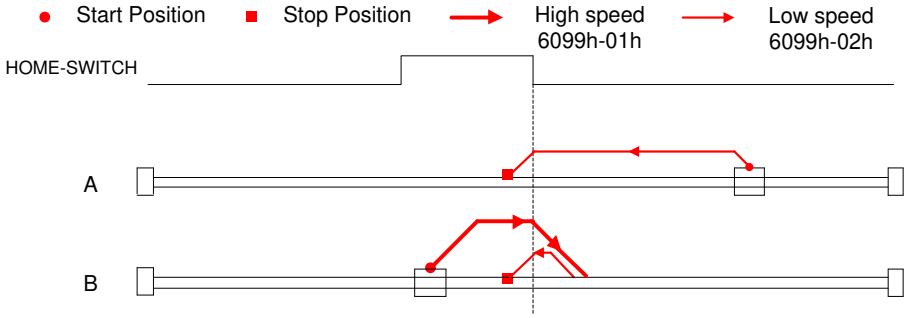

**Method 21:**

This method is similar to method 5



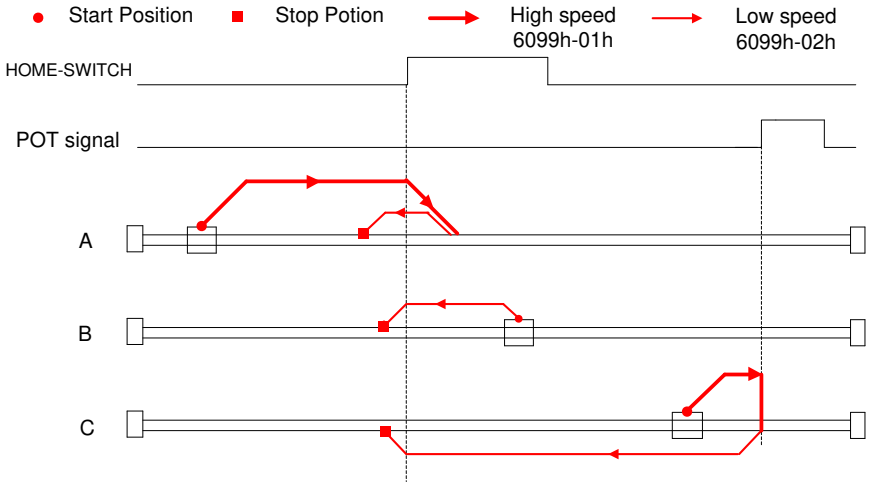
**Method 22:**

This method is similar to method 6



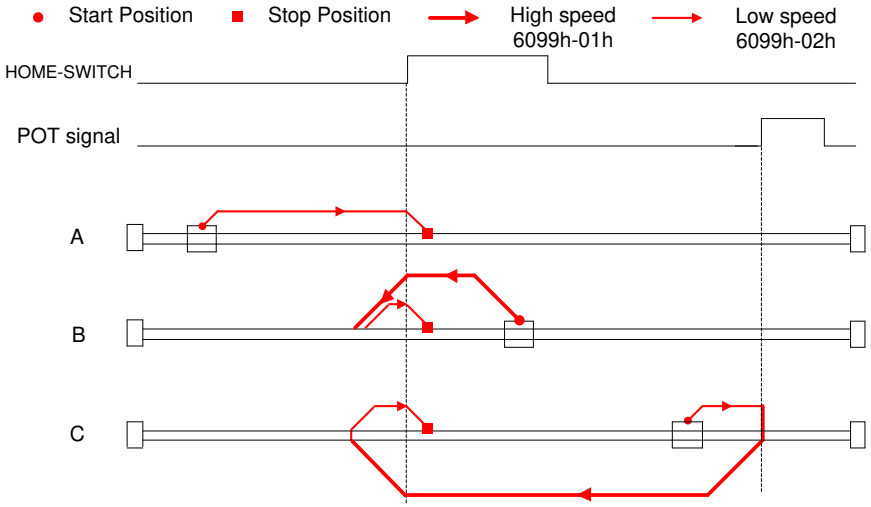

**Method 23:**

This method is similar to method 7



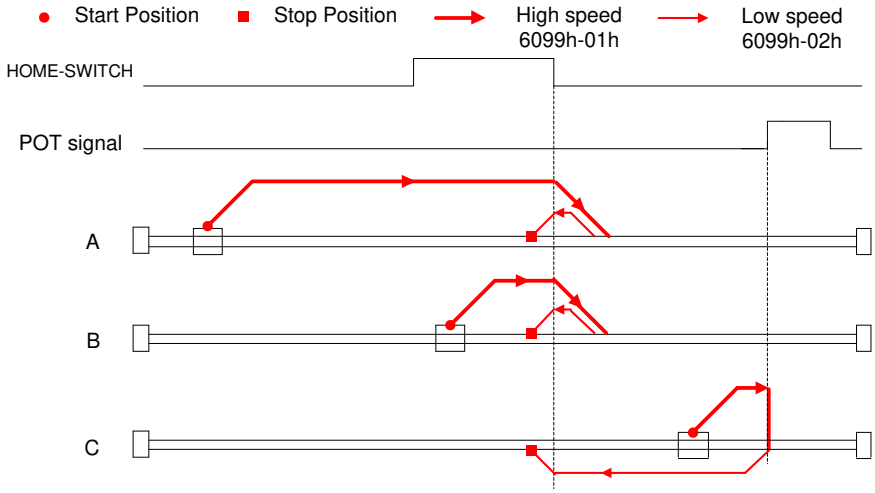

**Method 24:**

This method is similar to method 8



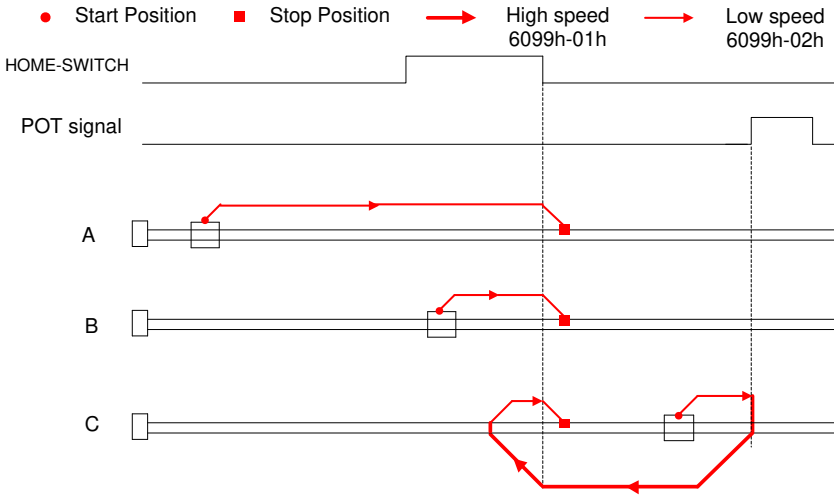
**Method 25:**

This method is similar to method 9



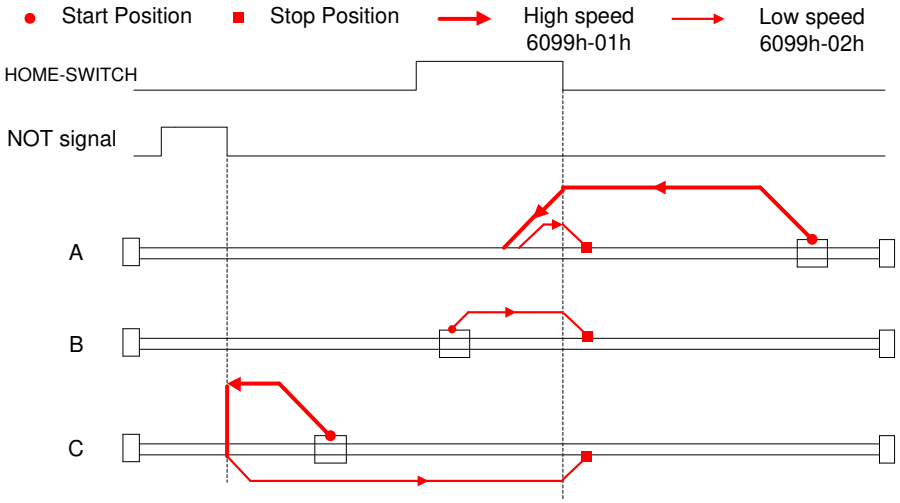

**Method 26:**

This method is similar to method 10



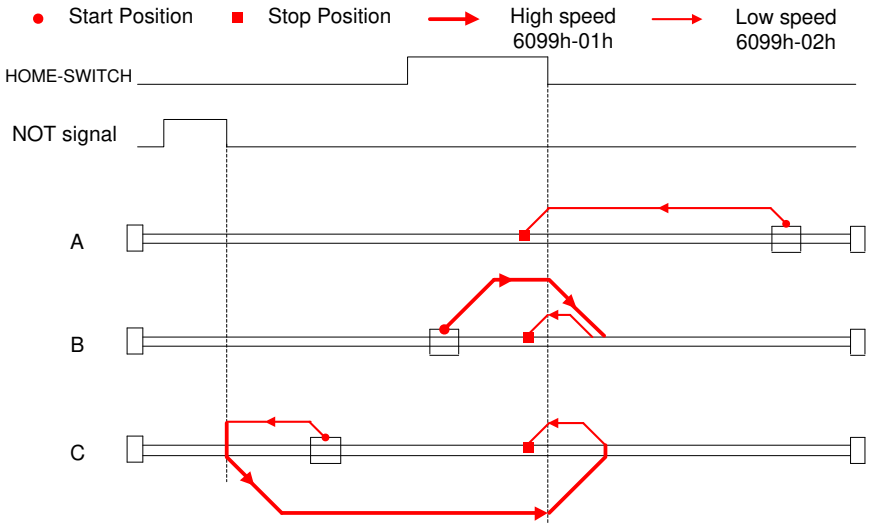

**Method 27:**

This method is similar to method 11



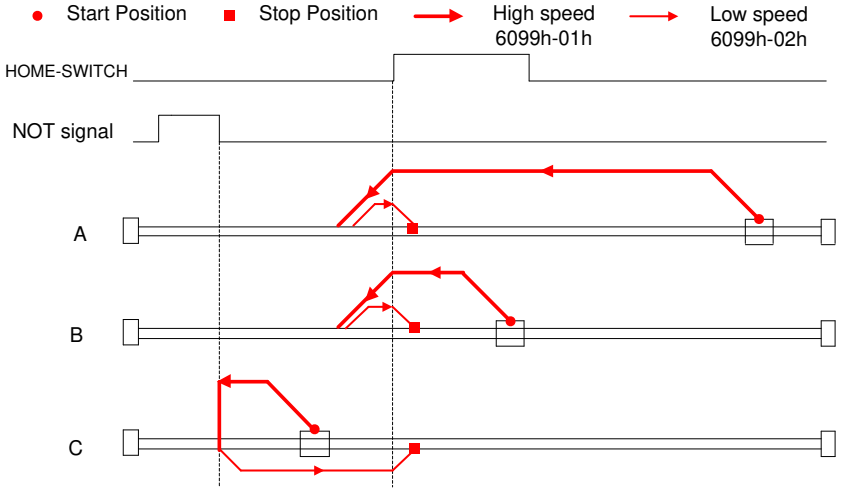
**Method 28:**

This method is similar to method 12



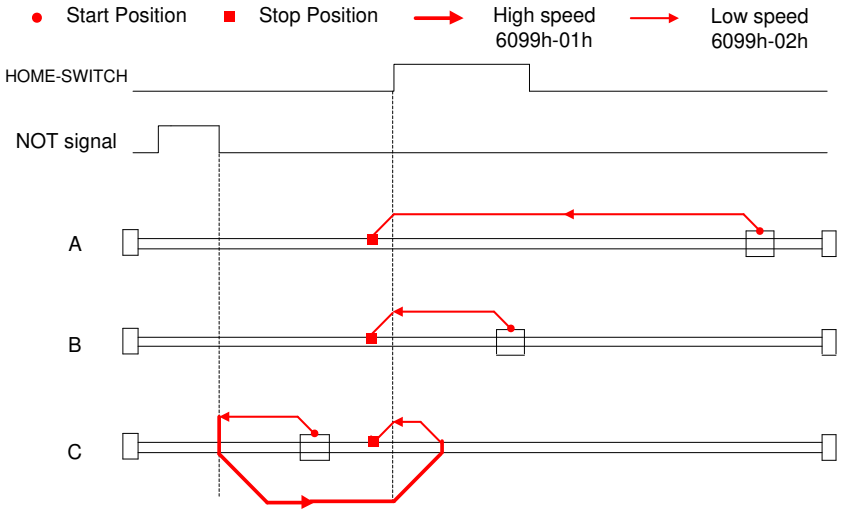

**Method 29:**

This method is similar to method 13




**Method 30:**

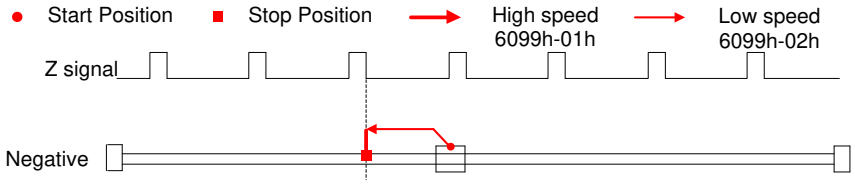
This method is similar to method 14



**Method 33:**

The motor starts to move in a negative direction and stops when the Z signal is valid.

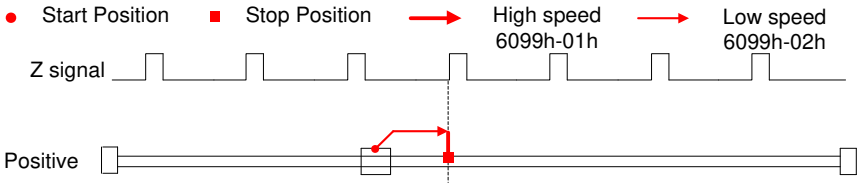
If the positive/negative limit switch signal and homing switch is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.




**Method 34:**

The motor starts to move in a positive direction and stops when the Z signal is valid.

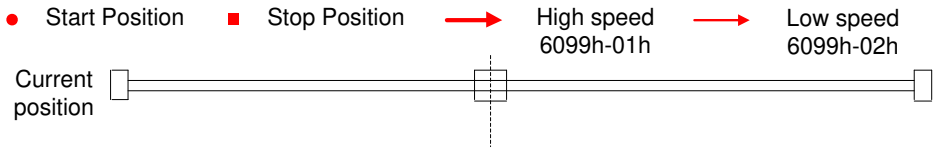
If the positive/negative limit switch signal and homing switch is valid during the homing process, the status word (6041h) bit 13 will be valid, indicating that the homing error and the motor will stop immediately.




**Method 35/37:**

Set the current position as homing point.

When using this method, the motor does not need to be enabled, only the control word (6041h) needs to be executed from 0 to 1.




Control word 6040h bit4：0->1

# *6.9 Security Features*

## *6.9.1 BRK-OFF output*

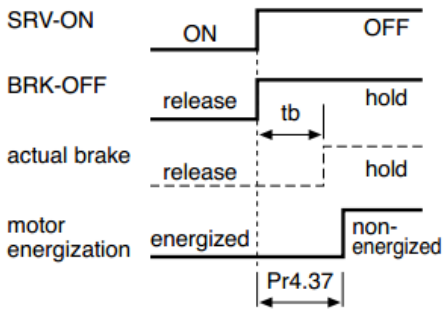
This function can be configured by set digital DO output functions allocation. refer to IO Pr4.10 parameter description. When the enable and time meet the set conditions, the digital output IO port can output ON.

| Pr4.37 | Name | Mechanical brake action at stalling setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 1ms | Default | 0 | Index | 2437h | | | | |

Motor brake delay time setup, mainly used to prevent servo on “galloping “phenomenon.

Set up the time from when the brake release signal(BRK-OFF) turns off to when the motor is de-energized (servo-free),when the motor turns to servo-off while the motor is at stall

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

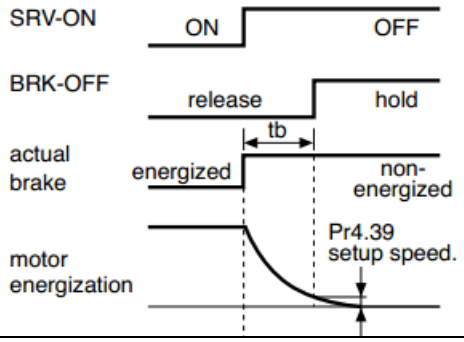


actually activated.

| Pr4.38 | Name | Mechanical brake action at running setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | 1ms | Default | 0 | Index | | 2438h | | | |

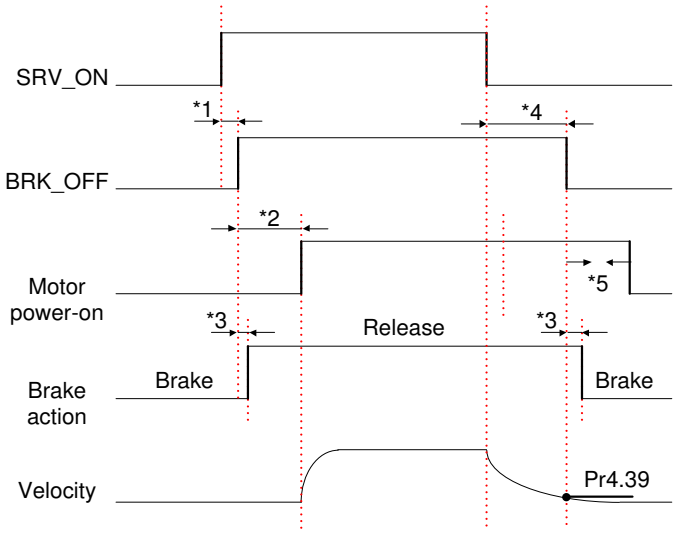
Mechanical brake start delay time setup, mainly used to prevent servo off "galloping "phenomenon. Set up time from when detecting the off of servo-on input signal(SRV-ON)is to when external brake release signal(BRK-OFF)turns off, while the motor turns to servo off during the motor in motion.

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




| Pr4.39 | Name | Brake release speed setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 30~3000 | Unit | 1ms | Default | 30 | Index | | 2439h | | | |

Set up the speed timing of brake output checking during operation .




Notice：

*1：The delay time between SRV_ON and BRK_OFF is less than 500ms;

*2：Time setting in Pr4.38;

*3：The delay time between the BRK_OFF signal output and the actual brake release action, which depends on the hardware characteristics of the motor brake;

*4：The smaller value of Pr4.37 and Pr4.39;

### 6.9.2 Servo stop mode

| Pr5.06 | Name | Stop mode | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~1 | Unit | — | Default | 0 | Index | 2506h | | | | |

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

| Setup value | Details |
|---|---|
| 0 | Disabled when disable signal effective and speed reduce to Pr4.39 |
| 1 | Disabled when disable signal effective, free-run to stop |

### 6.9.3 Emergency stop function

| Pr5.11 | Name | Torque setup for emergency stop | | | Mode | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~500 | Unit | % | Default | 0 | Index | 2511h | | | |

Set up the torque limit at emergency stop

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

Compared with the maximum torque 6072, the actual torque limit value is smaller one.

## 6.10 Inertia ratio identification

| Pr0.04 | Name | Inertia ratio | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~10000 | Unit | % | Default | 250 | Index | 2004h | | | | |

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.

### 6.10.1 On-line inertia ratio identification

The motor is operated by the controller, and the motor speed is above 400rmp. The running stroke has obvious acceleration, uniform speed and deceleration process, and the load inertia ratio can be tested by running 2-3 times continuously. The inertia ratio of the test is viewed in *Drive Operating Data Monitor-> d16Jr.* Set the monitor value minus 100 into Pr0.04..

### 6.10.2 Motion Studio inertia ratio identification

This inertia ratio identification function also added in Motion Studio configuration software.

**Pre-conditions：** 1、Servo disable. 2、Positive limit and negative limit invalid

**Steps:**

1、Set the Jog speed Pr6.04, and the setting should not be too large(600~1000rpm is recommend)

Set the Acc Pr6.25(50~100 ms/1000rpm is recommend)

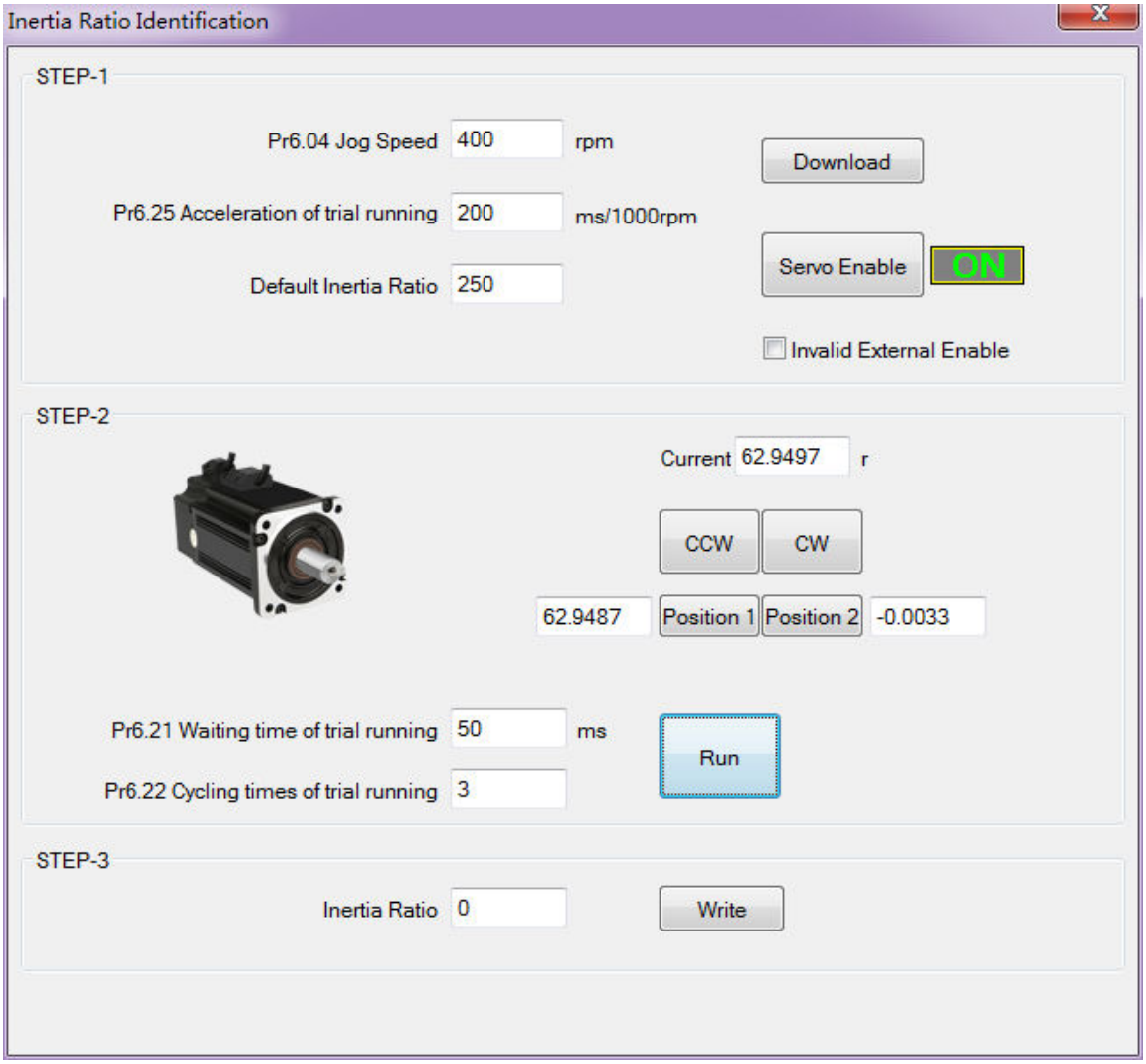
Set the Default Inertia Ratio.

***Download*** these settings, then ***Servo Enable***.

2、Click “CCW” to make motor run to CCW direction，click “Position 1” to save the position limit 1

Click “CW” to make motor run to CW direction， click “Position 2” to save the position limit 2

Click “Run” to start Inertia ratio identification.




3、After finishing，Click“Write”to save the Inertia ratio identification result.

# *6.11 Vibration Suppression*

Specific resonance frequency can be obtained from PC configuration software according to waveform monitoring, and filter frequency can be set to effectively suppress the oscillation ripple of a certain frequency in the current instruction.

The width of the notch is the ratio of the frequency of the notch center at a depth of 0 to the frequency range width of the attenuation rate of -3db.

The depth of the trap is: when the set value is 0, the input of the center frequency is completely disconnected; When the set value is 100, it represents the ratio of input and output that are completely passed

**How to use:**

1. Set Pr2.00=1
2. Decrease Pr0.03 to get higher stiffness, higher position loop gain and velocity loop gain. Decrease Pr0.03 gradually, while abnormal sound or oscillation occurred, decrease the current value by 2.
3. Execute movement by controller or Motion Studio, drive will record notch frequency automatically.
4. Upload the drive parameters, the record notch frequency saved in Pr2.07.
   Read the value of Pr2.07, and set this value into Pr2.01. Then reset Pr2.07 to 2000.
5. Saving parameters setting.

| Pr2.00 | Name | Adaptive filter mode setup | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~4 | Unit | - | Default | 0 | Index | | | | | 2200h |

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 | Name | 1st notch frequency | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 | Index | | | | | 2201h |

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 | Name | 1st notch width selection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | - | Default | 2 | Index | | | | | 2202h |

Set the width of notch at the center frequency of the 1st notch filter.
Notice: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

| Pr2.03 | Name | 1st notch depth selection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | - | Default | 0 | Index | | | | | 2203h |

Set the depth of notch at the center frequency of the 1st notch filter.
Notice: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

| Pr2.04 | Name | 2nd notch frequency | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 50~2000 | Unit | Hz | Default | 2000 | Index | | | | | 2204h |

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 | Name | 2nd notch width selection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~20 | Unit | - | Default | 2 | Index | | | | | 2205h |

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

| Pr2.06 | Name | 2nd notch depth selection | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~99 | Unit | - | Default | 0 | Index | | 2206h | | | |
| Set the depth of notch at the center frequency of the 2nd notch filter.<br>Notice: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain. | | | | | | | | | | | | |

## 6.12 Friction torque compensation

| Pr6.07 | Name | Torque command additional value | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | -100~100 | Unit | % | Default | 0 | Index | | 2607h | | | |
| Pr6.08 | Name | Positive direction torque compensation value | | | Mode | | | | | | | F |
| | Range | -100~100 | Unit | % | Default | 0 | Index | | 2608h | | | |
| Pr6.09 | Name | Negative direction torque compensation value | | | Mode | | | | | | | F |
| | Range | -100~100 | Unit | % | Default | 0 | Index | | 2609h | | | |
| These three parameters may apply feed forward torque superposition directly to torque command. | | | | | | | | | | | | |

## 6.13 Regenerative resister setting

When the torque of the motor is opposite to the direction of rotation ( such as deceleration, z-axis falling down, etc.), energy will feedback to the drive. At this time, the energy feedback received by the capacitor in the drive, which makes the voltage of the capacitor rise. When it rises to a certain voltage value, the excess energy needs to be consumed by the regenerative resistance.

| Pr0.16 | Name | External regenerative resistance value | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 40~500 | Unit | Ohm | Default | 100 | Index | | 2016h | | | |
| Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current. | | | | | | | | | | | | |

| Pr0.17 | Name | External regenerative resistance power value | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 20~5000 | Unit | W | Default | 20 | Index | | 2017h | | | |
| Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current. | | | | | | | | | | | | |

| Pr7.31 | Name | Regenerative resistance control mode setting | | | Mode | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 0～2 | Unit | -- | Default | 0 | | |

| Setup value | Details |
|---|---|
| 0 | Disable regenerative resistance discharge |
| 1 | Enable reactive pump lift suppression function |

| | | | |
|---|---|---|---|
| | 2 | Enable regenerative resistance discharge | |
| Notice： | | | |

| Pr7.32 | Name | Regenerative resistance open threshold setting | | | Mode | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 20～90 | Unit | V | Default | 80 | | |
| The external resistance is activated when the actual bus voltage is higher than Pr7.32 plus Pr7.33 and is deactivated when the actual bus voltage is lower than Pr7.32 minus Pr7.33 | | | | | | | | |
| Notice： | | | | | | | | |

| Pr7.33 | Name | Regenerative resistance control hysteresis | | | Mode | P | S | T |
|---|---|---|---|---|---|---|---|---|
| | Range | 1～50 | Unit | V | Default | 5 | | |
| The external resistance is activated when the actual bus voltage is higher than Pr7.32 plus Pr7.33 and is deactivated when the actual bus voltage is lower than Pr7.32 minus Pr7.33 | | | | | | | | |
| Notice： | | | | | | | | |

# *6.14 Multi-turn absolute encoder*

The absolute encoder remember position, When the absolute encoder is used for the first time, user need to move to the home position, and clear the absolute position value of multiple turns through the drive to set the home position. It is unnecessary to return to home position in the future (except for the absolute encoder alarm and other situations). It is recommended that the motor is stationary when reading the position to prevent dynamic data jump.

## *6.14.1 Parameters setting*

| Pr0.15 | Name | Absolute Encoder Setup | | | Mode | PP | | | HM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~15 | Unit | - | Default | 0 | Index | | 2015h | | | |

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

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

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

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

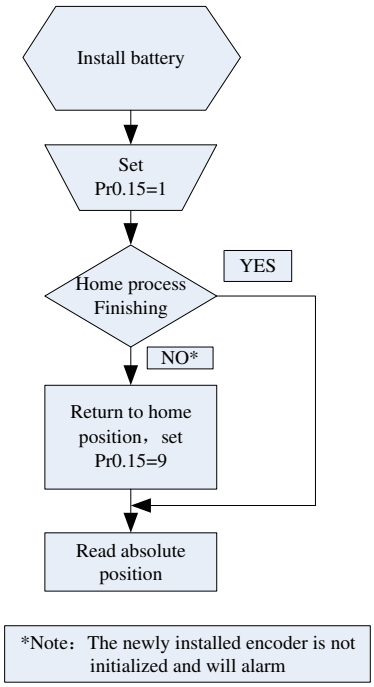
**9: Clear multi-turn position and reset multi-turn alarm**, open multi-turn absolute function.
It will become 1 when normal clearance, if it's still 9 after 3seconds, please deal with according to 153 alarm processing. Please remember to do mechanical homing.

**Notes:** Set to 9 after homing process finished and servo disabled, valid after restart power-supply

| Pr6.63 | Name | upper limit of multi - turn absolute position | | | Mode | | | | | | | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | 0~32766 | Unit | r | Default | 0 | Index | | 2663h | | | |
| While Pr0.15=2, the feedback position will loop between 0 - (Pr6.63+1)*Encoder resolution | | | | | | | | | | | | |

## *6.14.2 Read absolute position*

**1、Steps:**




（1）Firstly, select the multi-turns absolute encoder motor, install the battery, and confirm whether the drive version supports multi-turns absolute encoder motor;

（2）Set Pr0.15=1 to open absolute encoder. If it is the first time of installation, the drive will alarm Err153. The reason is that the multi-turn position is invalid due to the newly installed battery of the motor. At this time, it is necessary to return to the home position of the machine and perform the multi-turn position reset operation (see multi-turn position reset).

（3）When the absolute value origin is set and there is no battery fault, the alarm will be cancelled

（4）Finally, the user can read the absolute position, even if the power off the position will not lost.

**2、Read absolute position**

The absolute encoder counting mode is that when the motor rotates clockwise, the number of turns is defined as negative, while motor rotates counterclockwise the number of turns is defined as positive. The maximum rotation number is -32768 to +32767. After the number of turns is out of range, if the number of turns is 32767 counterclockwise, it will reverse to -32768, -32767... ; If the number of turns clockwise -32768, it will reverse to 32767, 32766...

Absolute encoder read mode: read 6064h data object

**3、Clear absolute position**

Before clear absolute position, the machine needs to return to the home point. After clear absolute position, the absolute position =0, the single-turn position remains unchanged, and the absolute value of the

encoder is cleared to alarm

Set Pr0.15=9: multi-turn zero clearing and reset multi-turn alarm, open multi-turn absolute function. It will become 1 when normal clearance, if it's still 9 after 3seconds, please deal with according to 153 alarm processing. Please remember to do mechanical homing.

## *6.14.3 Alarm*

1、Introductions

The multi-turns absolute encoder alarm function can determine whether the absolute encoder is valid or not, such as battery under voltage or power failure, encoder fault, etc., users can judge the absolute encoder alarm through bus alarm output, IO alarm output, and drive operation panel alarm. At this time, the controller should stop operation immediately, and the absolute motion operation can only be carried out after the alarm is eliminated

2、Alarm output

Absolute encoder alarm can be displayed by the panel Err153, IO output alarm signal, or read alarm information by communication

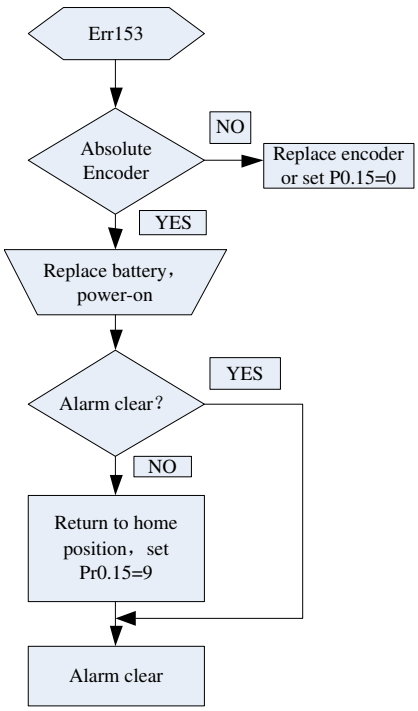
3、The drive sends an absolute encoder alarm Err153, the main situation is as follows:

（1）When the absolute encoder is used for the first time, absolute encoder alarm will be generated due to the new battery of the motor. At this time, it is necessary to return to the home point and perform multi-turn zero clearing operation

（2）When the battery under voltage is lower than 3.2v, absolute encoder alarm will be generated by the drive. At this time, the alarm will be automatically eliminated after the battery is recharged by replacing the battery

（3）When the battery voltage is lower than 2.5v, or the battery has a power failure, the absolute encoder alarm will be generated. Even if the battery is replaced, the alarm cannot be eliminated. At this time, the return to the home point and multi-turn zero clearing operation should be performed

4、Alarm processing flow chart

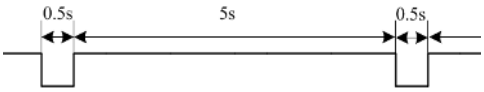
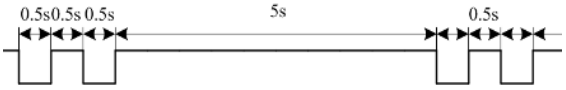
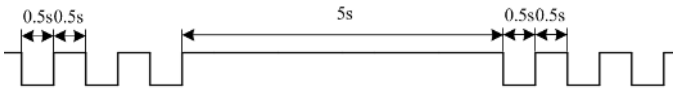
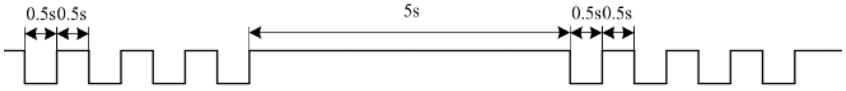
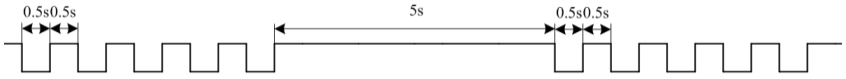
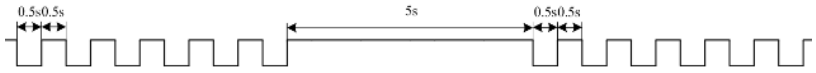
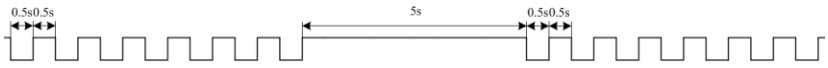
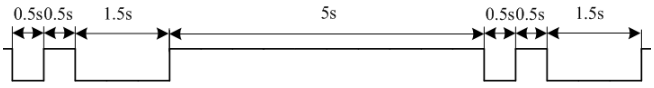
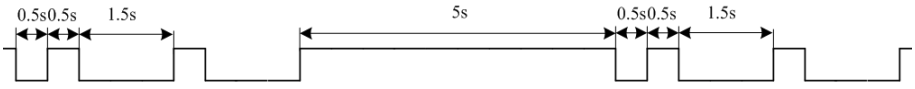
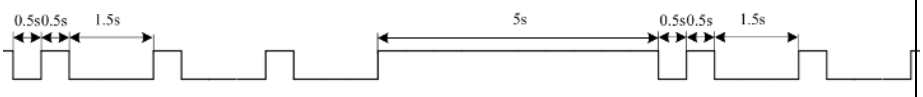
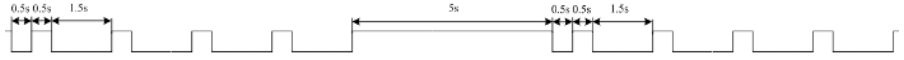


# Chapter 7 Alarm and Processing

## 7.1 Alarm List

If an error has occurred, the red power LED will flash in a 5s cycle. When the fault is cleared the red power LED is always off.

The following table shows the meaning of the error numbers.

| LED flashes | Time sequence | Errors |
|---|---|---|
| 1 short |  | Over-current |
| 2 short |  | DC bus over-voltage/ under-voltage |
| 3 short |  | CAN communication timeout |
| 4 short |  | Power line break |
| 5 short |  | Encoder error |
| 6 short |  | Over-load |
| 7 short |  | Too large position pulse deviation |
| 1 short 1 long |  | Motor speed out of control |
| 1 short 2 long |  | current detection circuit error |
| 1 short 3 long |  | CRC verification error |
| 1 short 4 long |  | Other errors |

The configuration software MotionStudio will automatically display the error code in alarm display window. The history of the error can be also viewed on alarm window from the configuration software.

**Table 7.1 Error Code List**

| 603F(hex) Error code | 1001(hex) Error register | Configuration software | Content |
|---|---|---|---|
| 2211 | 2 | 0E0 | Over-current |
| 2212 | 2 | 0E1 | Over-current of intelligent power module (IPM) |
| 3150 | 4 | 0A0 | Current detection circuit error |
| 3151 | 4 | 0A1 | Current detection circuit error |
| 3153 | 4 | 0A3 | Power line（U、V、W）break |
| 3201 | 4 | 0A5 | DC bus circuit error |
| 3211 | 4 | 0C0 | DC bus over-voltage |
| 3221 | 4 | 0D0 | DC bus under-voltage |
| 4210 | 8 | 0F0 | Drive over-heat |
| 5530 | 80 | 240 | CRC verification error when EEPROM parameter saved |
| 5531 | 80 | 241 | $I^2C$ Communication status error |
| 5532 | 80 | 242 | Read/write history alarm error |
| 5533 | 80 | 243 | Read/write diagnostic data error |
| 5534 | 80 | 244 | Read/write bus communication parameters error |
| 5535 | 80 | 245 | Read/write 402 parameters error |
| 6321 | 80 | 210 | input interface allocation error |
| 6322 | 80 | 211 | input interface function set error |
| 6323 | 80 | 212 | output interface function set error |
| 6329 | 80 | 090 | FPGA communication error |
| 7122 | 80 | 5F0 | Motor code error |
| 7321 | 80 | 150 | Encoder wiring error |
| 7322 | 80 | 151 | Encoder data error |
| 7323 | 80 | 152 | Encoder initial position error |
| 7324 | 80 | 170 | Encoder data error |
| 7329 | 80 | 260 | Positive/negative limit input active |
| 7701 | 80 | 120 | Brake resistor discharged circuit overload |

| | | | |
|---|---|---|---|
| 7702 | 80 | 121 | Brake resistor error |
| 8110 | 10 | 901 | CAN bus over-run |
| 8120 | 10 | 902 | CAN in error passive mode |
| 8130 | 10 | 903 | Lifeguard error |
| 8140 | 10 | 904 | Recovered from CAN bus off. |
| 8141 | 10 | 905 | CAN Bus off occurred. |
| 8150 | 10 | 906 | ID error |
| 8310 | 2 | 101 | Motor over-load |
| 8311 | 2 | 100 | Drive over-load |
| 8305 | 2 | 105 | Torque saturation alarm |
| 8401 | 20 | 190 | Vibration is too large |
| 8402 | 20 | 1A0 | Over-speed 1 |
| 8403 | 20 | 1A1 | Motor speed out of control |
| 8503 | 20 | 1B1 | Electronic gear ratio error |
| 8611 | 20 | 180 | Too large position pulse deviation |
| 8610 | 20 | 181 | Too large velocity deviation |
| 8612 | 20 | 1B0 | Position pulse input frequency error |

# *7.2 Alarm Processing Method*

When error occurred, please clear error reason, restart the power supply.

| **Error code** | Main | Extra | **Display:** "EA0090"--"EA009F" |
|---|---|---|---|
| | 09 | 0~F | **Content:** FPGA communication error |
| Cause | | Confirmation | Solution |
| Vdc/GND under-voltage | | Check the voltage of Vdc/GND terminal | Make sure voltage of Vdc/GND in proper range |
| Drive internal fault | | / | replace the drive with a new one |

| Error code | Main | Extra | Display:' Er0A0 "_-" Er0A1 " |
|---|---|---|---|
| | 0A | 0~1 | Content: current detection circuit error |

| Cause | Confirmation | Solution |
|---|---|---|
| Wiring error of motor output U,V,W terminal | Check wiring of motor output U,V,W terminal | Make sure motor U,V,W terminal wiring correctly |
| Vdc/GND under-voltage | Check the voltage of Vdc/GND terminal | Make sure voltage of Vdc/GND in proper range |
| Drive inner fault | / | replace the drive with a new one |

| Error code | Main | Extra | Display: " Er0A2 "_-" Er0A4 " |
|---|---|---|---|
| | 0A | 2~4 | Content: analog input circuit error |

| Cause | Confirmation | Solution |
|---|---|---|
| Analog input Wiring error | Check wiring of analog input | Make sure analog input wiring correctly |
| Drive inner fault | / | replace the drive with a new one |

| Error code | Main | Extra | Display: " Er0A3 " |
|---|---|---|---|
| | 0A | 3 | Content: Power line break |

| Cause | Confirmation | Solution |
|---|---|---|
| Power line break | Check wiring of analog input | Use a multimeter to measure the resistance between the winding wires. If the three-phase resistance is inconsistent, the winding may be open or the motor may be damaged |
| Drive inner fault | / | replace the motor with a new one |

| Error code | Main | Extra | Display: " Er0A5 " |
|---|---|---|---|
| | 0A | 5 | Content: DC bus circuit error |

| Cause | Confirmation | Solution |
|---|---|---|
| Vdc/GND under-voltage | Check the voltage of Vdc/GND terminal | Make sure voltage of Vdc/GND in proper range |
| Drive inner fault | / | replace the drive with a new one |

| Error code | Main | Extra | Display: " Er0A6 " |
|---|---|---|---|
| | 0A | 6 | Content: temperature detection circuit error |

| Cause | Confirmation | Solution |
|---|---|---|
| Vdc/GND under-voltage | Check the voltage of Vdc/GND terminal | Make sure voltage of Vdc/GND in proper range |
| Drive inner fault | / | replace the drive with a new one |

| Error code | Main | Extra | Display: "Er060" |
|---|---|---|---|
| | 06 | 0 | Content: control power under-voltage |

| Cause | Confirmation | Solution |
|---|---|---|
| Vdc/GND under-voltage | Check the voltage of Vdc/GND terminal | Make sure voltage of Vdc/GND in proper range |
| Drive inner fault | / | replace the drive with a new one |

| Error code | Main | Extra | Display: "Er0c0" |
|---|---|---|---|
| | 0c | 0 | Content: DC bus over-voltage |

| Cause | Confirmation | Solution |
|---|---|---|
| Vdc/GND over-voltage | Check the voltage of Vdc/GND terminal | Make sure voltage of Vdc/GND in proper range |
| Inner brake circuit damaged | / | replace the drive with a new one |
| Drive inner fault | / | replace the drive with a new one |

| Error code | Main | Extra | Display: "Er0d0" |
|---|---|---|---|
| | 0d | 0 | Content: DC bus under-voltage |

| Cause | Confirmation | Solution |
|---|---|---|
| Vdc/GND under-voltage | Check the voltage of Vdc/GND terminal | Make sure voltage of Vdc/GND in proper range |
| Drive inner fault | / | replace the drive with a new one |

| Error code | Main | Extra | Display: "Er0E0" |
|---|---|---|---|
| | 0E | 0 | Content: over-current |

| Cause | Confirmation | Solution |
|---|---|---|
| Short of drive output wire | Short of drive output wire, whether short circuit to PG ground or not | Assure drive 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 drive output wiring, make srv_on available and drive motor, check whether over-current exists | replace the drive 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 |

| Error code | Main | Extra | Display: "Er0E1" |
|---|---|---|---|
| | 0E | 1 | Content: IPM over-current |

| Cause | Confirmation | Solution |
|---|---|---|
| Short of drive output wire | Short of drive output wire, whether short circuit to PG ground or not | Assure drive 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 drive output wiring, make srv_on available and drive motor, check whether over-current exists or not | replace the drive with a new one |
| Short of IGBT module | / | replace the drive 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 |

| **Error code** | Main | Extra | **Display:** "Er 0F 0" |
|---|---|---|---|
| | 0F | 0 | **Content**: drive over-heat |

| Cause | Confirmation | Solution |
|---|---|---|
| the temperature of power module have exceeded upper limit | Check drive radiator whether the temperature is too high or not | Strengthen cooling conditions, promote the capacity of drive and motor, enlarge acceleration/deceleration time, reduce load |

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

| Cause | Confirmation | Solution |
|---|---|---|
| Load is too heavy | Check actual load if the value of parameter exceed maximum or not | Decrease load, adjust limit parameter |
| 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 |

| **Error code** | Main | Extra | **Display:** "Er 10 -1" |
|---|---|---|---|
| | 10 | -1 | **Content:** Motor overload/drive overload |

| Cause | Confirmation | Solution |
|---|---|---|
| Power line connection error | UVW connection error | Check connection of UVW |
| Over current | Over current | Use another drive with higher rated power |

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

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

| Error code | Main | Extra | Display: "Er.12.1" |
|---|---|---|---|
| | 12 | 1 | **Content:** Leakage triode malfunction |

| Cause | Confirmation | Solution |
|---|---|---|
| Brake circuit failure | Brake resistance short circuit | repair |
| | IGBT damaged | repair |

| Error code | Main | Extra | Display: "Er.15.0" |
|---|---|---|---|
| | 15 | 0 | **Content:** encoder line breaked |

| Cause | Confirmation | Solution |
|---|---|---|
| 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 drive with a new one |

| Error code | Main | Extra | Display: "Er.15.1" |
|---|---|---|---|
| | 15 | 1 | **Content:** Encoder communication error |

| Cause | Confirmation | Solution |
|---|---|---|
| Encoder communication error | Interference is caused by noise | |

| Error code | Main | Extra | Display: "Er.15.2" |
|---|---|---|---|
| | 15 | 2 | **Content:** initialized position of encoder error |

| Cause | Confirmation | Solution |
|---|---|---|
| Communication data abnormal | Check encoder power voltage if it is DC5V ± 5% or not; check encoder cable and shielded line if it is damaged or not; check encoder cable 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 drive with a new one |

| Error code | Main | Extra | Display: "Er.17.0" |
|---|---|---|---|
| | 17 | 0 | **Content:** encoder data error |

| Cause | Confirmation | Solution |
|---|---|---|
| Communication data abnormal | Check encoder power voltage if it is DC5V ± 5% or not ; check encoder cable and shielded line if it is damaged or not; check encoder cable whether it is intertwined with other power wire or not | Ensure power voltage of encoder normally, ensure encoder cable and shielded line well with FG ground, ensure encoder cable separated with other power wire |

| | | |
|---|---|---|
| Encoder damaged | / | replace the motor with a new one |
| Encoder measuring circuit damaged | / | replace the drive with a new one |

| **Error code** | Main | Extra | **Display:** "Er018 0" |
|---|---|---|---|
| | 18 | 0 | **Content:** position error over-large error |

| Cause | Confirmation | Solution |
|---|---|---|
| Unreasonable set of position error parameter | Check parameter Pr_014 value if it is too small or not | Enlarge the value of Pr_014 |
| Gain set is too small | Check parameter Pr_100, Pr_105 value if it is too small or not | Enlarge the value of Pr_100, Pr_105 |
| Torque limit is too small | Check parameter Pr_013, Pr_522 value whether too small or not | Enlarge the value of Pr_103, Pr_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 |

| **Error code** | Main | Extra | **Display:** "Er018 1" |
|---|---|---|---|
| | 18 | 1 | **Content:** velocity error over-large error |

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

| **Error code** | Main | Extra | **Display:** "Er019 0" |
|---|---|---|---|
| | 19 | 0 | **Content:** excessive vibration |

| Cause | Confirmation | Solution |
|---|---|---|
| Current vibration | Current vibration | Cut down the value of Pr003. Pr004 |
| Stiffness is too strong | Stiffness is too strong | |

| **Error code** | Main | Extra | **Display:** "Er01A 0" |
|---|---|---|---|
| | 1A | 0 | **Content:** over-speed 1 |

| Cause | Confirmation | Solution |
|---|---|---|
| Motor speed has exceeded the first speed limit (Pr_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 Pr_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 Pr_321 value, modify command pulse input frequency and division frequency coefficient, assure encoder wiring correctly |

| **Error** | Main | Extra | **Display:** "Er01A 1" |
|---|---|---|---|

| code | 1A | 1 | **Content:** Motor speed out of control | |
|---|---|---|---|---|
| Cause | | Confirmation | | Solution |
| UVW connection error | | UVW connection error | | |
| Encoder error | | Encoder error | | Replace motor |
| Special function | | | | Set Pr1.37=4 |

| Error code | Main | Extra | **Display:** "Er.16.0" | |
|---|---|---|---|---|
| | 16 | 0 | **Content:** Wrong pulse input frequency | |
| Cause | | Confirmation | | Solution |
| Wrong pulse input frequency | | | | |

| Error code | Main | Extra | **Display:** "Er.16.1" | |
|---|---|---|---|---|
| | 16 | 1 | **Content:** Electronic gear ratio error | |
| Cause | | Confirmation | | Solution |
| Pulse input frequency is too high | | Pulse input frequency is too high | | Make sure the pulse frequency is blew 500K |

| Error code | Main | Extra | **Display:** "Er.210" | |
|---|---|---|---|---|
| | 21 | 0 | **Content:** I/F input interface allocation error | |
| Cause | | Confirmation | | Solution |
| The input signal are assigned with two or more functions. | | Check the value of Pr_400, Pr_401, Pr_402,Pr_403,Pr_404 if it is proper or not | | Assure the value of Pr_400, Pr_401, Pr_402, Pr_403, Pr_404 set correctly |
| The input signal aren't assigned with any functions. | | Check the value of Pr_400, Pr_401,Pr_402,Pr_403,Pr_404 if it is proper or not | | Assure parameter Pr_400, Pr_401, Pr_402,Pr_403,Pr_404 set correctly |

| Error code | Main | Extra | **Display:** "Er.211" | |
|---|---|---|---|---|
| | 21 | 1 | **Content:** I/F input interface function set error | |
| Cause | | Confirmation | | Solution |
| Signal allocation error | | Check the value of Pr_400, Pr_401, Pr_402,Pr_403,Pr_404 if it is proper or not | | Assure the value of Pr_400, Pr_401, Pr_402, Pr_403, Pr_404 set correctly |

| Error code | Main | Extra | **Display:** "Er.212" | |
|---|---|---|---|---|
| | 21 | 2 | **Content:** I/F input interface function set error | |
| Cause | | Confirmation | | Solution |
| The input signal are assigned with two or more functions. | | Check the value of Pr_410, Pr_411, Pr_412, Pr_413, if it is proper or not | | Assure the value of Pr_410, Pr_411, Pr_412,Pr_413 set correctly |

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

| **Error code** | Main | Extra | **Display:** "Er240" |
|---|---|---|---|
| | 24 | 0 | **Content:** CRC verification error when EEPROM parameter is saved |

| Cause | Confirmation | Solution |
|---|---|---|
| Vdc/GND under-voltage | Check the voltage of Vdc/GND terminal | Make sure voltage of Vdc/GND in proper range |
| Drive is damaged | save the parameters for several times | replace the drive with a new one |
| The setting of drive maybe default setting which isn't suitable for motor . | Check the setting of drive if it is suitable for your motor | Download the suitable project file to drive for motor |

| **Error code** | Main | Extra | **Display:** "Er260" |
|---|---|---|---|
| | 26 | 0 | **Content:** positive negative over-travel input valid |

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

| **Error code** | Main | Extra | **Display:** "Er270" |
|---|---|---|---|
| | 27 | 0 | **Content:** Analog value 1 input error limit |

| Cause | Confirmation | Solution |
|---|---|---|
| Analog value 1 input error limit | Analog value 1 input error limit | |

| **Error code** | Main | Extra | **Display:** "Er590" |
|---|---|---|---|
| | 59 | 0 | **Content**: forced alarm input valid |

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

| **Error code** | Main | Extra | **Display:** "Er5F0" |
|---|---|---|---|
| | 5F | 0 | **Content:** Motor code error |

| Cause | Confirmation | Solution |
|---|---|---|
| Motor code error | Motor code error | Set Pr7.15 correctly |

# Chapter 8 Product Accessory

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

## 8.1 Accessory selection

1. **Power cable** (1.2m，2.2m，3m，5m，7m，10m selectable)
   CABLE-ACM3M0 (motor with –SS connector)
   CABLE-PL3M0-H (motor with –HD connector)
2. **Encoder cable** (1.2m，2.2m，3m，5m，7m，10m selectable)
   CABLE-LD2-BM3M0 (for motor with 1000lines and 2500lines encoder)
   CABLE-LD2-BM5M0-S (for motor with 5000lines、17bit、23bit encoder)
3. **Brake cable** (1.2m，2.2m，3m，5m，7m，10m selectable)
   CABLE-SC3M0-S
4. **Software configuration cable**
   CABLE-PC-1
5. **CAN communication cable**
   CABLE-TX1M0-LD2
6. **Regenerative resistance**(for application with big ACC and DEC )
   10Ω±5%, 100W RXFB-1, Part num Code : 10100469
   5Ω±5%, 200W RXLG, Part num Code : 10100522

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